DNOS

Operations Guide

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TEXAS INSTRUMENTS

MANUAL REVISION HISTORY

DNOS Operations Guide (2270502-9701)

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DNOS Software Manuals

This diagram shows the manuals supporting DNOS, arranged according to user type. Refer to the block identified by your user group and all blocks above that set to determine which manuals are most beneficial to your needs.

All DNOS Users:

DNOS Concepts and Facilities
2270501-9701

DNOS Operations Guide
2270502-9701

DNOS System Command Interpreter (SCI) Reference Manual
2270503-9701

DNOS Text Editor Reference Manual
2270504-9701

DNOS Messages and Codes Reference Manual
2270506-9701

DNOS Reference Handbook
2270505-9701

DNOS Master Index to Operating System Manuals
2270500-9701

High-Level Language Users:

COBOL Reference Manual
2270518-9701

DNOS COBOL Programmer's Guide
2270516-9701

DNOS Performance Package Documentation
2272109-9701

TI Pascal Reference Manual
2270519-9701

DNOS TI Pascal Programmer's Guide
2270517-9701

FORTRAN-78 Reference Manual
2268681-9701

DNOS FORTRAN-78 Programmer's Guide
2268680-9701

MATHSTAT-78 Programmer's Reference Manual
2268687-9701

FORTRAN-78 ISA Extensions Manual
2268696-9701

TI BASIC Reference Manual
2308769-9701

RPG II Programmer's Guide
939524-9701

Assembly Language Users:

990/99000 Assembly Language Reference Manual
2270509-9701

DNOS Assembly Language Programmer's Guide
2270508-9701

DNOS Link Editor Reference Manual
2270522-9701

DNOS Supervisor Call (SVC) Reference Manual
2270507-9701

Security Managers:

DNOS Security Manager's Guide
2308954-9701

Productivity Tools Users:

DNOS Sort/Merge User's Guide
2272060-9701

DNOS TIFORM Reference Manual
2276573-9701

DNOS Query-990 User's Guide
2276554-9701

DNOS Data Base Management System Programmer's Guide
2272058-9701

DNOS Data Base Administrator User's Guide
2272059-9701

Data Dictionary User's Guide
2276582-9701

DNOS TIPE Reference Manual
2308786-9701

DNOS TIPE Exercise Guide
2308787-9701

DNOS COBOL Program Generator User's Guide
2234375-9701

Communications Software Users:

DNOS DNCS/SNA User's Guide
2302663-9701

DNOS DNCS Operations Guide
2302662-9701

DNOS DNCS 914A User's Guide
2302664-9701

DNOS 3270 Interactive Communications Software (ICS) User's Guide
2302670-9701

DNOS 3780/2780 Emulator User's Guide
2270520-9701

DNOS DNCS System Generation Reference Manual
2302648-9701

DNOS DNCS X.25 Remote File Transfer (RFT) User's Guide
2302640-9701

DNOS Remote Terminal Subsystem (RTS) User's Guide
2302676-9701

Systems Programmers:

DNOS System Generation Reference Manual
2270511-9701

DNOS Systems Programmer's Guide
2270510-9701

DNOS Online Diagnostics and System Log Analysis Tasks User's Guide
2270532-9701

ROM Loader User's Guide
2270534-9701

Source Code Users:

DNOS System Design Document
2270512-9701

DNOS SCI and Utilities Design Document
2270513-9701

DNOS Software Manuals Summary

Concepts and Facilities
Presents an overview of DNOS with topics grouped by operating system functions. All new users (or evaluators) of DNOS should read this manual.

DNOS Operations Guide
Explains fundamental operations for a DNOS system. Includes detailed instructions on how to use each device supported by DNOS.

System Command Interpreter (SCI) Reference Manual
Describes how to use SCI in both interactive and batch jobs. Describes command procedures and gives a detailed presentation of all SCI commands in alphabetical order for easy reference.

Text Editor Reference Manual
Explains how to use the Text Editor on DNOS and describes each of the editing commands.

Messages and Codes Reference Manual
Lists the error messages, informative messages, and error codes reported by DNOS.

DNOS Reference Handbook
Provides a summary of commonly used information for quick reference.

Master Index to Operating System Manuals
Contains a composite index to topics in the DNOS operating system manuals.

Programmer's Guides and Reference Manuals for Languages
Contain information about the languages supported by DNOS. Each programmer's guide covers operating system information relevant to the use of that language on DNOS. Each reference manual covers details of the language itself, including language syntax and programming considerations.

Performance Package Documentation
Describes the enhanced capabilities that the DNOS Performance Package provides on the Model 990/12 Computer and Business System 800.

Link Editor Reference Manual
Describes how to use the Link Editor on DNOS to combine separately generated object modules to form a single linked output.

Supervisor Call (SVC) Reference Manual
Presents detailed information about each DNOS supervisor call and DNOS services.

DNOS System Generation Reference Manual
Explains how to generate a DNOS system for your particular configuration and environment.

User's Guides for Productivity Tools
Describe the features, functions, and use of each productivity tool supported by DNOS.

User's Guides for Communications Software
Describe the features, functions, and use of the communications software available for execution under DNOS.

Systems Programmer's Guide
Discusses the DNOS subsystems and how to modify the system for specific application environments.

Online Diagnostics and System Log Analysis Tasks User's Guide
Explains how to execute the online diagnostic tasks and the system log analysis task and how to interpret the results.

ROM Loader User's Guide
Explains how to load the operating system using the ROM loader and describes the error conditions.

DNOS Design Documents
Contain design information about the DNOS system, SCI, and the utilities.

DNOS Security Manager's Guide
Describes the file access security features available with DNOS.

Preface

This manual provides the information necessary to perform daily tasks at a Texas Instruments Computer installation that is using the Distributed Network Operating System (DNOS). The manual assumes that the system has been properly installed, configured, and generated. The functional operations are described in a step-by-step, how-to manner. These operations include handling peripherals, performing an initial program load, handling crashes, performing system backup, and manipulating disk files.

Each section in this manual discusses System Command Interpreter (SCI) commands that perform a particular function. Concepts central to the command are discussed, including information on how to use the commands in daily operations. Some commands are discussed in more than one section. The *DNOS System Command Interpreter (SCI) Reference Manual* presents a complete description of all commands discussed in this manual.

This manual is divided into 16 sections and 22 appendixes. Each section describes a major DNOS operation. Each appendix covers the operation of a device on a DNOS system.

Section

1 Introduction — Contains an overview of DNOS. The discussion includes basic concepts such as jobs, job priorities, background and foreground tasks, files, directories, and pathnames.

2 Powering Up and Powering Down — Describes how to power up and power down the system, and includes using the front panel controls and indicators, performing an initial program load, initializing the system, and recognizing system activity from the front panel lights.

3 Beginning and Ending a Session at a Terminal — Describes how to activate the System Command Interpreter (SCI), as well as how to log on and log off the system. This section also discusses the DNOS command families (the command groups listed in the DNOS SCI Main Menu).

4 Using Files and Directories — Describes file security and how to use the SCI commands that operate on files and directories.

5 Using Disk Volumes — Describes how to use disk volumes, including initializing, installing, and unloading disk volumes, showing volume status, and handling problems.

6 Backing Up Files, Directories, and Disks — Describes how to back up files and directories,and how to back up the system and data disks.

7 Using Logical Names, Synonyms, and LUNOs — Discusses the differences between logical names, synonyms, and Logical Unit Numbers (LUNOs), and the use of each.

8 Using the Output Spooler — Describes how to assign devices to the spooler, use the spooler to print files, and control output using the spooler.

9 Using the Operator Interface — Describes how to enable the operator interface for single-operator and multiple-operator systems and how to send and receive operator messages.

10 Executing and Controlling Jobs and Programs — Describes how to execute jobs and programs, including killing, halting, and resuming job and program execution, how to change job priorities, and how to show job and program status.

11 Handling a System Crash — Describes how to recognize a system crash, dump the contents of the crash file, perform an initial program load, and force a system crash.

12 Recovering from Power Failure — Describes how to recover from power failure.

13 Using the System Log — Describes how to enable the log device and dump the system log files.

14 Interpreting Error Messages — Describes how to interpret error messages, including the format of messages and some example messages.

15 Running Online Diagnostics — Contains general information about online diagnostics, including when online diagnostics should be run.

16 Status Commands — Discusses the status commands and their uses.

Appendix

A Keycap Cross-Reference — Gives the generic key names in a chart that relates the generic name to the key on a specific terminal.

B 733 ASR/KSR Terminal — Describes how to operate the 733 ASR/KSR Terminal, including using the terminal controls and indicators, loading paper, and using cassettes.

C 743 KSR Data Terminal — Describes how to operate the 743 Data Terminal, including using the controls and indicators, cleaning the printhead, and loading paper.

D 820 KSR Data Terminal — Describes how to operate the 820 KSR Data Terminal, including using the controls and indicators, loading paper, installing ribbons, and powering the terminal up and down.

E 840 RO Terminal — Describes how to use the 840 Receive Only printer, including using the controls and indicators and programming the printer to match system needs.

F 911 Video Display Terminal — Describes how to use the 911 Video Display Terminal.

G 931 Video Display Terminal — Describes how to use the 931 Video Display Terminal, including various key groups and status messages.

H 940 Video Display Terminal — Describes how to use the 940 Video Display Terminal operating under DNOS.

I CD1400/32 and CD1400/96 Disk Drives — Describes how to operate the CD1400 Disk System, including using the controls and indicators, powering up and down, fault operation, and cartridge handling, installation, and replacement.

J DS10 Disk Drive — Describes how to use the DS10 Disk Drive and disk packs, including information on controls and indicators, and procedures for installing and unloading disk volumes.

K DS50, DS80, DS200 and DS300 Disk Drives — Describes how to use the DS50, DS80, DS200, and DS300 disk drives and disk packs, including information on controls and indicators and procedures for using, handling, and storing disk packs.

L FD1000 Flexible Diskette Drive — Describes how to operate the FD1000 diskette drive, including using the controls and indicators, loading and removing diskettes, formatting diskettes, and handling diskettes.

M WD500 Disk Unit — Describes how to use the WD500 Disk Unit, including initializing and installing diskettes, controls and indicators.

N WD800 Disk System — Describes how to use the WD800 Disk System, including using the controls and indicators, powering up and down, and using the backup cartridge tape system.

O MT979A Magnetic Tape Drive — Describes how to operate the 979A Magnetic Tape Drive, including using the controls and indicators, loading a tape, reloading during a mid-reel operation, and rewinding and unloading.

P MT1600 Magnetic Tape System — Describes how to operate the MT1600, including using the controls, powering up, and powering down.

Q LP300 and LP600 Printers — Describes how to operate the LP300 and LP600 Printers, including using the controls and indicators, loading paper, changing ribbons, and powering on and off.

R LQ45 Printer — Describes how to operate the LQ45 Printer, including using the controls and indicators, loading paper, changing ribbons, and powering on and off.

S 810 Printer — Describes how to use the 810 Printer, including controls and indicators, loading paper, changing ribbons, setting top-of-form, setting switches, and powering the printer up and down.

T 850 Printer — Describes the 850 printer, including controls and indicators, loading paper, and operator adjustments.

U 855 Printer — Describes the 855 printer, including controls and indicators, loading paper, and operator adjustments.

V 804 Card Reader — Describes how to operate the 804 Card Reader.

In addition to the DNOS family of manuals shown on the frontispiece, this manual refers to the following documents:

Title	Part Number
Model 733 ASR/KSR Data Terminal Installation and Operation	945259-9701
Model 820 KSR Data Terminal Installation and Operation	2250454-9701
Model DS10 Cartridge Disk Systems Installation and Operation	946261-9701
Model DS25/DS50 Disk System Installation and Operation	946231-9701
Model DS200 Disk System Installation and Operation	949615-9701
Model 810 Printer Installation and Operation	939460-9701
Model 990/12 Computer Hardware User's Manual	2264446-9701
Model FD1000 Flexible Disk System Installation and Operation	2261886-9701
Model 743 KSR Data Terminal Installation and Operation	943462-9701
Model 804 Card Reader Installation and Operation	945262-9701
OMNI 800 Electronic Data Terminals Maintenance Manual for Model 810 Printer	994386-9701
Model 979A Magnetic Tape System Installation and Operation	946229-9701
Model 979A Tape Transport Installation and Operation	949612-9701

Title	Part Number
Model LP300 and LP600 Line Printers Installation and Operation Manual	2250364-9701
Model CD1400 Disk System Installation and Operation Manual	2272081-9701
Model LQ45 Letter Quality Printer System Installation and Operation Manual	2268695-9701
DNOS Online Diagnostics and System Log Analysis Task User's Guide	2270532-9701
Model LQ45 Letter Quality Printer Field Maintenance Manual	945419-9705
Model 911 Video Display Terminal Installation and Operation	945423-9701
Model 940 Electronic Video Terminal (EVT) Installation and Operation Manual	2250368-9701
Model 840 RO Printer Installation and Operation Manual	2302695-9701
Model DS80 Disk System Installation and Operation Manual	2302629-9701
Model DS300 Disk System Installation and Operation Manual	2302631-9701
WD800 Mass Storage Subsystem Installation and Operation Manual	2306140-9701
Model 931 Video Display Terminal General Description	2229228-0001
Model MT1600 Magnetic Tape System Installation and Operation	2302642-9701
WD500 Mass Storage System	2302688-9701
Model 990A13 Chassis	2308774-9701
Business Systems 600/800 Product Instruction Manual	2311343-9701
Model 850 Printer User's Manual	2219890-0001

Title	Part Number
Model 855 Printer User's Manual	2225911-0001
Model 850/851 Printer Maintenance Manual	2219896-9701
Model 855/856 Printer Maintenance Manual	2225914-0001
Model 855/856 Printer Technical Reference Manual	2225914-0001

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Introduction

1.1 GENERAL INFORMATION

This section gives a brief introduction to the Distributed Network Operating System (DNOS). The subjects discussed in this section are an overview of DNOS, the difference between a user and a system operator, jobs and execution priorities, interacting with the operating system, disk volume attributes and contents, and DNOS-supported devices.

All sections in this manual that reference a terminal use generic key names. To determine the generic key name for a key on your terminal, see the table in the Keycap Cross-Reference appendix to this manual. The appendixes on specific terminals do not use generic key names.

1.2 DNOS OVERVIEW

An operating system is software that manages tasks (programs), data, and resources for a computer. DNOS is a general-purpose operating system for the Texas Instruments Business Systems and Model 990 Computers developed to meet a wide variety of needs in the computing community. DNOS is a configurable operating system that allows users to generate small systems with minimal software development capability, medium range systems with a small variety of options, and large systems with a wide variety of options.

The system supports a wide range of user environments. DNOS can support as few as one or two terminals, thus allowing the user to perform tasks efficiently and yet inexpensively. Larger configurations with a wide variety of peripherals are also supported. The maximum configuration size varies with the user's environment.

1.3 TYPES OF OPERATORS

Two types of operators use DNOS through terminals, the user and the system operator. A user is anyone who makes use of a DNOS-based system. A system operator is someone who controls system start and restart functions, places information media into the input devices, removes the output, and performs other related functions. The terminal used by the system operator is called the system console.

The system operator can perform functions not available to the user, including the following:

- Terminating the execution of any job running on the system.
- Suspending any job currently executing on the system.
- Resuming the execution of any job that has been previously halted.
- Viewing the status of all jobs currently executing on the system.
- Modifying the priority of a job while it is executing.

Each DNOS-based system has only one system console receiving messages (one system operator) at any given time. The section on using the operator interface describes the procedure for identifying the system operator and console.

1.4 JOBS AND EXECUTION PRIORITIES

A job consists of *tasks*, which are programs running under the control of the operating system. Each job has one or more tasks running in an environment with a set of resources, such as files and devices.

Jobs can be *interactive* or *batch*. A terminal session is an interactive job. A job that runs independently of a terminal is a batch job. The user creates a batch job during a terminal session. This batch job can have job characteristics that are different from those assigned to the interactive session that created it. During a terminal session, the user can also create an interactive job for another terminal.

Task execution priority determines the order in which tasks are granted use of the central processing unit (CPU). The task starts with an initial priority based on how it was installed in a program file. While executing, it has a run-time priority to schedule its use of the CPU, determined by the initial priority and the job priority. Other factors, such as whether the task is real-time or time-sharing, and whether the installed priority is static or dynamic, determine how much the run-time priority can vary from the initial priority.

1.5 INTERACTING WITH THE OPERATING SYSTEM

The DNOS System Command Interpreter (SCI) provides a conversational interface between the user and the operating system. SCI commands issued in batch and interactive modes allow the user to control DNOS.

1.5.1 Interactive Operation

SCI is supported on DNOS interactive devices, including hard-copy terminals and video display terminals (VDTs). When using a hard-copy terminal, SCI prompts for information one line at a time. At a VDT, it presents prompts on the screen in menu form with the cursor positioned in the first position of the first user-response field. Command menus provide the names of the commands in logical groupings. For example, all device commands are listed in one menu.

When operating the system interactively, one foreground and one background program may be active concurrently at each terminal. Foreground programs interact with the user via the terminal. Background programs never interact directly with the user at the terminal, so that the foreground can stay available for use.

The following example shows how the user at a VDT enters an SCI command, in this case the List Terminal Status (LTS) command. SCI displays [ ] to tell the user to enter a command and the user responds with LTS.

```
[] LTS
```

Then SCI displays the LTS menu, as follows:

```
LIST TERMINAL STATUS
            TERMINAL NAME:
        OUTPUT ACCESS NAME:
```

The user responds ST01 (station one) to the TERMINAL NAME prompt and accepts the default value (user's terminal) for OUTPUT ACCESS NAME, as follows:

```
LIST TERMINAL STATUS
            TERMINAL NAME: ST01
        OUTPUT ACCESS NAME:
```

Once SCI has all the information it needs, it calls on DNOS to execute the command. DNOS checks the status of ST01 and replies as follows:

```
 TERMINAL     USER ID LOGON REQ"D    MODE    DEFAULT
   ST01       USER01       Y          VDT       VDT
11:07:58 FRIDAY, MAR 27, 1981.
```

After reading the display, the user presses the Command key to ask SCI to perform another command.

1.5.2 Batch Operation

SCI also runs in the background, doing batch processing. During batch operations, SCI commands can access files and devices controlled by DNOS, but not users' terminals. The user submits a task for batch processing in an interactive job with the Execute Batch (XB) command and checks its status with the Show Background Status (SBS) command. When the task finishes, SCI informs the user by displaying a message on the originating terminal between commands. As an alternative, the user can issue the WAIT command to have interactive execution pause until the batch processing finishes.

For batch operations the user prepares a batch stream, a sequence of commands, complete with prompts and responses. The *DNOS System Command Interpreter (SCI) Reference Manual* describes the format of batch stream commands.

A batch stream can also run in a separate job, independent of the interactive job. The Execute Batch Job (XBJ) command submits the batch stream. SCI passes it to DNOS to run as a separate job.

1.6 DISK VOLUME CONTENT AND ATTRIBUTES

DNOS uses disk volumes for system functions and user data. The disk drive known as the system disk is used to load the operating system; the system disk contains both system files and space for user files. DNOS also uses the system disk when it performs internal, disk-based functions. DNOS keeps pointers to all subdirectories on a disk volume in a directory named VCATALOG. Other than tracks 0 and 1, the area on a disk volume is allocated dynamically.

DNOS requires certain files on the system disk to support internal, disk-based functions. System files follow a strict naming convention to minimize conflict with user-assigned file names. When the system is delivered, all system file names begin with S$. User files can be data files or directories using names that are meaningful to the user. The Files and Directories section in this manual discusses creating and using files.

1.7 DNOS-SUPPORTED DEVICES

DNOS operates with the Business System and Model 990 minicomputers that offer a memory mapping feature. These systems have memory addressing capacities of up to two million bytes. DNOS requires a minimum hardware configuration that includes:

- The Business System or Model 990 minicomputer with the mapping option and a minimum random access memory of 256K (K equals 1024 8-bit bytes)
- A video display terminal
- A system disk drive and disk with a minimum size of approximately five megabytes
- A disk backup — either magnetic tape or a second disk drive

Appendixes to this manual discuss the operation of DNOS-supported devices. DNOS supports these peripheral devices:

- Models DS10 and DS50/DS200 Disk Drives
- Models DS80 and DS300 Disk Drives
- Model CD1400 Disk Drive
- Model FD1000 Flexible Diskette Drive
- Model WD800 and WD800A Winchester Disk Storage System
- Model WD500 Winchester Disk Storage System
- Model 911 Video Display Terminal
- Model 931 Video Display Terminal
- Model 940 Electronic Video Terminal

- Model 733 ASR/KSR Hard Copy Data Terminals
- Silent 700 family of portable KSR data terminals
- Model 820 KSR Data Terminal
- Model 840 RO Data Terminal
- Models 810 and 2230/2260 Printers
- Model 979A and MT1600 Magnetic Tape Drive
- Model 804 Card Reader
- LQ45 Letter Quality Printer
- Model LP300 and LP600 Printers
- Model 850 and 855 Printers

Before reading the rest of the manual, determine what hardware you are using. The rest of the manual discusses operational concepts. To understand this, you must know how to use disk drives, terminals, printers and tape drives. Find out exactly what hardware you have, then study the appropriate appendixes to learn how to operate that hardware.

2

Powering Up and Powering Down

2.1 GENERAL INFORMATION

This section tells how to power up and power down a computer running DNOS. It explains the controls and indicators on the programmer panels of the Model 990 and Business Systems Computers. Next, it provides instructions for starting the computer and loading DNOS from a variety of media. The section concludes with instructions for powering down the system.

The operator may need to take the following steps to maintain operation of DNOS:

1. Reinitialize the system date and time.

2. Save the system log files.

3. Reinitialize the system log.

2.2 FRONT PANEL CONTROLS AND INDICATORS

The Model 990 and Business Systems minicomputers have different front panels. The following paragraphs discuss the controls and indicators on the front panels of these computers.

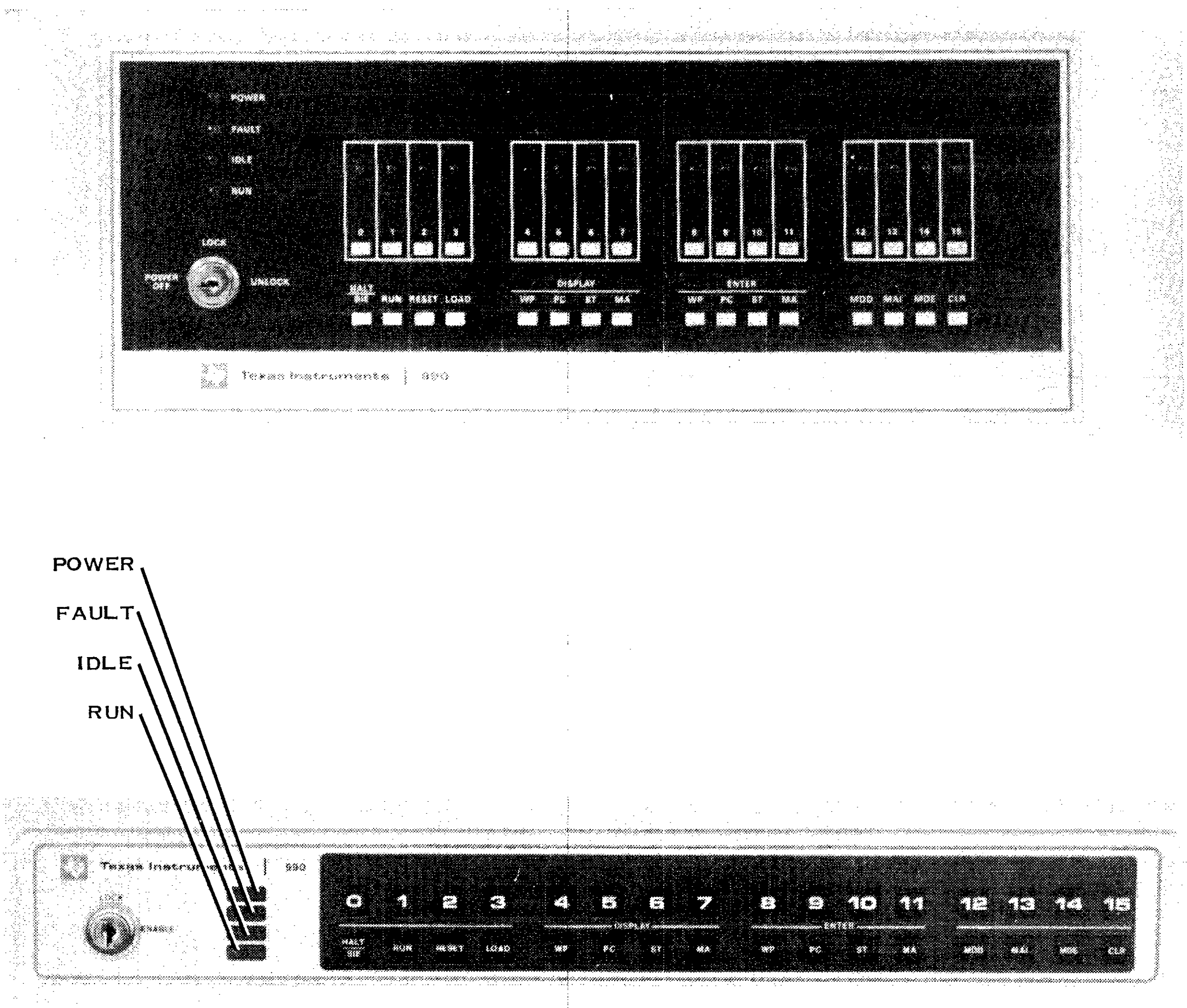
2.2.1 Model 990 Computers

The programmer (front) panels shown in Figure 2-1 and Figure 2-2 enable the user to load software initially and to load and examine memory locations and internal registers. The programmer panel consists of an array of controls and lamps used to enter and display information and status conditions in the CPU.

2.2.1.1 POWER Indicator. The POWER indicator lights when AC power is supplied.

2.2.1.2 FAULT Indicator. The FAULT indicator lights when a diagnostic test fails, a system crash occurs, or a loader crash occurs.

2.2.1.3 IDLE Indicator. The IDLE indicator lights when the 990 carries out an IDLE instruction and execution is suspended.



2285237

Figure 2-1. Models 990/10 and 990/12 Computer Programmer Panel

2.2.1.4 RUN Indicator. The RUN indicator lights during CPU activity. It goes off while the processor executes the programmer panel software.

2.2.1.5 Key-Switch. Turning the key-switch fully counterclockwise turns off ac power to the 990. Turning the switch to the center position connects the ac power, but leaves the programmer panel locked out. Turning it fully clockwise connects the ac power and unlocks the programmer panel.

2.2.1.6 HALT/SIE Switch. Pressing the Halt/Single Instruction Execution (HALT/SIE) switch halts the processor. Each subsequent time it is pressed, a single instruction is executed and the program counter is incremented.

2.2.1.7 RUN Switch. Pressing the RUN switch changes the processor state from single instruction mode to the normal run state.

2.2.1.8 RESET Switch. When the RESET switch is pressed, the processor issues a reset signal to all of the I/O devices in the system.

2.2.1.9 LOAD Switch. The LOAD switch causes the processor to execute a bootstrap loader program.

2.2.1.10 WP DISPLAY Switch. When the Workspace Pointer Display (WP DISPLAY) switch is pressed, the current value of the workspace pointer is displayed by the data lights.

2.2.1.11 PC DISPLAY Switch. When the Program Counter Display (PC DISPLAY) switch is pressed, the current value indicated by the program counter is displayed by the data lights.

2.2.1.12 ST DISPLAY Switch. When the Status Register Display (ST DISPLAY) switch is pressed, the current value indicated by the status register is displayed by the data lights.

2.2.1.13 MA DISPLAY Switch. A memory address is always maintained in a register called the memory address register. Pressing the Memory Address Display (MA DISPLAY) switch displays the current address on the data lights of the programmer panel.

2.2.1.14 WP ENTER Switch. Pressing the Workspace Pointer Enter (WP ENTER) switch loads the current value indicated by the data lights into register 13 of the programmer panel workspace. Then pressing the RUN or HALT/SIE switch places the altered values into the workspace registers.

2.2.1.15 PC ENTER Switch. Pressing the Program Counter Enter (PC ENTER) switch loads the current value indicated by the data lights into register 14 of the programmer panel workspace. Then pressing the RUN or HALT/SIE switch places the altered values into the workspace registers.

2.2.1.16 ST ENTER Switch. Pressing the Status Register Enter (ST ENTER) switch loads the current value indicated by the data lights into register 15 of the programmer panel workspace. Then pressing the RUN or HALT/SIE switch places the altered values into the workspace registers.

2.2.1.17 MA ENTER Switch. Pressing the Memory Address Enter (MA ENTER) switch loads the address indicated by the data lights into the memory address register.

2.2.1.18 MDD DISPLAY Switch. Pressing the Memory Data Display (MDD) switch displays the data at the currently maintained memory address on the programmer panel.

2.2.1.19 MAI Switch. Pressing the Memory Address Increment (MAI) switch causes the memory address registers to be stepped incrementally.

2.2.1.20 MDE Switch. Pressing the Memory Data Entry (MDE) switch enters the data displayed on the programmer panel into the current memory address.

2.2.1.21 CLR Switch. The Clear (CLR) switch turns off all of the data lights.

2.2.2 Business Systems Computers

Figure 2-2 shows the front panel of the Business Systems computer. The user can load the operating system and force system crashes from this panel. The following paragraphs discuss the switches and indicators found on the front panel.

2.2.2.1 1-S-2 Control. This switch, hidden by the upper trim panel during normal operation, is the local-secure-remote control. It also controls the numeric display on the front panel.

In the local (1) position, controls and indicators on the front panel are enabled. If a remote panel is connected, the remote panel displays operate but the controls do not.

In the secure (S) position, the computer is secure from any operator control. The displays continue to operate.

In the remote (2) position, all front panel controls and indicators are inoperative. If a remote panel is connected at the test connector, the remote panel is active.

2.2.2.2 Numeric Display. This is a four-digit hexadecimal display; the numbers displayed are determined by the central processing unit and the software being executed. The display is on unless the panel is in the remote (2) position.

2.2.2.3 POWER Indicator. Thes is a green light emitting diode (LED) that lights when operating power is on.

2.2.2.4 RUN Indicator. This is a green LED that lights when the central processor is executing instructions.

2.2.2.5 IDLE Indicator. This is a green LED that lights each time the central processor executes an idle instruction. The IDLE indicator may stay on, flicker, or appear to remain on; this depends on the activity in progress.

2.2.2.6 FAULT Indicator. This is a red LED that indicates a failure. Diagnostic self-tests built into the central processor turn the FAULT indicator on when they start and off when they successfully complete. It is normal for the FAULT indicator to remain on for a few seconds as part of the load operation. If the FAULT indicator remains on for more than a few seconds, a failure has occurred.

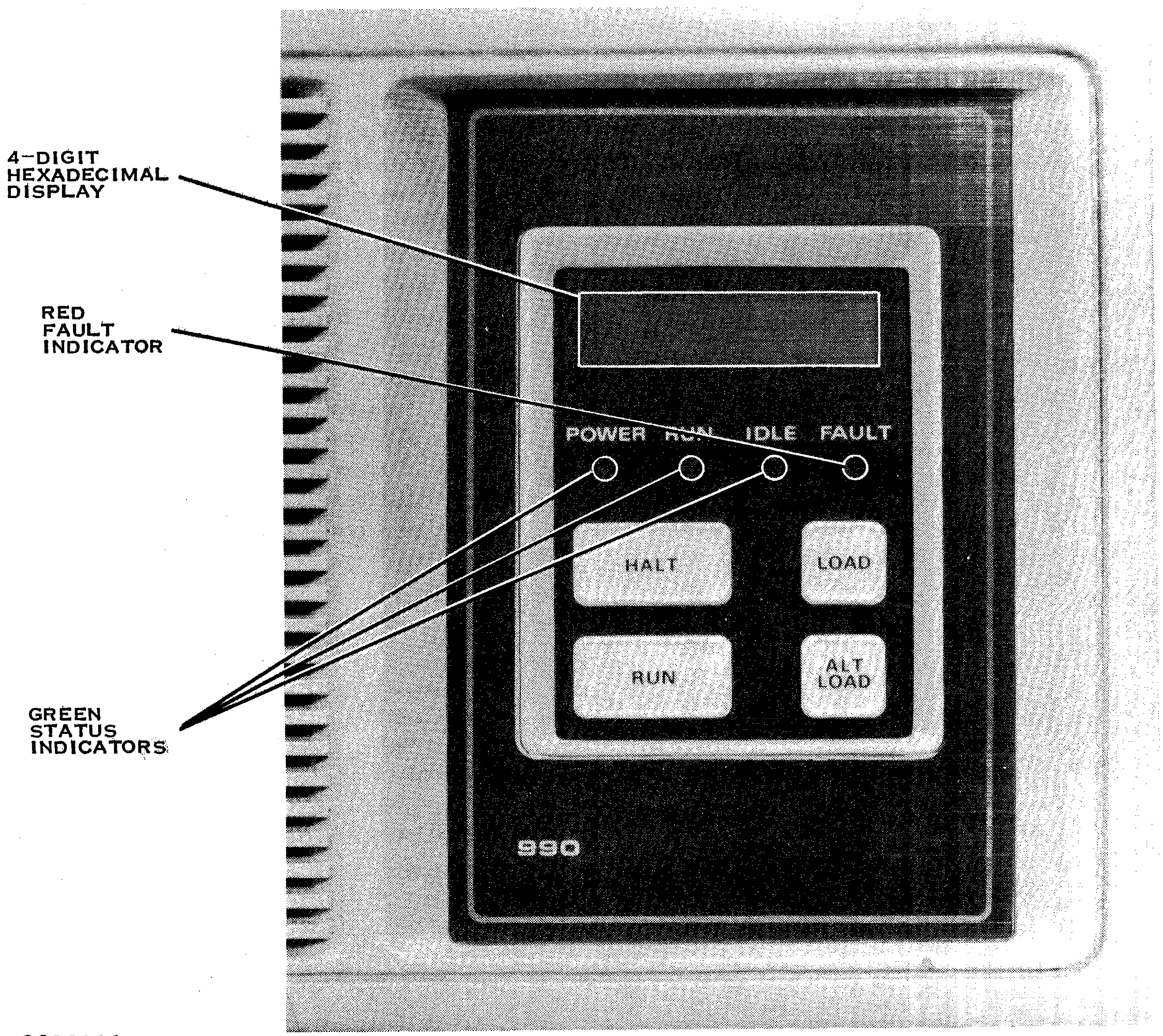


Figure 2-2. Business Systems Front Panel

2.2.2.7 HALT Control. Pushing the HALT control stops the operation of the processor at the next instruction and enables the RUN, LOAD, and ALT LOAD controls. The computer program counter (PC) is displayed while the computer is halted.

Pressing HALT repeatedly steps the computer through its instructions, one instruction each time HALT is pressed.

NOTE

> Although pressing the HALT control steps the computer through its instructions one at a time, pressing the HALT control 11 consecutive times forces a system crash.
>
> If the system has already crashed, pressing the HALT control, then pressing the RUN control copies the system memory into a special crash file, .S$CRASH. See the section Handling a System Crash.

2.2.2.8 RUN Control. Pressing RUN starts the computer operating at normal speed. Pressing the HALT and RUN controls in combination can be used to force a system crash or recover from a system crash — see the previous note.

2.2.2.9 LOAD Control. Pressing LOAD after HALT clears hardware errors, resets the TILINE*, and starts the normal system software load sequence from the designated system disk.

2.2.2.10 ALT LOAD Control. Pressing ALT LOAD after HALT performs the same operations as pressing LOAD after HALT except that the system software is not loaded from the designated system disk. ALT LOAD loads the system software from a TILINE tape or disk that is not designated as the system disk.

The following paragraphs discuss loading DNOS from both the system disk and devices that are not designated as the system disk.

2.3 STARTING AND LOADING THE COMPUTER

The following paragraphs discuss starting and loading Model 990 and Business Systems computers.

2.3.1 Model 990 Computers

DNOS is loaded into computer memory by a loader program. The procedure for starting the computer and loading DNOS depends on the medium of the loader program.

The following paragraphs describe procedures for loading DNOS from various disks. All switches mentioned in the procedures are switches on the programmer panel of the Model 990 Computer shown in Figure 2-2.

* TILINE is a trademark of Texas Instruments Incorporated.

In multiple-disk DNOS systems, the system disk is normally used for loading and executing the loader program from Read Only Memory (ROM). This is drive unit 0 at TILINE address > F800. Alternatively, the user can have the loader program in ROM load DNOS from some other disk unit. The following directions give the steps needed to load and execute the loader program from ROM in order to load DNOS from the system disk drive.

2.3.1.1 Loading DNOS from the System Disk. To load DNOS from the system disk drive unit 0, load and execute the disk bootstrap loader program as follows:

1. Place the disk cartridge containing the DNOS operating system in the system disk drive unit 0 and ready the unit for operation with the write-protect feature disabled.

2. Press the HALT/SIE switch.

3. Press the LOAD switch. This executes the bootstrap loader. DNOS is loaded into memory and the FAULT light goes on for about seven seconds as initialization takes place and online disks are automatically installed, then a number of system structures are created.

4. The system displays a banner line at each terminal.

5. Now the System Command Interpreter (SCI) can be activated. The Beginning and Ending a Session at a DNOS Terminal section discusses how to activate SCI.

2.3.1.2 Loading DNOS from a Disk Other than the System Disk. To load DNOS from a disk unit other than the system disk unit, load and execute the disk bootstrap/loader program as follows:

1. Place the disk cartridge containing DNOS in the desired disk drive unit and ready the unit for operation with the write-protect feature disabled. The address and interrupt level of the unit must be included on the system generation for the DNOS system being loaded.

2. Press the HALT/SIE switch.

3. Press the CLR switch.

4. Set the data switches to hexadecimal value > 0082.

5. Press the MA switch under ENTER.

6. Press the CLR switch.

7. On the data switches, enter the TILINE address of the controller of the disk unit from which DNOS is being loaded. (The TILINE address should be provided by your hardware support personnel.)

8. Press the MDE switch.

9. Press the MAI switch.

10. Press the MDD switch. (The panel displays the present disk unit selection code, which is usually 0800.)

11. Set the data switches to enter the unit selection code for the disk unit on the controller specified in step 7 — the one with the system disk cartridge. Disk unit selection codes are as follows:

    Unit 0 — 0800
    Unit 1 — 0400
    Unit 2 — 0200
    Unit 3 — 0100

12. Press the MDE switch.

13. Press the LOAD switch.

14. The bootstrap loader program executes. DNOS is loaded into memory and the FAULT light goes on for about seven seconds as initialization takes place and online disks are automatically installed, then a number of system structures are created. The banner line appears at each terminal.

15. The system is ready for activation of SCI. The Beginning and Ending a Session at a DNOS Terminal section discusses how to activate SCI.

2.3.2 Business Systems Computers

The following paragraphs discuss loading DNOS first from the system disk, then from an alternate device. These procedures apply to hard disks, double-sided double-density diskettes, and tapes.

2.3.2.1 Loading DNOS From the System Disk. The system disk is disk unit 0 at TILINE address >F800. To load DNOS from the system disk perform the following steps:

1. Mount the disk containing DNOS in the designated system disk drive and ready the unit for operation with the write-protect feature disabled.

2. Press the HALT switch on the front panel.

3. Press the LOAD switch. This executes the bootstrap loader. The FAULT indicator will light for about seven seconds.

4. When the FAULT indicator goes out and the system banner is displayed on each terminal, SCI can be activated. Refer to the section Beginning and Ending a Session at a DNOS Terminal for a description of how to activate SCI.

2.3.2.2 Loading DNOS from Other than the System Disk. The ALT LOAD (alternate load) switch commands the processor to load from the lowest-numbered and ready TILINE device found. DNOS cannot be loaded from a magnetic tape; it can be built by a system provided on magnetic tape as an initial build system. This special build system is shipped as the first tape of a DNOS tape object kit. The DNOS system resides on the tapes restored by the special build tape. To load DNOS from a device that is not the designated system disk perform the following sequence:

1. Ensure that the load device (hard disk, diskette, or tape) is ready and connected to the appropriate TILINE address. The appropriate TILINE address is the lowest-numbered address where a disk, diskette, or tape drive is connected and ready.

2. Depending on the type of media DNOS is on, mount the media in a TILINE disk or tape drive.

3. Press the HALT switch on the computer front panel

4. Press the ALT LOAD switch. This tells the system loader that you are loading the operating system from a device that is not the system disk. The FAULT indicator will light for about seven seconds. The processor attempts to load from a maintenance diagnostic unit (MDU) cassette. When an MDU is not found, the processor performs the following sequence to find the TILINE device to load from, and it loads from the first device found that meets the correct criteria:

   a. It searches for a magnetic tape unit at address >F880, units 0 through 3.

   b. It searches for a disk unit that is not write protected at address >F800, units 0 through 3.

   c. It searches for a disk unit that is not write protected at address >F810, units 0 through 3.

   d. It searches for a disk unit that is not write protected at address >F820, units 0 through 3.

   e. If it fails to find a unit that is ready and not write protected, it returns to step b and begins a search for a ready and write-protected disk. If it finds a ready and write-protected disk, it loads from the disk.

   f. If it fails to find a ready and write-protected disk unit, it returns to step a and restarts the search for a ready load device.

5. When the FAULT indicator goes out and the system banner is displayed on each terminal, SCI can be activated. Refer to the section Beginning and Ending a Session at a DNOS Terminal for a description of how to activate SCI.

2.4 POWERING DOWN THE SYSTEM

Shutting down DNOS while retaining system data integrity requires processes currently active in the system to be brought to an orderly end. To safely shut down DNOS, perform the following steps:

1. Terminate all application programs running at all terminals.

2. Terminate SCI by entering a Quit (Q) command at each terminal where SCI is active, except the one being used to bring down the system. If the Text Editor or Debugger is active at a terminal, the Q command automatically prompts for the Quit Edit (QE) or Quit Debug (QD) command responses. When it receives the proper response, it displays the following message:

   ```
   QUIT PROCESSING INCOMPLETE:    RE-ENTER Q COMMAND
   ```

   Press the Return key and reenter the Quit (Q) command to terminate SCI at the terminal.

   It the terminal has pending foreground operations when the Q command is entered, SCI displays the following message:

   ```
   U SCI--0048 QUIT OPERATION NOT VALID WITH YYY PENDING
   ```

   YYY is the name of the operation, such as SCU (System Configuration Utility).

   To erase the message, press the Return key. The operation must be completed or terminated with the appropriate command (for example, Quit System Configuration Utility (QSCU)). The Q command must then be reentered to terminate SCI at the terminal.

   If the terminal has a background task active when the Q command is entered, SCI displays the following message:

   ```
   U SCI--0029 CANNOT QUIT WITH BACKGROUND TASK PENDING
   ```

   The background task may be allowed to complete or it may be terminated using the Kill Background Task (KBT) command. The Q command must then be reentered to terminate SCI at the terminal.

3. Users other than the system operator enter the Execute Operator Interface (XOI) command to obtain the operator interface for the next steps. For details on XOI, see the paragraph Single Operator Systems in the section Using the Operator Interface.

4. Terminate or complete all output queued to devices. The Show Output Status (SOS) command with the default for USER ID and DEVICE NAME shows whether any file is being output or is queued for output. The user may wait for all queued output to terminate or may enter the Kill Output at Device (KO) command for each device shown in the SOS command output. In addition to DEVICE NAME, the KO command issues the following prompt:

   ```
   SPOOL ID?
   ```

   Use the response ALL to kill all files queued to an output device. For details on SOS and KO, see the *DNOS System Command Interpreter (SCI) Reference Manual.*

5. Enter the List Jobs (LJ) command to determine that only the system job, spooler job, and one user job are left. If there are any other tasks running, they must be allowed to complete or be terminated with the Kill Task (KT) command. For details on LJ and KT, see the *DNOS System Command Interpreter (SCI) Reference Manual.*

6. Enter the Unload Volume (UV) command for all disk volumes currently installed. The Show Volume Status (SVS) command may be used to determine the volume name and whether currently installed. It is not necessary to enter the UV command for the system disk. DNOS displays a message indicating which disk unit has been unloaded. The UV command format is as follows:

   ```
   UV
   UNLOAD VOLUME
           VOLUME NAME: name
   ```

   For a discussion on UV and SVS, see the paragraphs Unloading a Disk Volume and Showing the Status of a Disk Volume in the section on Using Disk Volumes. Complete details about these commands can be found in the *DNOS System Command Interpreter (SCI) Reference Manual.*

7. Press the HALT control to stop the computer.

8. Switch all disk units off. Dismount disk packs if the system is to be off for more than a few minutes.

9. Optionally, you can take other peripheral devices offline.

10. After all peripherals are powered down (off) and all disks have stopped rotating, you can power down the computer. If a standby power supply is installed and the computer will be turned off for more than 45 minutes, the standby power supply must also be turned off. Repeated deep-discharge cycles shorten battery life.

CAUTION

If a standby power supply is installed, turning off the computer does not remove all voltages from the chassis interior.

3

Beginning and Ending a Session at a Terminal

3.1 GENERAL INFORMATION

This section discusses the activation of the System Command Interpreter (SCI), which starts a session, and the deactivation of SCI, which completes the session. It discusses logging onto the system, logging off the system, and identifying a system console.

Before a user can operate DNOS at a terminal, SCI must be activated. In addition to activating SCI, a log-on procedure may optionally be required at the terminal.

Requiring a log-on controls the use of the computer. Those wanting to use the computer must enter a valid user identification code recognized by the system before any commands can be executed.

User identification codes consist of user IDs and passcodes which are assigned by means of the Assign User ID (AUI) command. The Modify Terminal Status (MTS) command is used to specify whether log-on is required at a terminal. Refer to the *DNOS System Command Interpreter (SCI) Reference Manual* for a description of the AUI and MTS commands.

Since all configurations of the Model 990 and Business Systems minicomputers may not use the same terminals, Texas Instruments manuals use a generic key name when referring to terminal keys. Those keys for letters, numbers, punctuation, and special characters (for example, @, $, and +) common to all terminals are not assigned generic names. Keys such as editing, cursor control, and special function keys may not have the same label on each terminal; for this reason these keys have been given generic names. Except for the appendixes, which are device specific, this manual will refer to a key on a terminal by its generic name. The Keycap Cross-Reference appendix to this manual describes this in more detail. Refer to the appendix to identify the name of the key on your terminal that corresponds to the generic keyname.

The video display terminal (VDT) can operate in either the VDT mode or the TTY (Teletype) mode. The hard-copy terminals operate only in the TTY mode. The main difference between the two modes is in how the prompts for the commands are written to the terminal. In the VDT mode, all the prompts are displayed at once and the cursor is positioned at the start of the first field. In the TTY mode, one prompt is shown at a time. The system waits for the user to respond before showing the next prompt.

3.2 ACTIVATING SCI AT A TERMINAL

The following procedure shows the steps to activate SCI at a VDT. Some of the following prompts do not appear if they have been preset for the terminal in use.

1. Turn on the terminal, if it is not already on.

2. Press the Attention key.

3. Press an exclamation point (!).

4. If this is the first terminal to log on after loading DNOS, enter the year, month, day, hour, and minute as requested.

5. DNOS responds by displaying or printing the following message:

   ```
   DNOS 1.2.00
   ```

   where:

   1.2.00 is the release version of DNOS.

6. If user identification is required, DNOS displays the following two prompts:

   ```
    USER ID:
   PASSCODE:
   ```

   Type in the assigned user ID and press the Return key to signal DNOS that an entry has been made. Next, type in the assigned passcode and press the Return key to signal DNOS that an entry has been made. To preserve passcode security, the characters of the pass code are not displayed.

7. DNOS may respond by displaying the following prompt (unless it is preset or not required):

   ```
   ACCOUNT ID:
   ```

8. Type the assigned account ID and press the Return key to signal that an entry has been made.

9. DNOS may respond by displaying the following prompt (unless it is already displayed or not required):

   ```
   JOB NAME:
   ```

10. Type a job name and press the Return key to signal DNOS that an entry has been made. A job name can be any eight-character, uppercase alphanumeric string that starts with an alphabetic character or a dollar sign ($).

11. DNOS may respond by displaying the following message:

```
SYNONYM FILE PATHNAME:
```

12. Type in the pathname of the file that contains the synonyms and logical names to be used, or press the Return key to use the default pathname.

13. If the job name entered is already in use with the same user ID, DNOS may respond with the following prompt:

```
RECONNECT?:
```

An ACCOUNT ID validation is not performed with a RECONNECT prompt.

14. Type in YES or NO and press the Return key to signal that an entry has been made. YES specifies that the terminal is also to be associated with the job name in use. NO specifies that this terminal is to be associated with a new job.

15. If the log-on is successful, DNOS may respond with the default main menu and SCI prompt ([ ]), or it displays the news file, if one exists. If a news file is displayed, SCI then waits for the Command key to be pressed. After the Command key is pressed, SCI displays the default main menu and SCI prompt ([ ]) as shown in Figure 3-1. The default main menu may be changed at the option of the systems programmer.

16. Enter the SCI commands that are available to the associated ID privilege level to begin operating the terminal. If you enter a command that is not authorized, SCI displays an appropriate error message.

17. When executing SCI commands, do not turn off the terminal. If the terminal is turned off, device errors are written to the system log and the system may loop in an attempt to complete the command.

NOTE

The default symbols displayed as the SCI prompt depend on the country code installed by the user during system generation. The prompt default symbols are as follows:

Country	Prompt	
Germany/Austria	Ä	Ü
Norway/Denmark	Æ	Å
Sweden/Finland	Ä	Å
All Others	[	]

```
        ****************************************************
        **       T E X A S   I N S T R U M E N T S       **
        **       D N O S   S Y S T E M   1 . 2 . 0       **
        ****************************************************

Command Groups:

/DEBUG  - Interactive Debugger          /OPER   - Operator Interface
/DEVICE - I/O Devices                   /PREXEC - Program Execution
/DIR    - Directories                   /PRFILE - Program Files
/EDIT   - Text Editor                   /SECURE - File Security
/FILE   - File Management               /SPOOL  - Spooler
/JOB    - Job Management                /STATUS - Status Reports
/LANG   - Language Support              /SYSCON - System Configuration
/LUNO   - Logical Unit Numbers          /SYSGEN - System Generation
/MSG    - Message Facilities            /SYSMGT - System Management
/NAME   - Synonyms and Logical Names    /TPD    - Teleprinter Devices
/NET    - Networking Support            /VOLUME - Disk Volumes

        []
```

Figure 3-1. SCI Command Group Main Menu

With activation completed, the user can begin using SCI at the terminal. Though a comprehensive account of the use of SCI exceeds the scope of this document, the following list can help orient the user to the most common SCI activities:

- Using Menus — Each item on the DNOS main menu is the name of another menu. The other menus either list groups of command or more menus. Menu names begin with a slash. To view a menu, the user enters the menu name in response to the SCI prompt. This way the user can find a needed command by looking through lists of related commands instead of consulting a manual. The main menu reappears when the user presses Command or a command completes. For more information on SCI command groups and menus, see the appropriate section in the *DNOS System Command Interpreter (SCI) Reference Manual.*

- Entering SCI Commands — To enter an SCI command, hold down the Shift key (or press the Upper Case Lock key), press the keys for the letters in the command, and then press the Return key. (Everywhere this manual says to enter a command, key in the command, then press the Return key.) Setting the .OPTION LOWERCASE=YES allows the user to enter upper and/or lowercase characters.

- Privilege Level — The set of commands available to the user depends on the privilege level assigned to the user ID supplied when logging on. Certain commands discussed in the section Using the Operator Interface are reserved for the system operator. The *DNOS System Command Interpreter (SCI) Reference Manual* contains a more detailed discussion of privileged commands and a table of the privilege levels for all commands.

- Responding to SCI Prompts — Most SCI commands ask the user for more information after the command is entered. The user responds to a list of prompts that identify the information needed to carry out the command. After each response, the cursor moves into position for the next response. The user can respond to a prompt in the following ways:

  — Accept the initial value by pressing the Return key.

  — Enter a new value in one of two ways: press Erase Field to erase the initial value, key in the new value, and press Return; or, enter the new value over the initial value and press Skip to erase the remainder of the line.

  — Accept a system default by pressing Skip to erase the initial value. For prompts without defaults, the cursor stays in the field until the user supplies a valid response.

  — Abort the command by pressing Command to regain the DNOS main menu and the SCI prompt.

- Using the Text Editor — To use the DNOS Text Editor, the user issues the Execute Editor (XE) command. The *DNOS Text Editor Reference Manual* gives complete details on the Text Editor commands.

- Viewing the Terminal Local File — Each terminal where SCI is active has a terminal local file to receive the output of various commands. Since the amount of output returned frequently exceeds the capacity of the screen, DNOS enables the user to page through the output by using the function keys described in the *DNOS System Command Interpreter (SCI) Reference Manual*.

- Handling Errors — When errors occur in the processing of a command, DNOS informs the user with a message displayed on the screen. The types of DNOS error messages and explanations are discussed in the section Interpretating Error Messages. For a complete account of the individual messages, consult the *DNOS Messages and Codes Reference Manual*.

- Aborting a Command in Progress — Sometimes the user enters an incorrect command response and needs to abort the command in progress. For this reason, DNOS provides a hard break sequence for aborting potentially destructive commands such as Delete Directory (DD). The sequence requires the user to first press the Attention key and then, while holding down the Control key, press the X key. One task is killed each time the hard break sequence is used. If only SCI is active, SCI is killed, the job terminates, and the terminal is available again for use. Tasks are killed in the following order: foreground tasks, background tasks, and SCI.

3.3 SCI COMMAND GROUP PURPOSE

The following paragraphs discuss the purpose of each SCI command group. Refer to the SCI main menu in Figure 3-1 for the list of command groups. The *DNOS System Command Interpreter (SCI) Reference Manual* discusses each command in each group in detail in the Commands of SCI Groups table. Additionally, the following paragraphs contain general discussions of each command group and tell which DNOS manual explains the commands in detail.

3.3.1 Interactive Debugger Group

The interactive debugger commands provide support for correcting a program. This command group includes commands which execute and terminate the debug mode, display the debug panel for specific tasks, and evaluate expressions for debugging purposes. Additional commands in this group enable you to modify and manipulate breakpoints, tasks, system memory and registers, and search for specific values in memory areas. Discussions on this command group can be found in *DNOS Assembly Language Programmer's Guide*.

3.3.2 I/O Devices Group

The I/O device commands pertain to the use and operation of online input and output devices. These commands allow you to perform operations on mounted media, manipulate I/O devices, and display and modify system device information. Discussions on this command group can be found in the *DNOS System Command Interpreter (SCI) Reference Manual*.

3.3.3 Directories Group

The directory commands enable you to perform copy, verify, and restore functions at the directory level. This command group also allows you to manipulate directories and list information contained on the disk volume or within specific directories. Discussions on this command group can be found in this manual.

3.3.4 Text Editor Group

The Text Editor commands allow you to modify the contents of source files and manipulate the terminal display with horizontal and vertical rolls of the screen. These commands are accessible only after activating the Text Editor. Discussions on this command group can be found in *DNOS Text Editor Reference Manual.*

3.3.5 File Management Group

The file management commands maintain user data with the ability to create relative record files, image files, key indexed files, and sequential files. Files and filenames can be copied, modified and manipulated to meet your needs. This command group also contains SCI commands which enable you to display and print files and list the file information in a disk map. Discussions on this command group can be found in this manual.

3.3.6 Job Management Group

The job management commands control jobs executing on the DNOS system. These commands allow you to list and manipulate job priority and job execution. Discussions on this command group can be found in this manual.

3.3.7 Language Support Group

The language support commands enable you to perform assemble, compile, and link operations, to execute programs and tasks, and to perform various language operations supported by Texas Instruments. Several languages have command menus which can be displayed in place of the DNOS main menu while using the language commands. Refer to the programmer's guide of each DNOS language for details of commands in specific language command groups.

3.3.8 Logical Unit Numbers Group

The logical unit numbers commands allow DNOS to perform input and output to logical units (LUNOs) rather than directly to the resources the LUNOs represent. These commands assign, release, and manipulate the resources to which the LUNOs are assigned. Discussions on this command group can be found in this manual.

3.3.9 Message Facilities Group

Message facilities include user interfaces to the system operator, other users, and the error handling facilities. Discussions on this command group can be found in this manual, *DNOS System Command Interpreter (SCI) Reference Manual*, and *DNOS Messages and Codes Reference Manual*.

3.3.10 Networking Support Group

The networking support group lists commands and submenus of commands for networking products of DNOS. See the specific networking product manual for further information.

3.3.11 Synonyms and Logical Names Group

The DNOS system enables the use of synonyms and logical names which access I/O resources. This command group assigns and lists synonyms and logical names. Synonyms can also be modified and deleted; logical names can be released. Discussions on this command group can be found in this manual.

3.3.12 Operator Interface Group

The operator interface commands send messages to the system operator when operator intervention is necessary. The responsibility for responding to the operator messages can be the responsibility of a designated system operator or shared between the system users. Discussions on this command group can be found in this manual.

3.3.13 Program Files Group

Program file commands create and maintain DNOS program files. These file commands can modify, delete, and install procedures, program segments, tasks, and overlays within a program file. Discussions on this command group can be found in *DNOS Assembly Language Programmer's Guide*.

3.3.14 Program Execution Group

The program execution group contains commands associated with batch streams during creation, execution, and termination. Other commands display and control program activity and errors encountered during activation. Discussions on this command group can be found in this manual.

3.3.15 File Security Group

Three general groups of commands are available. A set of user commands allow any user to examine access rightsand set up his own security environment. Commands for access group leaders allow those users to create and manage access groups. Commands in the security manager group allow the security manager to control the system's overall security. Discussions on this command group can be found in this manual and in the *DNOS Security Manager's Guide*.

3.3.16 Spooler Group

The spooler commands pertain to the use and operation of online output devices. These commands allow you to print files, manipulate output devices, and examine output status. Discussions on this command group can be found in this manual.

3.3.17 Status Reports Group

Status report commands enable you to obtain the status of programs executing on a DNOS system, the status of the whole operating system, and the status of devices attached to the system. Discussions on this command group can be found in this manual.

3.3.18 System Configuration Group

System configuration commands allow you to examine and modify a system configuration. Discussions on this command group can be found in *DNOS System Generation Manual*.

3.3.19 System Generation Group

System Generation commands allow you to generate a new system. Discussions on this command group can be found in *DNOS System Generation Manual*.

3.3.20 System Management Group

System management commands allow you to perform required functions prior to system operation, to analyze a system crash, to maintain user IDs, and to recover data. Discussions on this command group can be found in this manual and *DNOS Systems Programmer's Guide*.

3.3.21 Teleprinter Devices Group

The teleprinter device utilities commands establish connections, monitor completion of connections, and terminate connections between terminals. Other commands list the port characteristics of the hard-copy terminal ports and allow modifications to those characteristics. Discussions on this command group can be found in *DNOS System Command Interpreter (SCI) Reference Manual*.

3.3.22 Disk Volumes Group

Disk volume commands inspect and modify the contents of a disk medium, prepare a disk medium for storing data, and copy the contents of one disk to another disk of the same type. Discussions on this command group can be found in this manual.

3.4 LOGGING OFF

SCI is deactivated (logged off) at a terminal by entering the Quit (Q) command and pressing the Return key.

SCI cannot be deactivated at a terminal if the Text Editor, Debugger, or a background task is active. If this is attempted, DNOS displays one of the following error messages:

```
QUIT PROCESSING INCOMPLETE: RE-ENTER Q COMMAND

U SCI-0029 CANNOT QUIT WITH BACKGROUND TASK PENDING
```

Refer to the QUIT (Q) command in the *DNOS System Command Interpreter (SCI) Reference Manual* for the correct procedures to deactivate SCI under these conditions.

4

Using Files and Directories

4.1 GENERAL INFORMATION

This section discusses file security and the commands for creating directories and files, deleting directories and files, and viewing directories and files. For complete directions on using each command, refer to the appropriate command description in the *DNOS System Command Interpreter (SCI) Reference Manual.*

4.2 FILE SECURITY

DNOS provides file security with two mechanisms: access groups and access rights. Access to a secure file is granted to a user only if he is a member of an access group that has appropriate access rights to the file.

4.2.1 Access Groups

An access group is a group of users that have similar requirements for system resources or perform similar tasks. Anyone having access to the Create Access Group (CAG) command can create an access group; the person creating the access group becomes the group leader until the leadership is changed with the Modify Access Group (MAG) command. Only the group leader can execute some commands related to access groups.

DNOS defines two special access groups: PUBLIC and SYSMGR. Anyone having access to the system is a member of PUBLIC; files available to this group are not secure. The SYSMGR access group contains only those users who are responsible for managing system security.

4.2.2 Creation Access Group

Each user can specify which of his access groups should be the access group used when creating a file. When a file is created, the file has the access rights of the user's creation access group. The file access rights can be changed by the user who created the file or any member of his creation access group. If the creation access group is PUBLIC, the access rights can be changed by anyone.

4.2.3 File Access Rights

DNOS systems using file security have two general types of files, public and secure. Public files are accessable to anyone able to log on to the system. Access to secure files is restricted to users who are members of an access group having access rights to a specific file. Up to nine groups can be given access rights to any one secure file.

Access rights are verified when a logical unit number (LUNO) is assigned to the file. If a global LUNO is assigned to a secure file, that file's security is compromised, since anyone can use that LUNO. Once a global LUNO is assigned, it remains assigned until removed with a Release Global LUNO (RGL) command.

Access groups can be given any combination of five access rights to a file:

- Read Access — Read access is more than just the right to read a file. If the file is an SCI batch stream or procedure file, read access provides the right to execute the batch stream or procedure. Read access on a program file also allows the user to map the file with the map program file (MPF) command.
- Write Access — Write access is the right to write data to a file; this includes writing new data as well as writing over existing data. Write access to a program file is the right to install or delete tasks, segments, procedures, and overlays. Write access to a key indexed file (KIF) includes the right to insert and delete records from that file.
- Delete Access — Delete access is the right to delete a file. Delete access is required for text editing and replacing the input file.
- Execute Access — Execute access is the right to execute tasks, segments, procedures, and overlays within a program file.
- Control Access — Control access is the right to change the security associated with a file. This includes providing access to an access group as well as changing the rights held by an access group.

4.2.4 Security Manager Responsibilities

The security manager is responsible for the orderly setup of the system environment and handling security problems during normal operations. The system can be as restricted or as relaxed as needed. The system manager must secure the system resources when a DNOS system is built by establishing access groups and file access rights for system files, SCI commands, user data files, and application programs.

As a member of the SYSMGR access group, the security manager can access any file; therefore he can modify access rights to any file, delete any file, access any SCI command, assign new user IDs, and help in recovery of data.

4.2.5 User Commands

Anyone having proper privileges and access can use commands affecting file security. DNOS has the following commands for establishing and modifying security access groups and their access rights:

- Create Access Group (CAG) Command — CAG creates access groups if they do not exist or adds new members to an existing group. When an access group is created with CAG, the person creating the group becomes the group leader.
- Delete Access Group (DAG) Command — DAG deletes an access group. The access group cannot be deleted until all members of the group except the group leader have been removed from the group.
- List Access Groups (LAG) Command — For a given user ID, LAG lists all access groups for that ID, indicates for which access group the user is the leader, and the current creation access group for that ID. For members of the SYSMGR group, LAG shows all access groups in the system.

- List Access Group Members (LAGM) Command — Only an access group leader can use LAGM. LAGM lists all the members of an access group. Members of the SYSMGR group can list the members of any access group on the system.
- List Security Access Rights (LSAR) Command — LSAR can only be used by the group having control access rights to a file. LSAR lists all access groups and their access rights for a particular file.
- Modify Access Group (MAG) Command — MAG adds and deletes members of an access group; it also changes the group leader. Any user ID entered as a response to the MAG prompts is validated before action is taken.
- Modify Passcode (MPC) Command — MPC modifies the current log-on passcode. The current passcode is validated before replacing it with the new passcode.
- Modify Security Access Rights (MSAR) Command — MSAR can only be used by the person having control rights to the file. MSAR adds and deletes groups to the list of groups having access to a file. MSAR also modifies a group's access rights to a file. Security can be removed from a file by responding with PUBLIC to the ACCESS GROUP NAME: prompt.
- Set Creation Access Group (SCAG) Command — SCAG designates the access group having full access rights to a file being created by the user. The group is effective the next time the user logs on.
- List Access Group File Rights (LAGFR) — LAGFR lists all files in a specified directory and the access rights to each listed file that a named access group has access to.

To provide file security, the person having control access to a file can use the following steps to limit file access to a set of users:

1. Determine which user IDs should be in the access group(s).
2. Create the access groups and add the user IDs to the appropriate group.
3. Create the files if they do not already exist.
4. Define the file access rights for each group with the MSAR command.

4.3 FILE AND DIRECTORY FORMAT

DNOS references files by pathname. The pathname leads DNOS through the hierarchy of directories, starting with the disk volume and ending with the identifier of the file within its directory. Periods serve as separators between elements of the pathname. Each element corresponds to one of the levels shown in Figure 4-1 so that the first element indicates the volume or drive, the second element indicates the level-one directory belonging to the volume or drive, the third element identifies the level-two subdirectory of the level-one directory, and so on. The final element identifies the file within the directory hierarchy specified by the other elements.

```
VOLONE.AGENCY.RECORDS
VOLTWO.JOE
EMPLOY01.USRB.PAYROLL
MYDIRECT.MYDIRCTA.MYFILE
EMPLOY01.USRA.PAYROLL
EMPLOY01.USRB.CATALOGX.PAYROLL
DS02.DIR1.FILE
.DIR2.FILE
```

In the examples, JOE is the only file directly cataloged in the VCATALOG directory for the volume named VOLTWO. Absence of a volume or drive name implies the system volume as shown in the last example. If either the drive or volume name is absent, the pathname must begin with a period.

When the system is part of a network, pathnames can also include site names. A site name must be included as the first part of the pathname when accessing a file on a remote system. If the file DS02.DIRI.FILE is at a site named DALLAS, the pathname is DALLAS:DS02.DIRI.FILE. The colon separates the the site name from the rest of the pathname. The restriction of 48 characters applies to any pathname and includes the site name characters.

4.4 CREATING A DIRECTORY

The CFDIR (Create File Directory) command creates special files, called directories, that contain pointers to other files and to subdirectories.

Each directory and subdirectory in a hierarchy must be created by a separate CFDIR command. For example, a file may be identified by the pathname VOL1.DIR.SUBDIR.FILE1. The directory and the subdirectory in that hierarchy are created by entering separate CFDIR commands — one to create VOL1.DIR, and another to create VOL1.DIR.SUBDIR.

Files are created under directories or subdirectories by separate Create File commands.

4.5 CREATING FILES

Files may be created by the Text Editor or the Create File (CF) command. The Text Editor can create sequential files interactively.

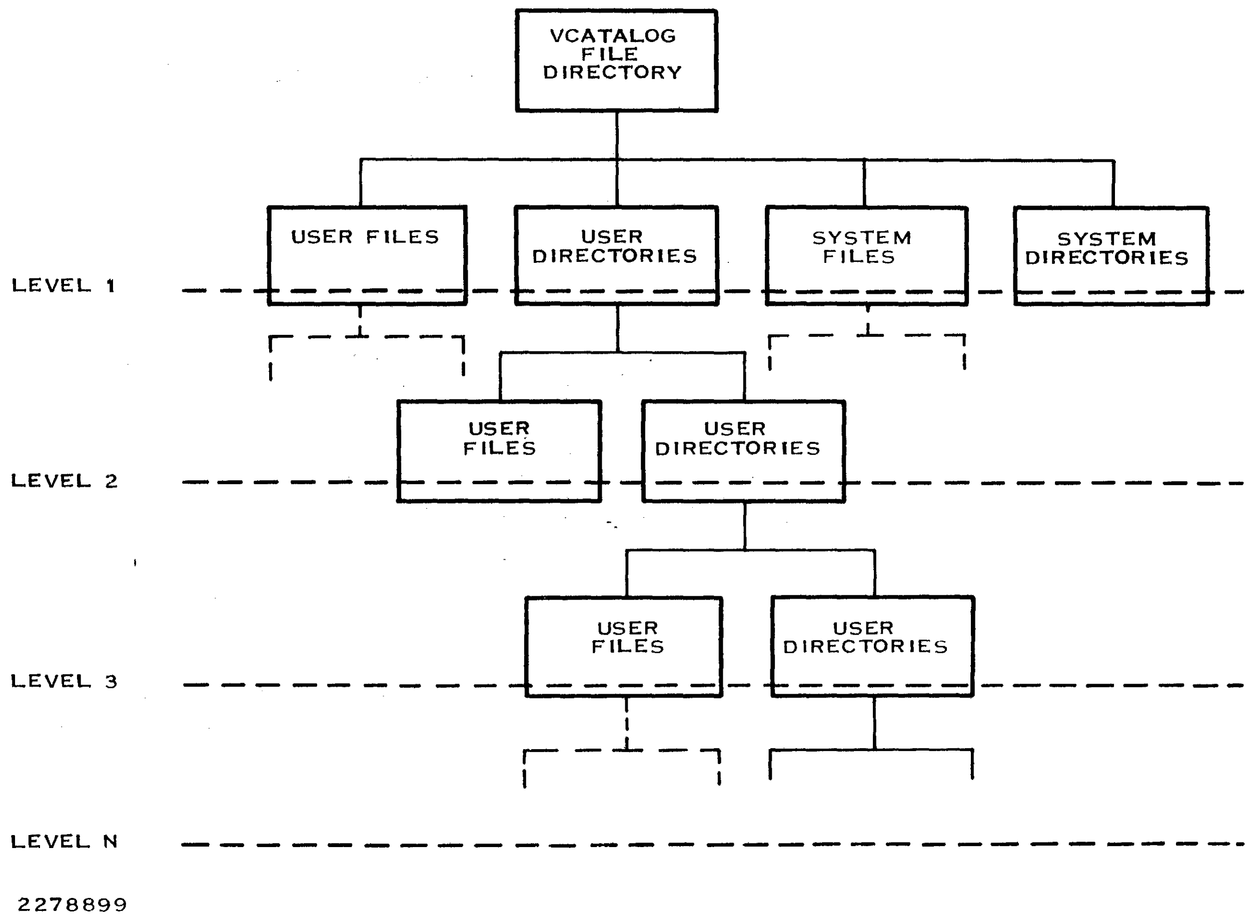


Figure 4-1. Files and Directory Structure

4.5.1 Creating a File Using the Text Editor

Files can be created using the Text Editor by entering the Text Editor with the Execute Text Editor (XE) command using an existing file pathname, modifying or entering information in the file, then quiting the edit session with the Quit Edit (QE) command. Answer NO — the default value — to the ABORT?: prompt and enter the new file pathname for the OUTPUT FILE ACCESS NAME: prompt.

For a complete description of the use of the Text Editor, refer to the *DNOS Text Editor Reference Manual*.

4.5.2 Creating a File Using the Create File Command

The Create File (CF) command creates directories, image files, key indexed files, program files, relative record files, and sequential files. The directories to contain the directories and files must already exist.

When the CF command is executed, SCI prompts ask for the type of file to be created. These are the response options:

- DIR — Directories and subdirectories. Directory files are relative record files whose contents are file names and pointers.
- IMG — Image files. Image files are relative record files whose record sizes are related to physical divisions on the disk. These are special-purpose files used primarily by DNOS for memory images, swapping, and diagnostic dumps.
- KEY — Key indexed files. Key indexed files have variable length records that are randomly or sequentially accessed by key values for each of up to 14 separate keys. Only even-length records are allowed.
- PRO — Program files. Program files are relative record files that contain executable programs including tasks, procedures, and overlays.
- REL — Relative record files. Relative record files have fixed, even-length records that are randomly accessed by record number. Physical records (units of disk access) may contain several logical records.
- SEQ — Sequential files. Sequential files have variable length records that are only accessed sequentially. They may have odd, even, or zero-length records.

This prompt can be combined with the CF command; for example, CFSEQ creates a sequential file.

4.6 DELETING FILES

The Delete File (DF) command deletes files. If the file is a directory, it must be empty or the command will abort. Directories that are not empty can only be deleted by the Delete Directory command. If the file to be deleted is delete-protected, the DF command fails and reports an error. Use the Modify File Protection (MFP) command to remove the delete protection.

4.7 DELETING A DIRECTORY

The Delete Directory (DD) command deletes directories. Deleting a directory removes the directory and all files and subdirectories it contains. No delete-protected file in the directory or in its subdirectories will be deleted. Upon completion of the DD command SCI sends a listing of all deleted subdirectories and files in the named directory to the device named by the LISTING ACCESS NAME: prompt. If any files are delete-protected, the listing marks those files in the listing with DELETE-PROTECTED. Any files marked DELETE-PROTECTED are not deleted, nor are the subdirectories containing these files.

The listing in Figure 4-2 was produced when a user attempted to delete the .DNOS$DIR directory. The directory .DNOS$DIR.I02 has delete-protected files; therefore neither .DNOS$DIR, .DNOS$DIR.I02, nor the protected files were deleted. However, the directory .DNOS$DIR.I03 did not have any delete-protected files; .DNOS$I03 and all the files it contained were deleted. All files not delete-protected in .DNOS$DIR and .DNOS$DIR.I02 were also deleted.

```
 DELETED  DNOS$DIR.JOBS
 DELETED  DNOS$DIR.I03.SIS$O
 DELETED  DNOS$DIR.I03.MD$O
 DELETED  DNOS$DIR.I03.SMM$O
 DELETED  DNOS$DIR.I03
 DELETED  DNOS$DIR.SC1
U SVC-0319 DNOS$DIR.I02.S3$I IS DELETE-PROTECTED
 DELETED  DNOS$DIR.I02.SMS$O
 DELETED  DNOS$DIR.I02.SDT$O
U SVC-0319 DNOS$DIR.I02.LD$O IS DELETE-PROTECTED
 DELETED  DNOS$DIR.I02.LDC$O
 DELETED  DNOS$DIR.I02.APPENDS
 DELETED  DNOS$DIR.I02.PROMPT$O
 DELETED  DNOS$DIR.I02.LSC$O
 DELETED  DNOS$DIR.I02.STI$O
 DELETED  DNOS$DIR.I02.LTS$O
U SVC-0319 DNOS$DIR.I02.C IS DELETE-PROTECTED
U SVC-0319 DNOS$DIR.I02.DNOSMENU IS DELETE-PROTECTED
U SVC-0325 DNOS$DIR.I02 IS A DIRECTORY CONTAINING FILES
U SVC-0325 DNOS$DIR IS A DIRECTORY CONTAINING FILES
```

Figure 4-2. Delete Directory Output Listing

4.8 VIEWING AND LISTING FILES AND DIRECTORIES

Directories and files can be viewed using the List Directory, Map Disk, and Show File commands.

These commands display information on either a VDT or a hard-copy terminal. The hard-copy terminal prints the entire file. The number of lines and columns that can be displayed on a VDT limit the amount of the file that can be seen at one time; the file can be scrolled forward, backward, left, and right to view all of it.

4.8.1 Listing the Contents of a Directory

The List Directory (LD) command lists the names of all files and subdirectories in a directory. It does not list files within the subdirectories. The LD command does not process directories with 3000 or more entries. Figure 4-3 shows an example of the output from the LD command.

```
DIRECTORY LISTING OF:  DS07.VCATALOG
  MAX # OF ENTRIES: 347    # OF ENTRIES AVAILABLE: 334

 DIRECTORY  ALIAS OF  ENTRIES    LAST UPDATE           CREATION
  S$SYSLIB     *         29   02/02/83  17:49:45   02/02/83  17:49:42
  S$SYSTEM     *         23   02/02/83  17:50:03   02/02/83  17:49:46
  VCATALOG     *        347   02/11/83  14:30:83   01/24/82  15:21:40


 FILE       ALIAS OF  RECORDS    LAST UPDATE         FMT   TYPE   BLK PROTECT
  CDATA        *        200   01/24/82  11:25:52   BS    N KEY  YES
  FDATA        *         65   02/04/83  15:25:52   BS    N SEQ  YES
  S$DIAG       *         40   01/24/82  15:21:40   NBS   C REL  NO    WRT DEL
  S$IPL        *         29   02/09/83  11:03:12   NBS   C ING  NO
  S$SHIP       *        595   02/09/83  11:08:12   NBS   N PRO  NO
  S$UTIL       *       4321   02/04/83  10:13:49   NBS   N PRO  NO    DEL


  CHANNEL    PRG FILE   ID   TYPE  SCOPE RESOURCE ASSIGNS   SHARED  MAX
  S$DSTCHN  S$UTIL     4D   M/S     GL     DEV      NO        YES   362
  S$MAIL    S$UTIL      7   M/S     GL     DEV      NO        YES   348
  S$SPOOL   S$UTIL     5B   M/S     TL     DEV      YES       NO    510
11:50:32 WEDNESDAY, MAR 09, 1983.
```

Figure 4-3. List Directory Output Listing

4.8.2 Mapping the Contents of a Disk, Directory, or File

The Map Disk (MD) command generates a map showing the structure and size of the files in a disk volume, directory, or file. The MD command cannot process directories with 3000 or more entries. The amount of information generated depends on the options selected. The options available are short form, top level only, and directory nodes only.

4.8.2.1 Short Form. This option produces a list containing each directory level, each directory name, type of file, number of records per file, number of allocatable disk units (ADUs) needed to contain the file, total ADUs allocated to the directory or file, last update date and time, number of subdirectories and files in the directory, remaining spaces for subdirectories and files, and the total number of ADUs allocated for the directory. Figure 4-4 shows an example of the short form.

```
    DISK MAP OF SYS1.GVB.MENU
      TODAY IS 17:05:21 WEDNESDAY, AUG 03, 1983.

                                   NUMBER CURRENT TOTAL
                              FILE   OF     EOM   ALLOC
LV NAME                       TYPE RECORDS  ADU    ADU        LAST UPDATE
-- ------------------          -   ------  -----  -----    ---------------
    MENU                        D   30       4      4       8/ 5/83  21:43:29
 2 MENU:                                        FILES=11  AVAILABLE=18
     APPAX                      S   245      3      3       2/18/83  10:39:30
     BATCH                      S   322      5      5       2/13/83   9: 0:28
     CMDHDR                     S   30       1      1       2/15/83   9: 7: 0
     CMDLST                     S   230      8      8       2/15/83   9: 7:23
     DUMMY                      S   26       1      1       2/13/83   9: 3:26
     DUMMY1                     S   560      9      9       2/13/83  16:48:20
     M$DEVICE                   S   25       1      1       2/13/83   8:59:45
     M$EDIT                     S   18       1      1       2/13/83   9: 0:32
     M$JOB                      S   11       1      1       2/13/83   8:59:31
     M$LC                       S   23       1      1       2/13/83   8:59:33
     PROC                       S   35       1      1       2/13/83   9: 0:16
**SYS1.GVB.MENU                                 TOTAL SIZE = 32 ADUS
```

Figure 4-4. Map Disk of a Directory Short Form

Not selecting the short form produces a list containing everything in the short form plus the primary allocation size in ADUs of the directory, the secondary allocation size of the directory, number of secondary allocations that have been made, logical record length, number of physical records per ADU, write-protected, delete-protected, blocked, permanent, forced write, format of the data in the file, and the date and time of creation. Figure 4-5 shows an example of the long form.

```
      DISK MAP OF SYS2.KAC.LIST
        TODAY IS 10:52:48 MONDAY, FEB 23, 1981.

                                              NUMBER CURRENT TOTAL
                                         FILE   OF      EOM   ALLOC
LV NAME                                  TYPE RECORDS   ADU    ADU       LAST UPDATE
-- -------------------                     -  ------  -----  -----    ---------------
     LIST                                  D   12       4      4       12/ 8/81   2:46: 2

    ALLOC: PRI=4      SEC=0        #SECS=0   LRECL=134  PRECL=134  BLK/ADU=3
  WPT/DPT/BLK/PERM/FORCED/=NNNYN  DATA-FMT=BINARY   CREATED 10/ 9/81  19: 7:33

 2 LIST:                                                 FILES=8  AVAILABLE=3
     BCT                                   S   8        1      1       11/ 2/81  17:16:10

    ALLOC: PRI=1      SEC=1        #SECS=0   LRECL=80   PRECL=864  BLK/ADU=1
  WPT/DPT/BLK/PERM/FORCED/=NNYYN  DATA-FMT=B SUPPRS CREATED 11/ 2/81  17:16: 9

     BET                                   S   13       1      1        7/28/81   8:23:37

    ALLOC: PRI=1      SEC=1        #SECS=0   LRECL=80   PRECL=864  BLK/ADU=1
  WPT/DPT/BLK/PERM/FORCED/=NNYYN  DATA-FMT=B SUPPRS CREATED  7/28/81   8:23:36

     CLEAN                                 S   7        1      1        8/22/81  14:19:53

    ALLOC: PRI=1      SEC=1        #SECS=0   LRECL=80   PRECL=864  BLK/ADU=1
  WPT/DPT/BLK/PERM/FORCED/=NNYYN  DATA-FMT=B SUPPRS CREATED  8/22/81  14:19:52

     COMPARE                               S   7        1      1        8/22/81  15:30:28

    ALLOC: PRI=1      SEC=1        #SECS=0   LRECL=80   PRECL=864  BLK/ADU=1
  WPT/DPT/BLK/PERM/FORCED/=NNYYN  DATA-FMT=B SUPPRS CREATED  8/22/81  15:30:27

     MASTER                                S   8        1      1        7/29/81  10:31:10

**SYS2.KAC.LIST                                          TOTAL SIZE = 13 ADUS
```

Figure 4-5. Map Disk of a Directory Long Form

4.8.2.2 Top Level Only. This option produces a listing of only the contents of the directory given by the pathname. Not selecting this option produces a listing of the contents of the directory given in the pathname and the contents of all the subdirectories.

4.8.2.3 Directory Nodes Only. This option produces a listing of information on the directories only. This listing contains the number of subdirectories and files in the directory, the amount of space remaining for new files or subdirectories, and the total size of the directories and subdirectories. Not selecting this option lists all the subdirectories, files, amount of space remaining in the directory and subdirectories, file type, number of records per file, size of the files in allocated disk units (ADUs), and date and time of the last update.

4.8.3 Viewing the Contents of a File

The Show File (SF) command displays the contents of a file at a VDT or data terminal. The entire contents of the file is printed on a data terminal while a VDT can show only the portion that the screen will contain. Users of VDTs can scroll through the file; when scrolling left or right, a scaling line appears on the bottom line of the screen to show which columns are being displayed.

5

Using Disk Volumes

5.1 GENERAL INFORMATION

This section discusses SCI commands that initialize, install, unload, and show the status of disk volumes:

- Initialize Disk Surface (IDS)
- Initialize New Volume (INV)
- Install Volume (IV)
- Show Volume Status (SVS)
- Check and Reset Volume (CRV)

This section also discusses volume commands that delete and correct data errors on volumes:

- Check Disk for Consistency (CKD)
- Recover Volume Information (RVI)
- Scan Disk (SD)

These commands are used for all of the disk types that are supported by DNOS. Detailed information and specific directions for the use of each command can be found in the *DNOS System Command Interpreter (SCI) Reference Manual.*

Information on copying entire volumes can be found in the Backing Up Files, Directories, and Disks section in this manual.

5.2 INITIALIZING THE DISK SURFACE

The Initialize Disk Surface (IDS) command prepares a new disk for use by DNOS. IDS checks the surface of the disk, searching for flaws in the medium and noting any bad tracks found. Several IDS commands can be executed simultaneously as long as each command specifies a different disk unit.

The Initialize Disk Surface command might not locate all the bad tracks on a disk. If the manufacturer supplies a list of bad tracks, this list must be entered by answering ME to the BAD TRACK ACCESS NAME: prompt. SCI responds with prompts for the list of bad tracks.

A new disk can also be initialized using IDS by answering YES to the INITIALIZE NEW VOLUME: YES/NO prompt. SCI displays prompts for the information necessary to initialize a new volume. After all prompts have been answered, the IDS task is performed and then the INV task is performed. Using IDS to initialize a new volume eliminates the necessity of executing two separate SCI commands and entering much of the information twice.

5.3 INITIALIZING NEW VOLUMES

The Initialize New Volume (INV) command prepares a disk for use by DNOS. Before a new disk can be initialized, the disk surface must be prepared with the IDS command. INV formats the disk into tracks and sectors, creates the .VCATALOG directory which is the primary directory for the disk, assigns the disk a volume name, and installs the volume for use. Once the INV command completes, the disk is ready for use; there is no need to execute the Install Volume (IV) command unless the disk is unloaded from the drive physically or unloaded with the Unload Volume (UV) command. SCI automatically executes the IV command when the INV task completes.

5.4 INSTALLING VOLUMES

The Install Volume (IV) command logically installs a disk on a drive. None of the files on a disk can be accessed until the disk is installed with the IV command. A new disk must be initialized before it can be installed.

Some disk drives hold two volumes, one on a fixed drive and the other on a removable drive. Installing a new volume on the removable drive requires unloading both volumes, installing the new volume on the removable drive, and reinstalling the old volume on the fixed drive. When one of the disks is the system disk, the system must be halted before the removable disk can be changed. See the Backing Up Files, Directories, and Disks section in this manual for more details.

5.5 UNLOADING A DISK VOLUME

The Unload Volume (UV) command logically removes a volume from a disk drive. Although a disk can be physically removed from a drive without using this command, executing the UV command before removing the disk prevents loss of data and system errors. If a a LUNO is assigned to the disk or a file on the disk, the UV command will not execute and an error message will be displayed on the terminal where the attempt to execute the UV command was made. The UV command must precede the IV command that installs the next volume. If a disk has been removed without executing the UV command, another disk cannot be installed until the previous disk has been logically unloaded with the UV command. See the Backing Up Files, Directories, and Disks section in this manual for more details.

Volumes on a disk drive that holds two volumes must be unloaded together. When one of the two disks is the system disk, the system must be halted before the removable disk is changed.

5.6 CHECKING THE STATUS OF A DISK VOLUME

The Check and Reset Volume (CRV) command resets a media change condition on the disk drive. The system registers a media change condition if the disk drive power has been turned off and on or if the disk has been replaced without a UV command followed by an IV command. If the CRV command is not performed, the disk can be read but any attempt to write to the disk results in an error. This prevents dual allocation problems on a disk.

The CRV command compares the volume information of the disk currently mounted in a specified drive with the volume information of the disk mounted in that drive by the last IV command. If the volume information matches, the CRV command resets the media change condition. If the volume information does not match, the CRV command executes a UV command on the installed disk name and resets the media change condition. A message informs the user of the results of the CRV command. It may be necessary to execute an IV command on the currently-mounted disk if that disk was not installed with an IV command.

5.7 SHOWING THE STATUS OF A DISK VOLUME

The Show Volume Status (SVS) command displays the status of a disk volume.

Accepting the default value for the OUTPUT ACCESS NAME: prompt causes the output from the SVS command to be displayed on the terminal were the SVS command was executed. Responding to the OUTPUT ACCESS NAME: prompt with a file pathname causes the output to be written to the file. Figure 5-1 shows a sample output from the SVS command.

5.8 HANDLING PROBLEMS WITH DISK VOLUMES

The SCI commands Check Disk for Consistency (CKD), Recover Volume Information (RVI), and Scan Disk (SD) help recover from error conditions on disks. The *DNOS System Command Interpreter (SCI) Reference Manual* has detailed instructions for using these commands. The following paragraphs summarize the CKD, RVI, and SD commands.

5.8.1 Check Disk for Consistency (CKD)

The CKD command examines the named disk unit for dual allocation and errors in the directory overhead. For instance, if the size of the directory, the number of files allocated, and the number of available entries in the directory do not agree, the directory is flagged. Use this command if you have reason to believe disk or directory structures have been destroyed.

```
 VOLUME NAME: DISK6      ADUS: 4004    # BAD: 0    BYTES/ADU: 288
AVAILABLE: 1638   LARGEST AVAILABLE BLOCK: 1624   CONTROLLER ERRORS: 0
PRIMARY SYSTEM IMAGE:            SECONDARY SYSTEM IMAGE:
NAME INSTALLED: DISK6    DEVICE NAME: DS03
```

Figure 5-1. Show Volume Status Output Listing

5.8.2 Recover Volume Information (RVI)

If the volume information on track 0 was destroyed, the disk cannot be installed. The RVI command recovers the volume information normally stored on track 0 sector 0 of the disk by using the copy stored on track 1 when the disk was initialized.

Execute the RVI command if either of these two situations occur:

- A flashing crash code of > 1, > 6, or > B occurs during an IPL
- An error code of > 10, > 11, > 12, > 17, > 1B, or > 1C when executing the IV command

The RVI command flags all ADUs as allocated. Copy the disk to another device using one of the commands for copying directories (see the Backing Up Files, Directories, and Disks section in this manual), then reinitialize the disk with the INV command. After the disk has been reinitialized, restore the directories and files to the disk.

5.8.3 Scan Disk (SD)

The SD command scans a disk for hard and soft errors. Hard errors are physical flaws in the disk surface; soft errors are logical data flaws. The SD command produces a report that can contain none, some or all of the following:

- Locations where the errors were found — Locations are in terms of tracks, sectors, and ADUs.
- File names — The file pathname of any file using the disk area in error is listed.

The bad track information on the disk is not changed, however the report may show which files must be reconstructed.

The SD command scans disks whether or not the disks are installed with the IV command. Use this command if you suspect your disk has physical flaws and you want to know which files are affected and need to be recovered.

6

Backing Up Files, Directories, and Disks

6.1 GENERAL INFORMATION

This section describes how to copy the contents of files, directories, and disks, how to verify the copies made, and how to back up a DNOS system. The (SCI) discusses the commands for backing up files, directories, and disks in detail.

Backing up files provides a method of recovering data should files or storage media be damaged. Any of the following could cause loss of data:

- Accidental deletion (erasure)
- Power failure
- Fire that damages equipment and/or media
- Other hardware failure such as a defective disk controller
- System software failure
- Application software failure

Loss of DNOS disk files is uncommon. However, when it does occur, the user faces a difficult or impossible task of recovering lost data unless backup copies of files, directories, and disks are on hand. When backup copies are available, lost files, directories, and disks can be recovered using the procedures outlined in this section.

The following guidelines are offered to help you understand how to protect your data. If your backup system does not meet these guidelines, you run the risk of data loss.

1. Always keep a log of what is done to the system and when. Such a log can help trace problems and devise methods to prevent the problem from recurring. The log should contain entries for these items:

   a. Backups

   b. Hardware maintenance

   c. Both system and applications changes to the software

2. Use a rotation system that uses at least three backup copies. Never back up your current data over your most recent backup. If something fails, both the current data and the backup could be lost. This could leave you with an outdated backup or nothing.

3. Back up data as frequently as necessary to ensure data integrity. The more volatile the data, the more often it should be backed up. Once a week may be sufficient for data that changes rarely, but data that is constantly changing may need to be backed up more than once a day.

4. Always keep two system disks. One disk can be used to troubleshoot your system. If some type of failure occurs that erases the data on the system disk, the same problem may recur and destroy the backup disk.

5. Always verify a copy operation. Hardware failures can cause data to be copied incorrectly but no errors are reported by the copy utility.

6. Consider transaction logging. If done properly, this can reduce the frequency with which backup operations are required without compromising recovery capabilities. Transaction logging is not difficult to implement and makes data recovery easier.

6.1.1 Some Suggested Procedures

The following paragraphs suggest methods for implementing a backup program and the reasons for each step. You may want to use these procedures as is or modify them to meet your needs. You should plan to be able to recover from total loss of the disk pack in the drive at the time of a failure. This plan will enable you to recover data lost because of accidental deletion as well as power failure, severe head crash, and controller failure. You should also consider planning for recovering from worst case situations.

6.1.1.1 Offsite Archive and Computing Capacity. Your data is valuable. If a fire, explosion, or some similar catastrophic event destroyed your computer installation and the media, your business could experience difficulty depending on how critical the data center is to its operation. You may want to consider archiving backup packs offsite. Based on the cost of recovery, the cost of maintaining extra backups, and the risk of such a loss, you may decide that you need total offsite backup. In many cases, maintaining offsite backup capable of restoring your data base completely is not worth the cost. You may only want to keep your oldest backup offsite, along with old archived transaction logs capable of bringing your data back to the status it had at the beginning of the day. Other methods of handling larger risks (such as insurance) may be appropriate for you.

If you lose your computer and have to replace it, you may need computing capacity to perform the minimum amount of work needed to keep your business going until your new computer arrives. Sometimes you can make arrangements with another firm that has a computer similar to yours so that you have access to such capacity. You must make sure that you save your data and programs in a form that is usable by this alternate system.

6.1.1.2 A Rotation Backup System. System and data disks can be backed up on magnetic tape or disks. Regardless of the media you use for backup, a minimum rotation backup system requires two extra volumes for each online volume that you want to back up. Put labels on each volume to identify its position in the rotation cycle and to identify which online volume it backs up. Develop a well-documented system of keeping a written log of which volumes were backed up, which volumes they were copied to, who did the copy, when the copy was made (date and time), and any other information you may need to identify any problems with the backup cycle. Some common mistakes are to back up to the wrong volume in the cycle, or to a volume meant for a different online volume. Figure 6-1 shows a suggested disk pack rotation in a weekly backup procedure.

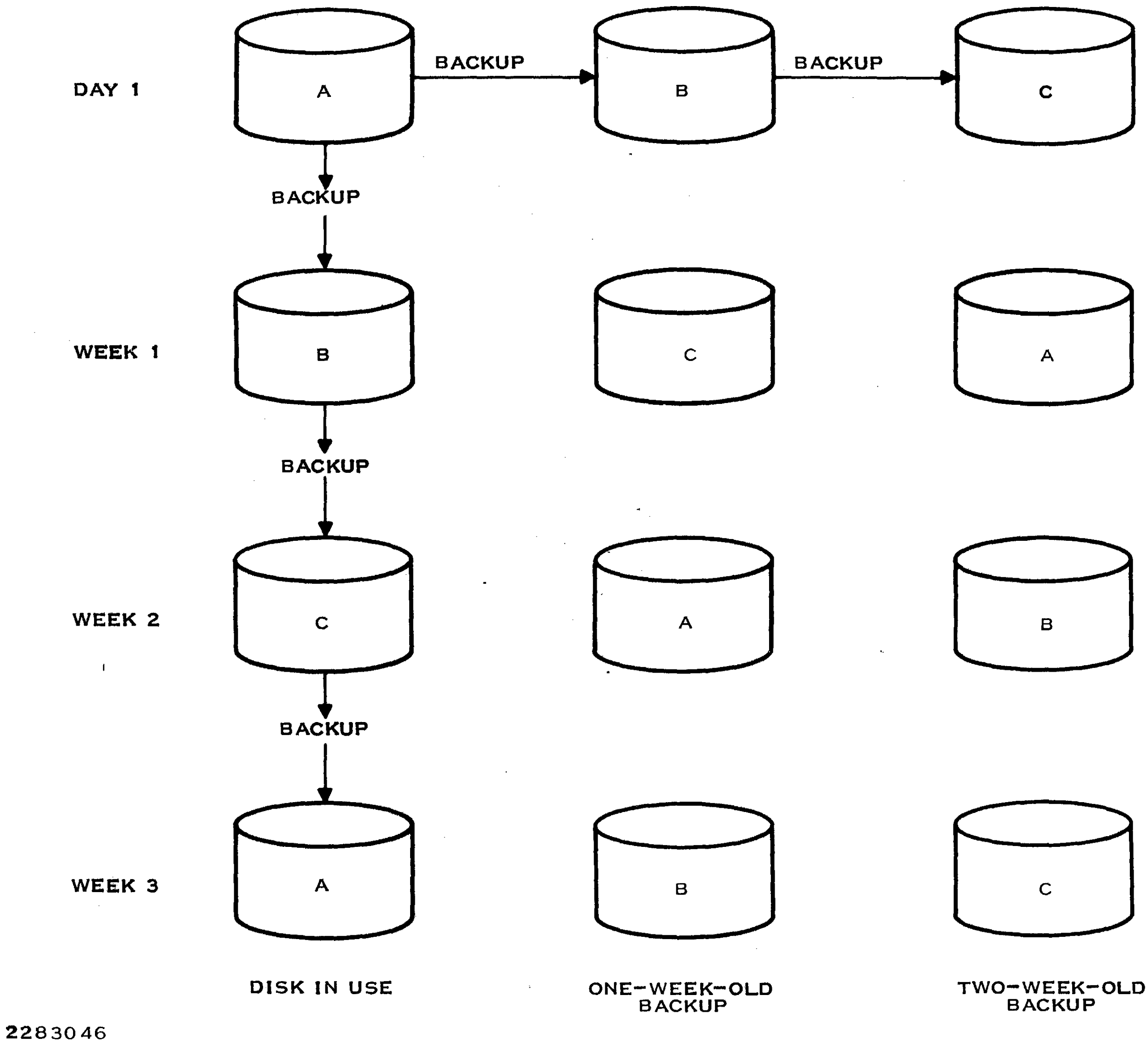


Figure 6-1. Suggested Disk Pack Rotation in a Weekly Backup Procedure

If you are using magnetic tape, label each reel in sequence. Disk Copy/Restore (DCOPY), Backup Directory (BD) and Backup Directory to Device (BDD) maintain headers and trailers to identify the reels and can detect out-of-sequence reels on restore, but your procedure should not depend on that alone to ensure correct backups.

In addition, check the integrity of the backup media periodically. Magnetic tape wears out and needs to be replaced. Disks can develop soft spots that hold data long enough for verification but lose the data over a span of time. Plan to check the media periodically to ensure smooth functioning of your backup procedures and to ensure availability of the data if you need it.

Develop and document contingency plans to use in case any step of the backup procedure does not work correctly. Such a plan might include copying the disk with Copy Directory (CD) rather than Copy Volume (CV) or Copy and Verify Disk (CVD). The backup operator can flag any file in error, and you can recover from the previous backup prior to beginning the next day's business. Your plans should also include keeping extra tapes (and possibly disks too) for archiving extra logs and making extra backups. Any point of the procedure is subject to failure, and you should analyze what you need for recovery at any point.

Develop and document plans for recovery in case of failure during system operation between backups. Such a plan may include extra tapes to archive partial transaction logs, and procedures for when to use them.

6.2 BACKING UP FILES

DNOS provides the Copy/Concatenate (CC) and Append File (AF) commands for copying files. The two commands are slightly different. The CC command copies a file or concatenates two or more files and copies them to another file destroying the contents in the destination file. The AF command copies one or more files and appends them to the end of another file. Both the CC and AF commands have these things in common:

- The number of files that can be copied with one execution of the command is limited only by the space allowed to enter input pathnames — a total of 50 characters. Synonyms can be used to shorten the file pathnames.
- The CC and AF commands copy only sequential and relative record files.
- If the output file does not exist, an expandable, blank-suppressed, sequential file with an 80-character logical record length is created.
- The output can be directed to a file, printer, or magnetic tape.
- Input appended to a file goes immediately after the last record of the file. This writes over and destroys the end-of-file mark in the file; a new end-of-file mark is added after the appended information.

6.3 BACKING UP DIRECTORIES

The data managed by DNOS is in disk files organized into hierarchies of directories. Maintaining backup copies of the directories provides easy retrieval in case of loss. Backup copies can be created on disk files, or sequential files on disk or magnetic tape. The following DNOS commands can be used for backing up and restoring both system and user directories:

- Copy Directory (CD) — Copies a directory from one location to another.
- Backup Directory (BD) — Copies a directory to a sequential file
- Backup Directory to Device (BDD) — Copies a directory to a sequential file.
- Restore Directory (RD) — Builds a directory from a sequential file created with the BD or BDD command.
- Verify Copy (VC) — Compares two directories to determine whether the copy matches the original
- Verify Backup (VB) — Compares a directory with a backup file to determine whether the copy matches the original

The type of media used to hold the backup (disk or tape) determines the command used to perform the copy. On tape media, the directory has to be stored sequentially using BD or BDD. On disk, a backup can be stored in either a directory using CD or a sequential file using BD or BDD. When direct access to a file in the backup copy is required, the better choice is a directory. A sequential backup file is better when the backup is to be copied back to the original disk or other media, or is to be transmitted over a communications link. When using the DATE option while producing backup directories, it may be necessary to retain several backup volumes to ensure that the latest copies of all directories and files are kept. In this case, retaining backup copies on magnetic tape may be more desirable than using disks.

6.3.1 Copying a Directory from Disk to Disk

The Copy Directory (CD) command copies a set of files from one disk directory to another disk directory. The contents of the source directory do not change as a result of the copy operation. Files and directories that do not exist in the destination directory are automatically created by CD. The CD command creates a directory with the same maximum number of entries as the one copied.

When the CD command completes, a listing is displayed of all directories and files that were copied. If the CD command is executed in the background mode or the listing must be preserved, the listing can be written to file by responding to the LISTING ACCESS NAME: prompt with a file pathname. Figure 6-2 shows an example of such a listing.

```
 COPY DIRECTORY
ORIGINAL SOURCE:
ORIGINAL DESTINATION:  VOL1.SAVEMY
ORIGINAL OPTIONS:      ADD,ALAISES
CONTROL FILE:          VOL1.CONTROL
LIST FILE:

OPTION REPL
MOVE VOL1.MYFILES
EX LIST,CONTROL
  **  X

  **       DIRECTORY VOL1.SAVEMY.OBJECT
  **  PROGA
  **       END OF DIRECTORY VOL1.SAVEMY.OBJECT

  **       DIRECTORY VOL1.SAVEMY.SOURCE
  **  PROGA
  **       END OF DIRECTORY VOL1.SAVEMY.SOURCE

  **  PROG      - PROGRAM FILE
  **  TASK        ID
  **  PROGA      >01
  **  PROGB      >02
  **       END OF PROGRAM FILE
  **  C
O ADD
MOVE VOL1.HISFILES
IN     A
IN     B
IN     C
INCL   X
I      PROG
  **  X          NOT REPLACED
  **  A
  **  PROG      -PROGRAM FILE

  **  TASK       ID
  **  PROGB     >01   NOT REPLACED
  **       END OF PROGRAM FILE
  **  C            TYPE/USAGE CONFLICT
  **  B         WAS NOT IN THE SOURCE
END
****** COPY DIRECTORY COMPLETED
```

Figure 6-2. Copy Directory (CD) Output Listing

6.3.2 Verifying a Directory Copy

The Verify Copy (VC) command verifies a copy made by Copy Directory. The VC command compares a set of files in a master (source) directory to a set of files in a copy directory to determine whether the files match. The VC command detects matches by comparing the file type, file use, file name, and file contents of files at corresponding levels of each set. When the VC command completes, a listing of all directories and files that were verified is displayed. If discrepancies are found, error messages are included in the listing. If the VC command is executed in the background mode or the listing must be preserved, the listing can be written to file by responding to the LISTING ACCESS NAME: prompt with a file pathname. Figure 6-3 shows an example of such a listing.

```
  VERIFY COPY              14:28:17 TUESDAY, OCTOBER 26, 1982.

ORIGINAL SOURCE:         VOL2.DIR1
ORIGINAL DESTINATION:    VOL2.DIR2
ORIGINAL OPTIONS:        ALIASES, NODATE, ADD, NOSPRL, NORPRL, SYSFILE
CONTROL FILE:
LIST FILE:               LP

  **       DIRECTORY  VOL2.DIR1
  **   FILE2
  **   FILE3
  **   PROGRAMS - PROGRAM FILE

  **   TASK        ID
  **   PROGA      >03
  **   PROGB      >0E

  **   PROCEDURE  ID

  **   OVERLAY     ID
  **        END OF PROGRAM FILE

  **   FILE1

ELAPSED TIME = 0 MINUTES   58 SECONDS
SIZE OF INPUT = 439 ADU'S

****** VERIFY COPY COMPLETED
```

Figure 6-3. Verify Copy Output Listing

If a control file is specified with the VC command, it limits the files in the master directory that are compared against files in the copy directory in the same manner as it limits the copy operation of a Copy Directory (CD) command. For more information, refer to the *DNOS System Command Interpreter* (SCI) *Reference Manual*.

6.3.3 Backup Directory (BD)

To copy a directory to magnetic tape or any sequential file, the directory must be changed from a hierarchy of directories and files to a single sequential file. The Backup Directory (BD) command copies a set of directories and files in a directory to a sequential file or to a magnetic tape.

6.3.4 Backup Directory to a Device (BDD)

The Backup Directory to Device (BDD) command copies directories to either disk or tape and verifies the copy. The BDD command creates a backup file as the BD command does, then makes a sequential copy to the specified device. The directory can be restored to a disk using the Restore Directory (RD) command.

The BDD command does not require the system disk to be mounted unless you are copying from the system disk, therefore, the system disk can be replaced with a data disk. If the system disk is involved in the copy process, no other tasks or terminals can be active while the copy is in progress. In all cases, when BDD is copying to a disk, that disk cannot be installed and used by another task.

BDD is generally faster than the BD command, but does not offer all the options available for the BD command. For specific instructions for using the BDD command, see the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

6.3.5 Restore Directory (RD)

The Restore Directory (RD) command builds a directory from a sequential file created with the BD or BDD command.

6.3.6 Verifying a Backup or Restored Copy

The Verify Backup (VB) command verifies the output of a BD or RD command. The VB command the compares the sequential file created with the BD command to the directory used as input to the BD command. The VB command also compares a directory created with an RD command to the sequential file used as input to the RD command. The Verify Backup operation detects matches by comparing the file type, file use, filename, and file contents. The results of the verify operation can be listed at a device or sent to a file by giving the proper response to the LISTING ACCESS NAME: prompt. Figure 6-4 shows a sample output listing from the VB command.

```
  VERIFY BACKUP          13:57:48 TUESDAY, OCTOBER 26, 1982.

ORIGINAL SOURCE:        BACKUP82.OCTOBER
ORIGINAL DESTINATION:   VOL2.DIR1
ORIGINAL OPTIONS:       ALIASES, DATE, NOREWIND, NOUNLOAD, SYSFILE, NOFAST
CONTROL FILE:
LIST FILE:              LP


  **        DIRECTORY  VOL2.DIR1
  **   FILE3
  **   FILE2
  **   PROGRAMS - PROGRAM FILE

  **   TASK        ID
  **   PROGA      >03
  **   PROGB      >0E
  **        END OF PROGRAM FILE

  **        END OF DIRECTORY  VOL2.DIR1


ELAPSED TIME = 0 MINUTES   24 SECONDS
SIZE OF INPUT = 1782 ADU'S

****** VERIFY BACKUP COMPLETED
```

Figure 6-4. Verify Backup Output Listing

6.4 BACKING UP ENTIRE DISK VOLUMES

Since the .VCATALOG directory contains the entire contents of a volume, the directory backup commands can copy entire disk volumes, however, entire disk volumes can be copied faster using the Disk Copy/Restore (DCOPY), Copy and Verify Disk (CVD), and Copy Volume (CV) commands. However, these commands do not have the variety of options offered by the directory commands.

6.4.1 Backing Up Using the DCOPY Command

The Disk Copy/Restore (DCOPY) command copies and optionally verifies volumes used with DNOS. The copy process can be performed from disk to magnetic tape, magnetic tape to disk, or disk to disk. The copy operation is processed track by track without disk compression. A disk-to-disk copy requires that the copy disk be the same type as the master disk, for example, two DS80s or two DS300s. When a magnetic tape copy is made, the destination disk (when restoring the disk from the tape) must be the same type as the original source disk even when tape is the intermediate medium.

When a magnetic tape unit is used as an output device, the first and last records are identification records. Each identification record contains a volume name, the date of creation, a reel number, and data describing the type of disk from which the tape was created. The reel number contained in the identification records at the beginning and end of the tape provides the means for copying disks to or from multiple tapes.

The system disk does not have to be mounted to perform a copy operation using DCOPY; this allows systems having only two disk drives to perform a disk-to-disk copy operation on data-only disks.

DCOPY does not transmit disk errors; if it encounters a disk error it will render the output disk unusable and terminate the copy process. DCOPY is inflexible with disk allocation and cannot handle a condition where the input disk has data on a track and the output disk has a bad track at the same track number location.

CAUTION

We recommend you only use error-free disk packs when using the DCOPY utility; you should not use flag-free packs. Error-free disk packs are higher quality than flag-free disk packs. However, you can use DCOPY on disks that are not error-free by initializing each disk of a backup set with the union of the bad track sets from all the disks.

The DCOPY command executes line by line as in TTY mode. That is, the command appears from the bottom of the VDT screen and presents the next prompt only after satisfactory response to the prompt currently on the bottom of the screen. For specific instructions on using the DCOPY command, see the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

6.4.2 Backing Up Using the CVD Command

The Copy and Verify Disk (CVD) command copies from disk to disk with an optional verify operation. The copy disk and the master disk must be the same type of disk. The copy procedure is performed file by file with disk compression on all files except key indexed files. Program files are partially compressed by releasing the unused space at the end of the file. Space available in program files as a result of deleting tasks cannot be released with the CVD command. A copy directory (CD) is required to release this additional space in program files.

CVD can tolerate imperfect media; that is, if the output disk has a bad track at the same track number location where the input disk has data, CVD copies the data to a different track on the output disk rather than terminate the copy process. As with DCOPY, the system disk does not have to be mounted. CVD runs somewhat slower than DCOPY, but CVD's more flexible allocation may be preferable. CVD rebuilds directory structures and performs disk compression. (Disk compression includes merging all secondary allocations of a file together.) CVD recovers unused space from the end of all files except key indexed files. It does not perform compression within a file, which means it does not recover disk space released by deleting records from a key indexed file or deleting tasks, procedures, or overlays from a program file. If CVD encounters an unrecoverable disk error, it renders the copy unusable and terminates the copy process.

The CVD command executes line by line as in TTY mode. That is, the command appears from the bottom of the VDT screen and presents the next prompt only after satisfactory response to the prompt currently on the bottom of the screen. For specific instructions on using the CVD command, see the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

6.4.3 Backing Up Using the Copy Volume (CV) Command

The Copy Volume (CV) command copies and verifies an entire disk volume regardless of the disk type. The destination volume must be large enough to copy the entire source volume. CV performs a limited amount of disk compression. CV will not compress key indexed files, nonexpandable files, and some program files.

CV is flexible with disk allocation and can tolerate media errors. That is, if the output disk has a bad track at the same track number location where the input disk has data, CV copies the data to a different track on the output disk rather than terminate the copy process.

CV does not require the system disk to be mounted unless you are copying the system disk. When using CV, the system disk in a two disk drive system can be replaced with a data disk. If you are copying the system disk, no other terminals or tasks can be active. For specific instructions for using the CV command, see the *DNOS System Command Interpreter* (SCI) *Reference Manual*.

6.5 BACKING UP THE SYSTEM AND DATA DISKS

The directory backup commands discussed in this section back up the system disk and data files to disk or magnetic tape. The procedures in the following paragraphs also refer to other commands described in the *DNOS System Command Interpreter (SCI) Reference Manual*.

Decisions concerning which procedure to use for a given backup should be based on the characteristics of the available options. The directory backup commands are flexible. Partial volumes can be selected from the disk as desired. Using the DATE option, you can select only those files that have changed since the last backup. These commands compress unneeded space in files and directories, thus saving disk resources.

The volume backup commands copy the whole disk faster than the directory commands. The DCOPY command creates a physical, track for track copy, thus allowing ready backup to other media. The CVD command is a fast way of copying an entire disk to a disk of the same type with space compression. The CV command is a fast way of copying to a disk of any type.

Data disks can be backed up to one or more volumes and later restored to operation. Disk fragmentation is eliminated when the copy is made with CD, BD, and RD commands. While these commands make the copy, other activities can go on. Table 6-1 shows the other distinguishing features of the volume and directory backup commands.

Table 6-1. Volume and Directory Backup Utilities

Features	BD	BDD	CD	CVD	DCOPY	CV
Sequential backup or copy of entire disk	Yes	Yes	Yes	Yes	Yes	Yes
Sequential backup or copy of subdirectory or file	Yes	Yes	Yes	No	No	No
Backup or copy to tape	Yes	Yes	No	No	Yes	No
Backup or copy between different disk types	Yes	Yes	Yes	No	No	Yes
Self-verification	No	Option	No	Option	Option	Option
Other tasks allowed on system	Yes	Varies	Yes	Varies	Varies	Varies
Requires system disk to remain mounted	Yes	No	Yes	No	No	No
Tolerates media errors	Yes	Yes	Yes	Yes	No	Yes
Limit backup to files created or updated on or after a specified date	Option	No	Option	No	No	No
Destroys existing data on target disk	No	No	No	Yes	Yes	Yes
Performs limited disk compression	Yes	Yes	Yes	Yes	No	Yes
Recover space from the end of a KIF	Option	Option	Option	No	No	No
Recover unused space from the end of a program file	Option	Yes	Yes	Yes	No	Yes

Table 6-1. Volume and Directory Backup Utilities (Continued)

Features	BD	BDD	CD	CVD	DCOPY	CV
Recover space within a program file released by deleting tasks, procedures, or overlays	Varies	No	Varies	No	No	Yes
Security rights preserved with backup/restore	No	Yes	No	Yes	Yes	Yes

The following procedures assume the operator has already prepared all backup disks required.

- Each new disk must have its surface initialized by the Initialize Disk Surface (IDS) command.
- Each backup disk must be prepared for use by DNOS with the Initialize New Volume (INV).
- The user must insure the backup volume has enough storage space to hold the information to be backed up. In particular, when backing up a large file on a removable disk to a fixed disk, the user needs to insure the fixed disk has a block of storage large enough for the entire file. Otherwise, the procedures in the following paragraphs could fail.
- Rotate backup volumes, retaining the old backup copy until the new one is completed. This guards against system failure during backup. When using the DATE option, be careful to retain the latest copy of all directories and files; this may required several backup volumes be retained.
- If the spooler file is going to be copied, the directory .S$SDTQUE must be specifically included in the backup directory step.

On systems that have two or more disk drives of the same type, the simplest backup procedures involve using the volume copy commands. The *DNOS System Command Interpreter* (SCI) *Reference Manual* gives complete instructions for using these commands to back up system or data disks. More complex procedures are needed to back up system and data disks when the system has only one disk drive. The following paragraphs discuss copying system and data disks for systems with various types of media.

6.5.1 Backup/Recovery Plan for Computer Systems with Fixed Disk Storage

In those computer systems equipped with a single disk drive with fixed disk storage such as the DS10, the disk drive accommodates two magnetic disks. One of the disks is a fixed (nonremovable) disk and the other is a removable disk. When the fixed disk contains the computer's operating system and other system files (as is the usual case), your data files are on the replaceable disk. In most instances, the disk containing the current data files is mounted on the disk drive. Additional data files (including backup files) are kept on other disks that can be mounted on the disk drive at your option.

Using the CV command is usually the best way to back up either the fixed disk or the removable disk when both disks are the same size. You can use CVD or DCOPY in the same way. If the fixed disk is larger than the removable disk (such as the C1400/96), more than one backup disk is required to copy the entire fixed disk. In that case use BD or BDD to allow you to change the removable disk during the backup process.

6.5.1.1 Single-Drive Fixed Disk Backup Using CV. Use CV to copy from the fixed disk to the removable disk when the disks are the same size (or when all the data on the fixed disk can be copied to the removable disk.) The following procedure illustrates the CV command:

1. Before removing the removable disk from the drive, release any LUNOs assigned to the removable disk by terminating applications using it and/or using the appropriate release LUNO command. Unload the removable disk by entering the Unload Volume (UV) command. After unloading the volume, the operating system displays a message indicating the disk unit has been unloaded.

2. Procedures for installation and removal of the disk cartridge are given in the DS10, CD1400/32, and CD1400/96 Disk Drives appendix to this manual. Stop the disk drive by pressing the START/STOP button on the drive. When the START/STOP indicator light goes out, remove the installed removable disk and install the disk that will be used to make the backup of the fixed disk.

3. Press the START/STOP switch to start the drive.

4. When the READY indicator on the disk drive lights, enter the CV command.

5. Have CV perform the copy from the fixed disk to the removable disk. Refer to the *DNOS System Command Interpreter (SCI) Reference Manual* for detailed instructions on the CV command.

6. Remove the removable disk. Identify the disk properly and store as the backup copy of the system files.

7. Replace the disk that was removed in step 2.

8. Perform an initial program load (IPL).

All the data on the backup removable disk is now exactly the same, file for file, as that on the fixed disk. The files have been consolidated and the volume information has been updated.

6.5.1.2 Single-Drive Fixed Disk Backup Using BDD or BD. When the fixed disk is larger than the removable disk you must use either BDD or BD to back up the entire fixed disk. These utilities allow you to change the removable disk during the backup operation. The following procedure uses BDD; if you use BD, substitute it in the procedure.

1. Before removing the removable disk from the disk drive, release any LUNOs assigned to the removable disk by terminating applications using it and/or using the appropriate release LUNO command. Unload the removable disk by entering the Unload Volume (UV) command. After you unload the volume, the operating system displays a message indicating that the disk unit has been unloaded.

2. Procedures for installation and removal of the disk cartridge are given in the DS10, CD1400/32, and CD1400/96 Disk Drives appendix to this manual. Stop the disk drive by pressing the START/STOP button on the drive. When the START/STOP indicator light goes out, remove the installed removable disk and replace it with the disk cartridge upon which the backup of the fixed disk is to be made.

3. Press the START/STOP switch to start the drive.

4. When the READY indicator on the disk drive lights, enter the BDD command.

5. Back up the fixed disk to the removable disk. The operating procedure for the BDD command is detailed in the BDD command description in the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

6. When the space on the backup disk is filled, you must remove the removable disk and replace it with another. Each time this is necessary the following message appears:

   ```
   Mount Volume <VOLUME NAME>    #N in DSxx

   Are you ready? (Y/N)
   ```

   Change the disks using the appropriate procedures, check to see if the device is ready, then enter Y to continue.

7. When the entire fixed disk is backed up, remove the final backup disk, identify the backup disks properly, and store as the backup copy of the system files.

8. Replace the disk that was removed in step 2.

9. Perform an initial program load (IPL).

Backup copies produced by BDD and BD cannot be used to load the system. The Restore Directory (RD) command must be used to produce a copy which can be used to load the system.

6.5.1.3 Single-Drive Removable Disk Backup. The CV and CVD commands can back up data on a removable disk. These procedures are more involved than the backup of the fixed disk because you must make four disk-to-disk copies. Two extra disks are required. One disk is a backup to hold the system data while the fixed disk is being used in the CV or CVD process; the other will contain the backup copy of the removable disk. The disk used to back up the fixed disk can be used once its contents are copied back to the fixed disk at the end of the process, or you can elect to use it as the archived backup of the fixed disk. In this case, part of this procedure serves as the fixed disk backup.

Backup Procedure Using CV. In the following procedure, the CV command is executed only once. The responses specify the information for all four copy sequences. Refer to the *DNOS System Command Interpreter (SCI) Reference Manual* for complete details on the CV command.

CAUTION

Once you execute the CV command, you must enter the information for all four copy sequences in the correct order. In this backup process you cannot enter the CV command to perform just one copy, then re-enter the CV command for the next copy. Since the system disk will be unloaded, all four copies must be specified in a single execution of CV. CV allows you to perform multiple copies of different disks, but all information must be entered before the first copy begins.

In the following procedure, the fixed disk is called FIXED, the removable disk containing data that is to be backed up is called CART, the disk used for backup of the fixed disk is called FIXEDBCK, and the disk used to backup the removable disk is called CARTBACK. To make a backup copy of data on the removable disk (CART) using CV, proceed as follows:

1. Enter the CV command.

2. Respond to the first set of prompts to initiate a copy of FIXED to FIXEDBCK. Respond YES to the MORE COPIES prompt.

3. Respond to the second set of prompts to initiate a copy of CART to FIXED. Respond YES to the MORE COPIES prompt.

4. Respond to the third set of prompts to initiate a copy of FIXED to CARTBCK. Respond YES to the MORE COPIES prompt.

5. Respond to the fourth set of prompts to initiate a copy of FIXEDBCK to FIXED. Respond NO to the MORE COPIES prompt.

6. CV prompts you to mount FIXEDBCK in the proper drive for the first copy, then begins the copy.

7. Each time a copy completes, CV prompts you to mount the proper disk.

8. When all four copies are complete, CV prompts you to perform an IPL from the fixed disk.

9. Properly identify and store CARTBCK as the backup copy of CART.

Backup Procedure Using CVD. The CVD procedure for backing up the data on the removable disk is similar to the CV procedure except CVD prompts you for each copy sequence individually, performs the copy, then asks whether you want to quit. You must respond NO to this prompt each time until you have completed all four copies.

CAUTION

In the following procedure, do not leave or terminate the CVD program until data on the system backup disk is restored to the fixed disk. Once CVD begins, the entire program is in computer memory and can be used repeatedly until all copies are complete. If this restoring of data to the fixed disk is not completed properly, you must perform an IPL using an installed system backup disk as the removable disk. Then you can use CVD to restore the system backup disk data to the fixed disk.

In the following procedure, the fixed disk is called FIXED, the removable disk containing data to be backed up is called CART, the disk used for backup of the fixed disk is called FIXEDBCK, and the disk used to backup the removable disk is called CARTBACK. Follow these steps to back up the data on the removable disk:

1. Remove CART and install FIXEDBCK. Copy FIXED to FIXEDBCK. Refer to the *DNOS System Command Interpreter* (SCI) *Reference Manual* for a complete description of the CVD command.

2. Replace FIXEDBCK with CART.

3. Use CVD to copy CART to FIXED.

4. Replace CART with CARTBACK.

5. Use CVD to copy FIXED to CARTBACK.

6. Replace CARTBACK with FIXEDBCK. Properly identify and store CARTBACK as the backup copy of CART.

7. Use CVD to restore FIXEDBCK to FIXED.

8. Terminate the CVD process and perform an IPL from the fixed disk.

6.5.1.4 Single Disk Drive Data Recovery. On systems having only a single disk drive, damage that causes loss of data can occur to either the fixed disk or to the removable disk. If the damage occurs through some malfunction of the system's hardware or software, take corrective action to restore the computer system to normal operation before attempting any data recovery procedures. Do not try to use backup disk packs to recover until the hardware has been repaired and verified operational with diagnostic procedures. Data recovery procedures can begin once the system is restored to normal operation, or can begin immediately if the data loss on the disk occurred through improper use of the computer system that is not likely to recur.

If damage causing data loss occurs to the removable disk, remove the damaged disk and replace it with the latest version of the backup copy of that disk. Reenter any data entries made to the damaged disk since the previous backup cycle occurred. Make a backup of the newly restored disk. You may elect to do this before or after reentering the data entries.

Data recovery is more involved if the damage occurs to the fixed disk causing data loss of operating system files. The following general procedure recovers data on the fixed disk:

1. Remove the undamaged removable disk.
2. Retrieve a valid backup copy of the system disk (FIXEDBCK) from storage and install it.
3. Perform an IPL from FIXEDBCK.
4. Enter the CV command. Respond to the prompts to copy FIXEDBK to the fixed disk. Answer NO to the MORE COPIES prompt.
5. CV prompts you to mount FIXEDBK in the proper drive, then begins the copy.
6. When the copy is complete CV prompts you to perform an IPL from the system disk.
7. Reinstall the disk removed in step 1 and resume normal operation.

6.5.2 Backup Using Two Disk Drives

The following steps backup disk volumes on a system having two or more disk drives, where at least two of the drives have removable disks. In this procedure, DS01 is the system disk and DS02 is the data disk.

1. Remove the disk from DS02 and install the disk pack to be used for backup.
2. Use CV to copy DS01 to DS02. Refer to the (SCI) for complete details on using the CV command.
3. Remove the backup copy of the system disk from DS02, identify, and store it. Reinstall the data files disk pack at DS02.
4. Terminate the CV process.

The following steps back up the data files on DS02:

1. Enter the CV command.

2. Remove the system disk from DS01 and install the disk to be used for backup.

3. Use CV to copy DS02 to DS01. Refer to the *DNOS System Command Interpreter* (SCI) *Reference Manual* for complete details on using the CV command.

4. Remove the backup copy of your data files from DS01, identify, and store it. Reinstall the system disk at DS01.

5. Terminate the CV process.

Damage that causes loss of stored data may occur to either of the two disk drives. If a system software or hardware malfunction causes damage, take corrective action to restore the computer system to normal operation before attempting any data recovery procedures. Begin data recovery procedures once the system is restored to normal operation, or begin immediately if the data loss on the disk occurred through improper use of the computer system that is not likely to recur.

If damage causing data loss occurs to the system disk, remove the disk and replace it with the system backup disk. If the damage causing data loss occurs to the data disk, remove the disk and replace it with the latest version of the backup copy of that disk. Reenter any data entries made to the damaged disk since the previous backup cycle occurred. Make a backup of the newly restored disk. You may decide to do this before or after reentering the data entries.

6.5.3 Backing up a Single Fixed Disk to Flexible Diskettes

On computer systems having a single fixed disk and a removable flexible diskette, the operating system resides on the fixed disk and cannot be contained on a single flexible diskette. When you first received your operating system it was on several flexible diskettes (an Initial Build diskette and two or more Backup Disks). These were used in the Disk Build procedure to build your base operating system on the large fixed disk. You may have then modified the base system to match your system's configuration. You should store the original set of diskettes in case it is necessary to go through the entire procedure again.

Restoring your system from the initial system can be avoided by copying the entire fixed disk to flexible diskettes using the BD or BDD command. When making this backup set, name the backup file DX.SYSTEM so you can later accept the default values during a Disk Build. Label and store this backup set and do not use it in your regular backup rotation. During your regularly scheduled backups, you need only to back up your data files.

If your fixed disk is destroyed, use this procedure to rebuild your operating system. Your system must contain the standard ROM loader. For a Model 990 and Business System minicomputers, the system must include a disk drive, a diskette drive, and at least one VDT in the following configuration for the build process to execute correctly:

Type	Address	Interrupt
Disk (4 possible)	TILINE >F800	13
FD1000 Diskette (4 possible)	TILINE > F820	9
911 VDT	CRU > 0100	10
931 or 940 VDT	CRU >1700 S300, CI402 or CI403	8 9600 Baud
931 or 940 VDT (channel 0)	TILINE >F980 CI403 or CI404	11 9600 Baud

Use the initial build diskette (DNOS12DB) shipped with your system and a set of backup diskettes that contain your saved operating system and files.

The build procedure initiates and executes the Disk Build utility. If you need to terminate Disk Build prematurely, enter a dollar sign ($) in response to any of the prompts.

Perform the following steps to build the DNOS system disk from diskette:

1. Insert the DNOS12DB diskette in an available diskette drive. Do not write-protect the diskette.

2. Insert the disk that will contain your restored system in an available drive with the write-protection enabled. (This disk will be referred to as the target disk.)

3. To load the Disk Build utility from the diskette to system memory, perform the steps that apply to your hardware.

   If you have a 990/10 or 990/12 system, perform the following steps on the programmer panel:

   a. Press HALT/SIE

   b. Press RESET

   c. Press CLR

   d. Enter > 0082 on the programmer panel

   e. Press ENTER MA

f. Press MDD

g. Enter > F820 on the programmer panel

h. Press MDE

i. Press LOAD

If you have a Business System computer, perform the following steps on the front panel:

a. Press HALT/SIE

b. Press ALTERNATE LOAD

4. The Disk Build utility is read from the diskette and sent to memory. When Disk Build begins execution, the following message and prompt are displayed on one or all the terminals:

```
***DISK BUILD UTILITY***
DO YOU WANT TO CHANGE ANY DEFAULT VALUES? (Y/N):
```

If you answer Y, you will have three opportunities to change default values during the execution of Disk Build:

a. Before Disk Build is copied from the initial build diskette to the target disk, you can change the default volume characteristics of the target disk.

b. When Disk Build is being loaded, you can specify the location of the target disk.

c. Before Disk Build restores the first backup diskette to the target disk, you can name your backup file.

At this point, turn off the write protection on the target disk drive. If you need to change any of the default values, enter Y in response to the prompt. Otherwise, enter N.

After your response to the prompt, only your terminal remains active; all others become blank. A digital clock display appears in the lower right corner of your screen and monitors the execution time of the Disk Build utility.

5. If you answered N to change the default values, skip this step. If you answered Y to change the default values, the following message and prompt will appear on the screen. The contents of this message vary with each system, depending on the drives that are configured and online. The following is an example of a typical message and prompt:

```
SYSTEM WILL BE BUILT ON ONE OF THE FOLLOWING DISKS:
ID    ADDRESS    UNIT      INTERRUPT     TYPE
1      F800       01           13      DS50   - 50M
2      F800       00           13      DS50   - 50M
3      F820       00            9      FD1000 - 1M
INPUT ID NUMBER OF DESIRED DISK UNIT:
```

The table listed in the message represents all of the disks that are online in the computer system. Choose the disk unit you want to be the system disk and inspect the leftmost column to determine the ID number of that disk unit. Enter the ID number in response to the prompt. For example, if you choose unit 01 located at > F800 for your target disk, its associated ID number is 1. Therefore, you enter 1 in response to the INPUT ID NUMBER OF DESIRED DISK UNIT prompt.

The system built to the disk you specify will support only those devices generated in the system being restored. If the system being built is the system shipped from Texas Instruments, it supports only the base S$SHIP configuration. If the system being restored is a system you backed up, it supports your configuration.

6. Disk Build now inspects the target disk and evaluates its condition. It will find the disk to be in one of three states. Your actions are outlined as Case 1, Case 2, and Case 3 below. Follow the set of instructions for the case that begins with the message you see next.

   a. CASE 1. If Disk Build does not find a bad track map on the target disk, the disk must have its surface analyzed for defects. The following message appears:

      ```
      DISK REQUIRES SURFACE ANALYSIS
      ```

      (1) If you answered N to the prompt to change defaults, the following message now appears as Disk Build begins the work of analyzing and formatting the disk.

      ```
      BEGIN STEP 1.
      ```

      Disk Build automatically issues an Initialize Disk Surface (IDS) command, which analyzes the target disk for physical flaws and lists the location of any flaw on a bad track map.

      When IDS completes, Disk Build performs an Initialize New Volume (INV) command, which creates VCATALOG, assigns a volume name, and installs the volume on the target disk. In this case Disk Build uses default values for the INV parameters.

      (2) If you answered Y to the prompt to change defaults, the following prompts appear:

      ```
                        VOLUME NAME: SYSTEM
         NUMBER OF VCATALOG ENTRIES:
      DEFAULT PHYSICAL RECORD SIZE:
                 INTERLEAVING FACTOR:
      ```

When you have answered this set of prompts, the following messages appear:

```
                  BEGIN STEP 1.

ENTER BAD TRACKS IN THE FORMAT:
 HEAD, CYLINDER;
      OR
 HEAD, CYLINDER; HEAD, CYLINDER; ETC.
TO END LIST, ENTER AN EMPTY LINE
```

Enter the list of known bad tracks in the requested format using decimal numbers for the values (for example, 2, 235; 0,15;). All entries, including the last, must end with a semicolon. Improper positioning or absence of the punctuation marks returns an error.

b. CASE 2. If Disk Build determines that no surface analysis is needed, only the INV process is required. The following message appears:

```
DISK REQUIRES INITIALIZATION.
```

(1) If you answered N to the prompt to change defaults, the following message appears:

```
BEGIN STEP 1.
```

(2) If you answered Y to the prompt to change defaults, the following message appears:

```
PERFORM INV?
```

If you want to reformat the disk (the equivalent of the INV command with FORCED CLEARING OF DISK set to YES), answer Y to this prompt. Otherwise answer N. If you answer Y, you are given the option to force surface analysis of the disk. The following prompt appears:

```
PERFORM IDS?
```

If you want to have the surface analyzed, answer Y. Otherwise answer N. The following prompts appear next:

```
                VOLUME NAME: SYSTEM
   NUMBER OF VCATALOG ENTRIES:
DEFAULT PHYSICAL RECORD SIZE:
          INTERLEAVING FACTOR:
```

When you have answered this set of prompts, the following message appears:

```
               BEGIN STEP 1.

    ENTER BAD TRACKS IN THE FORMAT:
     HEAD, CYLINDER;
          OR
     HEAD, CYLINDER; HEAD, CYLINDER; ETC.
    TO END LIST, ENTER AN EMPTY LINE
```

Enter the list of known bad tracks in the requested format using decimal numbers for the values (for example, 2, 235; 0,15;). All entries, including the last, must end with a semicolon. Improper positioning or absence of the punctuation marks returns an error.

c. CASE 3. If Disk Build determines that the disk does not have to be initialized and VCATALOG exists on the target disk, the following message and prompt appears:

```
VOLUME NAME: <your volume name>
THE SPECIFIED DISK COULD CONTAIN SOME INFORMATION
ABOUT YOUR BUSINESS. IF N IS ENTERED, THE DISK
WILL BE ERASED.  IF Y IS ENTERED, ONLY SYSTEM INFORMATION
WILL BE ERASED.  IF THERE IS INFORMATION THAT MUST
BE SAVED, ENTER Y.  IF THE INFORMATION CAN BE
REPLACED, ENTER N.

SHOULD THE USER INFORMATION ON THE
SYSTEM DISK BE SAVED? (Y/N):
```

The preceding message indicates that software or data may exist on the target disk. If you want to keep this information, enter Y. Disk Build will issue the Install Volume (IV) command. If you do not want to keep this information, enter N and Disk Build will issue the INV command with FORCED CLEARING set to NO.

Enter a Y or N.

(1) If you enter an N and you previously responded Y to change the default values, the following message appears:

```
PERFORM INV?
```

(2) If you want to reformat the disk (the equivalent of the INV command with FORCED CLEARING OF DISK set to YES), answer Y to this prompt. Otherwise answer N. If you answer Y, you are given the option to force surface analysis of the disk. The following prompt appears:

```
PERFORM IDS?
```

(3) If you want to have the surface analyzed, answer Y. Otherwise answer N. The following prompts appear next:

```
                  VOLUME NAME: <volume name>
    NUMBER OF VCATALOG ENTRIES:
  DEFAULT PHYSICAL RECORD SIZE:
           INTERLEAVING FACTOR:
```

where:

<volume name> is the current name of the target disk.

When you have answered this set of prompts, the following message appears:

```
          BEGIN STEP 1.

ENTER BAD TRACKS IN THE FORMAT:
 HEAD, CYLINDER;
      OR
 HEAD, CYLINDER; HEAD, CYLINDER; ETC.
TO END LIST, ENTER AN EMPTY LINE
```

Enter the list of known bad tracks in the requested format using decimal numbers for the values (for example, 2, 235; 0,15;). All entries, including the last, must end with a semicolon. Improper positioning or absence of the punctuation marks causes an error to be returned.

7. When the target disk is logically installed, the Disk Build utility copies the remainder of the Disk Build operating system software from DNOS12DB to the target disk using the Copy Directory (CD) command. During this process, the following message appears on the terminal:

```
BEGIN STEP 2.
```

While the CD command is executing, Disk Build creates a listing file named .B$LISTCD on the target disk. It also creates the Disk Build system files that are used to build DNOS. The following message appears on the terminal:

```
REMOVE INITIAL BUILD MEDIA.
THEN TYPE Y TO CONTINUE:
```

8. Remove DNOS12DB from the diskette drive.

9. Disk Build automatically loads the system from the newly created files on the target disk. The following message appears:

```
SYSTEM LOAD INITIATED - WAIT ONE MINUTE.
IF NO MESSAGES APPEAR, START OVER AT STEP 1.
```

   a. If the load is successful, this message appears on the screen:

   ```
   MOUNT BACKUP DATA VOLUME 1.
   THEN TYPE Y TO CONTINUE:
   ```

   b. If a message does not appear on the screen after one minute, the load process was not successful and the data lights on the front panel will display a crash code. Refer to the *DNOS Messages and Codes Reference Manual* for an explanation of the crash code. Correct the cause of the crash, and repeat the Disk Build procedure from the beginning.

   If you are preserving data on your target disk, you may receive a >120 crash code as a result of temporary files that needed to be deleted. Start over from the beginning; the build process should work the second time.

10. Insert the first diskette with your backup system in the diskette drive. Type Y to continue the build process. A response other than Y causes the message MOUNT BACKUP DATA VOLUME 1 to reappear. (Typing the dollar ($) sign aborts the Disk Build process.)

11. Disk Build is now ready to restore the backup data from the diskettes to the target disk. If you answered Y to change the default values, the following message appears on the screen:

```
ENTER THE PATHNAME OF SEQUENTIAL BACKUP FILE: DX.SYSTEM
```

   Press the RETURN key.

12. Disk Build issues the Restore Directory (RD) command and copies the DNOS operating system from the diskette to the target disk. The following message appears on your screen:

```
BEGIN STEP 3.
```

   During STEP 3, Disk Build deletes the .S$USER directory and the following files; they could cause a conflict with the new system if left in the drive:

   .S$UTIL
   .S$SHIP
   .S$SHARED
   .S$LANG
   .S$CLF
   .S$SCA
   .S$SDTQUE (file or directory)

Disk Build issues prompts at the appropriate times to insert the remaining diskettes. The following message will appear:

```
MOUNT VOLUME <x>
       ; TYPE $ TO QUIT, Y TO CONTINUE:
```

where:

<x> is the number of the next volume that you need to install.

Remove the current diskette and mount volume <x> as requested.

13. After Disk Build copies your entire set of backup diskettes to the target disk, the following message appears on the screen:

```
BUILD PROCESS COMPLETED.
REMOVE BACKUP MEDIA.
THEN TYPE Y TO CONTINUE:
```

14. Remove the diskette. Then type Y. The following message appears:

```
SYSTEM LOAD INITIATED - WAIT 1 MINUTE.
THEN LOG ON.
```

15. After four seconds, the system executes an IPL and the screen becomes blank. When the IPL is complete, the screen displays the following message:

```
*   TEXAS INSTRUMENTS * DNOS name SYSTEM IPL * STyy *
```

where:

STyy is the station number of your terminal.
name is the name of generated system.

Wait for all system activity to cease; that is, wait until all of the data lights on the programmer panel are off. If you are using a Business System computer, wait until the lights show 0000 on the front panel. This takes some time; the first IPL of the system must create several structures. These structures include a user ID defined for the first log-on, system swap files, and a number of interprocess communications (IPC) channels.

16. Log on at a terminal. Press the Attention key, then press the exclamation mark (!).

17. If no other terminal has logged on, the following message and prompts appear in the teletype (TTY) mode:

```
INITIALIZE DATE AND TIME
YEAR:   <year>
MONTH:  <month>
DAY:    <day>
HOUR:   <hour>
MINUTE: <minute>
```

Where you respond as follows:

<year>	is a two- or four-digit integer representing the current year.
<month>	is a one- or two-digit integer representing the current month.
<day>	is a one- or two-digit integer representing the current day.
<hour>	is a one- or two-digit integer representing the current hour according to the 24-hour clock.
<minute>	is a one- or two-digit integer representing the current minute.

18. The JOB NAME prompt appears next. Enter a one- to eight-character alphanumeric string (for example, your name).

    SCI is now active and the SCI prompt ([ ]) appears in the lower left corner.

19. The Disk Build process created the following files. They are deleted during IPL, therefore you should not use these file names for your own files.

    .B$PROGA
    .B$LOADER
    .B$PASS
    .B$CONFIG
    .B$OVLYA
    .S$PRINT
    .S$ROLLA
    .S$SLG1
    .S$SLG2
    .S$TCALIB
    .S$BGTCA
    .S$FGTCA

    The .B$LISTRD file is a restore directory (RD) listing of the system just built; the file can be deleted with the Delete File (DF) command.

6.5.4 Backup/Recovery Plan for Disk Drive/Tape Drive Computer Systems

If your computer system includes a single disk drive and a tape drive, your operating system resides on the disk. Your method of backing up this disk depends on whether the disk is removable or fixed. The following procedures cover these two cases.

6.5.4.1 Removable Disk. In a single disk drive/magnetic tape drive computer system with a removable disk, you should retain a backup copy of the system disk on disk media rather than tape media. This saves you from having to do a Tape Build if the system disk is destroyed. To copy your system disk onto another disk, use the following procedure:

1. Copy the system disk to magnetic tape using the DCOPY utility.

2. If you are performing this step immediately after step 1, and DCOPY is still in memory, remove the system disk. If this procedure was interrupted, and DCOPY is no longer in memory, reenter the command DCOPY and then remove the system disk.

3. Install a disk for backup, and copy the tape to disk using DCOPY. Since this disk is now an exact copy of the removed system disk, you can retain it in the system for operation. Label the disk previously removed as your backup copy, and store it properly.

The procedure for recovering lost data for the disk drive/tape drive computer system with a removable disk, assuming that any system malfunctions have been corrected, is to remove the damaged disk or tape and replace it with the latest version of the backup copy of the disk or tape. If you replace data files, reenter any data entries made since the previous backup cycle occurred. Make a backup of the newly restored disk. You may decide to do this before or after reentering the data entries.

6.5.4.2 Fixed Disk. In a single disk drive/tape drive system with a nonremovable disk, you should back up your system disk to magnetic tape using either the BDD or BD utility. Label these tapes as your system backup, store them properly, and do not use them in your regular backup rotation. During the regularly scheduled backups, you then need only to back up your data files.

If your system disk is destroyed, you must rebuild your operating system using the Tape Build procedure. The Tape Build procedure does not preserve file access security. If you must restore a system with file security using Tape Build, you will have to redefine the security of each file.

To build a DNOS system disk from tape, Your system must be a standard configuration. It may be a Model 990 or Business System minicomputer with a standard ROM loader, at least one disk drive, one magnetic tape drive, and one VDT in the following configuration:

Type	Address	Interrupt	
Disk	TILINE >F800	13	
Magnetic tape	TILINE >F880	9	
911 VDT	CRU >0100	10	
931 or 940 VDT	CRU >1700 S300, CI402 or 990/10A	8	9600 Baud
931 or 940 VDT (channel 0)	TILINE >F980 CI403 or CI404	11	9600 Baud

Your hardware can contain more than one magnetic tape drive at the specified location.

Perform these steps to build the DNOS system disk from tape:

1. Mount the tape labeled Build Tape on the tape drive with the write-protection enabled. Prepare the drive for use.

2. Enable write-protection on the disk to be used as the system disk. (This disk will be referred to as the target disk.)

3. To start the Tape Build process, perform the steps that apply to your hardware.

   If you have a 990/10 or 990/12 system, perform these steps on the programmer panel:

   a. Press HALT/SIE
   b. Press CLR
   c. Enter >0082 on the programmer panel
   d. Press ENTER MA
   e. Press CLR
   f. Enter >F880 on the programmer panel
   g. Press MDE
   h. Press MAI
   i. Press CLR
   j. Enter >8000 on the programmer panel
   k. Press MDE
   l. Press LOAD

   If you have a Business System 600 or 800, perform these steps on the front panel:

   a. Press HALT
   b. Press ALTERNATE LOAD

   If you have an S300 system:

   a. Turn off the power to the computer.
   b. Turn on the power to the computer.

4. The disk that you are building will be initialized during the build process. The effect will be the same as if you had issued an Initialize New Volume (INV) command with the FORCED CLEARING OF DISK response of NO. As the build is done, a Tape Build program is read into memory from the tape. When the Tape Build program begins execution, this message and prompt are displayed on one or all of the terminals:

```
***DISK BUILD UTILITY***
DO YOU WANT TO CHANGE ANY DEFAULT VALUES? (Y/N):
```

If you respond N and accept the default values, the Tape Build program will use its own values for the following items:

a. Volume name of the disk being built, using the current volume name of thedisk if it has one. The name SYSTEM is used if the volume currently has no name.

b. IDS defaults for testing level.

c. INV defaults for the physical record size, the number of VCATALOG (volume directory) entries, and the hardware interleaving factor while initializing the disk being built.

d. Bad track map, allowing you to enter none as the disk is initialized.

At this point, remove the write protection from the target drive. Answer N to this question if you want to make no changes. Answer Y if you want to make any changes to these items as the build proceeds.

Whether you enter Y or N, the terminal you are using remains active. All other terminal screens that displayed the introductory message become clear. A digital clock display appears in the bottom right corner of your screen and monitors the execution time of the Tape Build utility.

Tape Build now inspects the target disk and evaluates its condition. It will find the disk to be in one of two states. Your actions are outlined as Case 1 and Case 2 below. Follow the set of instructions for the case that begins with the message you see next.

a. CASE 1. If Tape Build does not find a bad track map on the target disk, the disk must have its surface analyzed for defects. The following message appears:

```
DISK REQUIRES SURFACE ANALYSIS
```

(1) If you answered N to the prompt to change defaults, the following message now appears as Tape Build begins the work of analyzing and formatting the disk.

```
BEGIN STEP 1.
```

Tape Build automatically issues an Initialize Disk Surface (IDS) command, which analyzes the target disk for physical flaws and lists the location of any flaw on a bad track map.

When the IDS is complete, Tape Build performs an Initialize New Volume (INV) command, which creates VCATALOG, assigns a volume name, and installs the volume on the target disk. In this case Tape Build uses default values for the INV parameters.

(2) If you answered Y to the prompt to change defaults, the following prompts appear:

```
                 VOLUME NAME: SYSTEM
   NUMBER OF VCATALOG ENTRIES:
 DEFAULT PHYSICAL RECORD SIZE:
          INTERLEAVING FACTOR:
```

When you have answered this set of prompts, the following messages appear:

```
BEGIN STEP 1.

ENTER HEAD AND CYLINDER ADDRESS OF KNOWN BAD TRACKS.
ENTER THE ADDRESSES ONE PER LINE.
END THE LIST BY ENTERING RETURN ONLY FOR THE NEXT HEAD.
HEAD #
```

Enter the addresses of any known bad tracks on this volume. Enter the decimal number for the head on the line prompting HEAD #, then press the Return key. Do not use any special characters such as commas or semicolons. Tape Build will then prompt with CYLINDER #. Enter the decimal value of the cylinder number immediately after this prompt. Then press the Return key. Do not use any special characters such as commas or semicolons. Tape Build will then prompt you for the next head and cylinder number in the same manner. When the list of head and cylinder pairs is complete, press only the Return key in response to the HEAD # prompt to terminate your input.

b. CASE 2. If Tape Build determines that no surface analysis is needed, only the INV process is required. The following message appears:

```
DISK REQUIRES INITIALIZATION.
```

(1) If you answered N to the prompt to change defaults, the following message appears:

```
BEGIN STEP 1.
```

(2) If you answered Y to the prompt to change defaults, the following message appears:

```
PERFORM INV?
```

If you want to reformat the disk (the equivalent of the INV command with FORCED CLEARING OF DISK set to YES), answer Y to this prompt. Otherwise answer N. If you answer Y, you are given the option to force surface analysis of the disk. The following prompt appears:

```
PERFORM IDS?
```

If you want to have the surface analyzed, answer Y. Otherwise answer N. The following prompts appear next:

```
                VOLUME NAME: SYSTEM
  NUMBER OF VCATALOG ENTRIES:
DEFAULT PHYSICAL RECORD SIZE:
         INTERLEAVING FACTOR:
```

When you have answered this set of prompts, the following messages appear:

```
             BEGIN STEP 1.

ENTER HEAD AND CYLINDER ADDRESS OF KNOWN BAD TRACKS.
ENTER THE ADDRESSES ONE PER LINE.
END THE LIST BY ENTERING RETURN ONLY FOR THE NEXT HEAD.
HEAD #
```

Enter the addresses of any known bad tracks on this volume. Enter the decimal number for the head on the line prompting HEAD #, then press the Return key. Do not use any special characters such as commas or semicolons. Tape Build will then prompt with CYLINDER #. Enter the decimal value of the cylinder number immediately after this prompt. Then press the Return key. Do not use any special characters such as commas or semicolons. Tape Build will then prompt you for the next head and cylinder number in the same manner. When the list of head and cylinder pairs is complete, press only the Return key in response to the HEAD # prompt to terminate your input.

5. If Tape Build is performing the IDS command, a graph is displayed to show progress and a list of any bad tracks is displayed on the screen when the IDS is complete.

6. When the target disk is logically installed, the Tape Build program copies the remainder of the Tape Build operating system software from the tape to the target disk. During this process, the following message appears on the terminal:

   ```
   BEGIN STEP 2.
   ```

The system files are being recreated for the system that builds DNOS. As directories and files are created, their names appear on the screen:

```
**VCATALOG**
**S$DIAG   **
**S$ROLLA **
**B$LOADER**
**S$PROC   **
**B$OVLYA **
**S$IMAGES**
**B$PROGA **
**B$PASS   **
```

7. Tape Build automatically loads the system using the newly created files on the target disk. The following message appears:

```
REMOVE INITIAL BUILD MEDIA.
THEN TYPE Y TO CONTINUE:
```

Unload and remove the tape. With no tape available, respond Y and press the Return key. The following message appears:

```
SYSTEM LOAD INITIATED - WAIT ONE MINUTE.
IF NO MESSAGES APPEAR, START OVER AT STEP 1.
```

If the tape remains mounted, the system might not load from the disk. In this case, to load the system you need to remove the tape, press HALT, and then press LOAD.

a. If the load is successful, the following message appears on the terminal:

```
MOUNT BACKUP DATA VOLUME 1.
THEN TYPE Y TO CONTINUE:
```

BACKUP DATA VOLUME 1 refers to your first backup tape.

b. If a message does not appear on the screen after one minute, the load process was not successful and the data lights on the front panel will display a crash code. Refer to the *DNOS Messages and Codes Reference Manual* for an explanation of the crash code. Correct the cause of the crash, rewind the Build Tape, and repeat the Tape Build procedure from the beginning.

8. Mount your backup tape on the tape drive. When the tape is ready, type Y to continue the build process. A response other than Y causes the message MOUNT BACKUP DATA VOLUME 1 to reappear. (Typing the dollar ($) sign aborts the Tape Build process.)

9. Tape Build issues the Restore Directory (RD) command and copies the DNOS operating system from tape to the target disk. The following message appears on your screen:

```
BEGIN STEP 3.
```

During STEP 3, Tape Build deletes the .S$USER directory and the following files since they could cause a conflict with the new system:

.S$UTIL
.S$SHIP
.S$LANG
.S$SHARED
.S$CLF
.S$SCA
.S$SDTQUE (file or directory)

10. If you have several tapes for your backup, when one tape finishes and Tape Build is ready for the next, the following message appears:

```
MOUNT VOLUME <X>; TYPE $ TO QUIT, Y TO CONTINUE
```

where:

<X> is the number of the next volume to be installed.

Remove the current tape and install volume <X> as requested.

11. After Tape Build copies your backup tape(s), the following message appears:

```
BUILD PROCESS COMPLETED.
REMOVE BACKUP MEDIA.
THEN TYPE Y TO CONTINUE:
```

12. Unload and remove the tape. With no tape available, respond Y and press the Return key. The following message appears:

```
SYSTEM LOAD INITIATED - WAIT 1 MINUTE.
THEN LOG ON.
```

13. After four seconds, the system executes an IPL and the screen becomes blank. When the IPL is complete, the following banner is displayed:

```
* TEXAS INSTRUMENTS * DNOS name SYSTEM IPL * STyy *
```

where:

STyy is the station number of your terminal.
name is the name of your generated system.

Wait for all system activity to cease. If you are using a 990/10 or 990/12, wait until all of the data lights on the front panel are off. If you are using a Business System computer, wait until all the lights show 0000 on the front panel. This may take some time; the first IPL of the system must create several structures. These structures include a user ID defined for the first log-on, system swap files, and a number of interprocess communication (IPC) channels.

14. Log on at a terminal. Press the Attention key and the press then exclamation mark (!).

15. If no other terminal has logged on, the screen displays the following message and prompts:

```
INITIALIZE DATE AND TIME
YEAR:   <year>
MONTH:  <month>
DAY:    <day>
HOUR:   <hour>
MINUTE: <minute>
```

    Where you supply the following responses:

<year>	is a two- or four-digit integer representing the current year.
<month>	is a one- or two-digit integer representing the current month.
<day>	is a one- or two-digit integer representing the current day.
<hour>	is a one- or two-digit integer representing the current hour according to the 24-hour clock.
<minute>	is a one- or two-digit integer representing the current minute.

16. The JOB NAME prompt appears next. Enter a one- to eight-character alphanumeric string (for example, your name).

    SCI is now active and the SCI prompt ([ ]) appears in the lower left corner.

17. The following file and directory names are reserved; they are created during the Tape Build process. They are deleted during an IPL of DNOS, therefore you should not use these names for your own files.

    .B$PROGA
    .B$LOADER
    .B$PASS
    .B$OVLYA
    .S$BGTCA
    .S$FGTCA
    .S$ROLLA
    .S$SLG1
    .S$SLG2
    .S$TCALIB

    The .B$LISTRD file is a restore directory (RD) listing of the system just built. The build process also creates the .S$PROC directory. Delete these with the Delete File (DF) and Delete Directory (DD) commands.

7

Using Logical Names, Synonyms, and LUNOs

7.1 GENERAL INFORMATION

Logical names, synonyms, and logical unit numbers (LUNOs) are alternate names for input/output (I/O) resources. They differ in where they are used and how DNOS resolves them to access the intended I/O resource.

A logical name is a variable used by DNOS which can have an I/O resource and various parameters associated with it. A logical name provides more flexibility for the user than synonyms or LUNOs.

A synonym is a variable used by SCI to name a file, channel, or device.

A LUNO is an operating system variable that must be allocated before any I/O resource can be accessed. The operating system or applications programs usually allocate LUNOs.

7.2 LOGICAL NAMES

Logical names are user-specified character strings used to name a resource; the character strings can be from one to eight characters in length. Logical names can be used in place of a device name or pathname or the first part of a pathname when issuing commands to SCI or in user programs. Using logical names that are the same as real device names on the system causes unpredictable results.

Logical names can be global or job-local in nature. Global logical names are those available to all users, jobs, and tasks. Job-local logical names, on the other hand, are available only to the job that creates them and tasks associated with that job.

DNOS uses a number of logical names; the logical name S$UTIL is the pathname of the current utility program file. Most language packages offered on DNOS define a global logical name for the program file or directory that they use. This practice minimizes the number of global LUNOs defined and it avoids defining the same logical name in every user's set of logical names.

Logical names can have associated user-defined parameters; these parameters pass values which are associated with the named resource to the job or task using the resource. The parameters associated with a logical name depend on the resource being accessed.

Logical names can logically concatenate several files together. These files must be of the same type but can be on different volumes. There are restrictions on concatenating files; these restrictions are discussed in the *DNOS Systems Programmer's Guide*.

7.2.1 Assigning, Saving, and Releasing Logical Names

DNOS uses four SCI commands to assign and release logical names; these commands are Assign Logical Name (ALN), Release Logical Name (RLN), Snapshot Name Definitions (SND), and Snapshop Global Name Definitions (SGND). ALN assigns a logical name and the associated parameters to an I/O resource. RLN deletes a specified logical name from the file containing all logical names. SND takes a snapshot of user-defined synonyms and logical names and writes them to a file. SGND saves the current set of global logical names that are in memory in a permanent file; this command should be used to save global logical names after they have been altered with an ALN command.

The List Logical Names (LLN) command displays all the logical names defined for the current job and all the global logical names.

When someone logs on at a terminal, that terminal has access to all global logical names and to all local logical names associated with the user ID used when logging on to the system. When the user logs off the system, all logical names created and not released are saved.

DNOS puts no limit on the number of terminals that can be logged on with the same ID. When more than one terminal logs on with the same ID, the logical names associated with that ID are saved to disk at the time the last terminal using the ID logs off. When a user logs on at a terminal, the terminal receives a copy of the logical names associated with the user ID used to log on; the next terminal logged on using the same user ID receives the same copy of the logical names associated with the user ID. Each terminal then has a separate set of logical names, each associated with the same user ID. When the last terminal using that user ID is logged off, the copy of the logical names is saved. This means all changes made at the other terminals are lost; only the changes made at the last terminal logged off using that user ID are retained.

7.2.2 Example of Logical Name Use

The user might assign the spooler logical name PRINTER1, and the logical name OUTFILE to a combination of files. For this example, assume the user has sequential files, without ANSI control characters, some files are on the system disk, some files are on a floppy disk, sometimes the user wants to print all the files together, and sometimes view the files on a VDT without changing from one file to another.

When you assign the logical name PRINTER1 to the spooler, prompts appear for all the spooler parameters and you respond with the desired values as shown below:

First:

```
[]ALN
ASSIGN LOGICAL NAME
                 LOGICAL NAME: PRINTER1
                RESOURCE TYPE: SPOOLER
```

Then respond to these prompts as shown:

```
ASSIGN SPOOLER PARAMETERS
             ANSI FORMAT?: NO
  LISTING DEVICE OR CLASS: LP01
     NUMBER OF LINES/PAGE: 55
                     FORM: STANDARD
         NUMBER OF COPIES: 5
            BANNER SHEET?: NO
             GLOBAL NAME?: NO
```

Assign the logical name OUTFILE with the desired values such as shown below:

First assign the logical name OUTFILE like this:

```
[]ALN
ASSIGN LOGICAL NAME
              LOGICAL NAME: OUTFILE
             RESOURCE TYPE: NONE
```

Next respond to these prompts as shown:

```
ASSIGN LOGICAL NAME
            ACCESS NAME(S): VOL1.FILEA,VOL2.FILEB
              GLOBAL NAME?: NO
```

After assigning these logical names, you might use the Copy/Concatenate (CC) command like this:

```
COPY/CONCATENATE
      INPUT ACCESS NAME(S): OUTFILE
        OUTPUT ACCESS NAME: PRINTER1
                  REPLACE?: Y
     MAXIMUM RECORD LENGTH:
```

DNOS then logically concatenates all the files associated with the logical name OUTFILE and sends the files to the output file. In the case where PRINTER1 is the output file, the result is the same as if you copied all the files to a temporary file and then printed the temporary file using the spooler.

7.3 SYNONYMS

Synonyms are variables in the System Command Interpreter (SCI) language that represent a string of characters or a null value. Both SCI and the user can assign values to synonyms. When user defined, synonyms are often used in place of a pathname or the first part of a pathname; this allows the user to equate a short character string to a long pathname.

Synonyms are associated with user IDs. When a user logs on the system, the job started receives a copy of all the synonyms associated with that user ID. When one or more batch jobs are executed from a terminal, each batch job inherits a complete copy of all synonyms from the job at the terminal. The batch job may create its own synonyms or modify the synonyms it inherited; these actions have no effect on the copy of the synonyms being used at the terminal or any other batch job already executing.

Since DNOS does not restrict the number of terminals that can be logged on at the same time with the same user ID, each terminal receives a copy of the synonyms associated with that user ID. Synonyms can be modified and changed at each terminal without affecting the synonyms the other terminals are using.

Synonyms are saved when the terminal is logged off. Since several terminals can be logged on using the same user ID, the copy of the synonyms being used by the last terminal to log off is the copy that is saved. When a user logs on at a terminal, the terminal receives a copy of the synonyms associated with the user ID used to log on; the next terminal logged on using the same user ID receives the same copy of the synonyms associated with the user ID. Each terminal then has a separate set of synonyms, each associated with the same user ID. When the last terminal using that user ID is logged off, the copy of the synonyms is saved. This means all changes made at the other terminals are lost; only the changes made at the last terminal logged off using that user ID are retained.

7.3.1 Assigning, Listing, and Modifying Synonyms

DNOS has three SCI commands that manipulate synonyms:

- Assign Synonym Value (AS) — AS allows the user to define a synonym (an alphanumeric character string of one to eight characters) and assign a value to that synonym. The synonym must begin with an alphabetic character.

- List Synonyms (LS) — LS lists all of the synonyms currently defined for the job and the values for those synonyms.

- Modify Synonym (MS) — MS allows a user to modify the value of a synonym or delete a synonym. Synonyms are deleted by changing the current value to a null value.

7.4 LOGICAL UNIT NUMBER (LUNO)

A LUNO is a number assigned to an I/O resource. I/O resources are devices, files, and interprocess communication channels. Where logical names and synonyms are character strings that name pathnames or devices, LUNOs are hexadecimal numbers in the range from >00 through >FF that point to specific I/O resources; that is, each LUNO points to one and only one I/O resource at a time. The LUNO must be opened by the task that uses it. The task opening a LUNO requests certain access privileges; these privileges can be read only, shared, exclusive write, or exclusive all. Both SCI and users can assign LUNOs. Whether a logical name or synonym is used to name an I/O resource, the resource cannot be accessed unless a LUNO is assigned to it. LUNO assignments are usually made by the operating system and applications programs. In some very special instances a user may want to assign a LUNO. Refer to the *DNOS System Command Interpreter* (SCI) *Reference Manual* and the *DNOS Supervisor Call (SVC) Reference Manual* for complete details and instructions on using LUNOs.

DNOS uses four types of LUNOs:

- Task-Local — A task-local LUNO is one created by a task through an SVC; this type of LUNO can only be accessed by the task creating it.
- Job-Local-Shared LUNOs — Job-local-shared LUNOs are job-local LUNOs that can be shared by tasks within a job. More than one task can access this type LUNO at the same time.
- Job-Local LUNOs — Any task within a job can access this LUNO, but only when no other task is using the LUNO.
- Global LUNOs — Global LUNOs are available to any job or task in the system. Depending on the access privilege requested when this LUNO is opened, tasks may or may not be able to access the same global LUNO at the same time.

CAUTION

Global LUNOs are not automatically released when a job or task completes; they must be released with the Release Global LUNO (RGL) command. If a global LUNO is assigned to a secure file, that file is accessible through the global LUNO to any user on the system. See the Security section in this manual for details.

LUNOs can be assigned and released using SVCs or SCI commands, as follows:

- Supervisor Calls (SVC) — DNOS and applications programs assign and release LUNOs through the use of SVC blocks. For further details see the *DNOS Supervisor Call (SVC) Reference Manual.*
- Assign Global LUNO (AGL) — AGL assigns a global LUNO to a device or file. Since this is a global LUNO, it is available to all jobs and tasks.
- Assign LUNO (AL) — AL assigns a job-local LUNO to a device or file.
- Release Global LUNO (RGL) — RGL releases a global LUNO assignment. Global LUNOs actively performing I/O operations cannot be released; an error is returned if the attempt is made.
- Release LUNO (RL) — RL releases a job-local LUNO. If the LUNO is in use, it cannot be released.
- Show I/O Status (SIS) — SIS displays the currently assigned LUNOs. For further details on this command see the Status Commands section in this manual and the SIS command in the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

8

Using the Output Spooler

8.1 GENERAL INFORMATION

The DNOS output spooler queues the output sent to a printer until the printer becomes free for use. Users can send output to a specific printer or to a predefined class of printers. Output sent to a device waits until the device is free. Output sent to a class of devices waits only until one of the devices in the class becomes free.

8.1.1 Enabling Devices for the Spooler

Initially, the spooler does not know of any devices available to it, and this causes all Print File (PF) commands to fail. The user must issue Modify Spooler Device (MSD) commands indicating device names, class names, and forms for each printer available for spooling. The MSD command also removes printers from use by the spooler.

Each type of device has its own writer task. LPWRITER is the writer task for line printers. For printers with device names such as LP01 and LP12, the task LPWRITER reads the spooled files and prints the contents on the selected printer. DNOS supplies LPWRITER as part of the standard system. For other types of devices, users must write their own spooler programs. These user-written tasks must have names beginning with the first two letters of the names of their devices, ending with WRITER. For instance, a user may wish to write task PUWRITER to serve as a spooler for punched output.

8.1.2 Changing the Spooler Device

The Modify Spooler Device (MSD) command allows the user to alter a device's availability to a spooler, its form type, or its class membership.

8.1.2.1 Availability to the Spooler. A device can be in one of four states with respect to the spooler:

- Exclusive mode — Available exclusively for output from the spooler
- Shared mode — Available for output from the spooler and any program
- Queue only mode — Available to have output queued for the spooler, but not printed until the device is placed in the exclusive or shared mode
- Not available to the spooler

When a device is available only to the spooler, STATUS = EXCLUSIVE appears on the Show Output Status (SOS) display. Responding EXCLUSIVE to the MSD prompt SPOOLER MODE reserves the device for the exclusive use of the spooler.

When a device is available to both the spooler and other programs, STATUS = SHARED appears in the SOS display. Responding SHARED to the SPOOLER MODE prompt puts the device in SHARED state. The spooler can use a device in the SHARED status just as when the device is in the SPOOLER state. When the device is in SHARED state, it can also be used for output by any SCI command or any I/O supervisor call. As with any other shared device, each user contends for access to the device and each attempt to use the device could result in an error if the device is being used by another command. In the SHARED state, output sent to the spooler remains queued until the spooler can access the device.

When the Spooler is not currently using a device but spooling to that device can take place (actual output will be allowed later), the SVS display shows STATUS = QUEUE ONLY. Responding QUEUE ONLY to the SPOOLER MODE prompt puts the device in QUEUE ONLY status. In this state, the Spooler spools files to the device, but does not actually output any files to the device until the mode is changed to EXCLUSIVE or SHARED.

Responding DELETE to the MSD prompt SPOOLER MODE makes the device unavailable to the spooler. In this state the Spooler cannot spool output to the device.

8.1.2.2 Form Type. This is the type of form currently mounted on the device. The default form type is STANDARD; other types are user defined. A form name can be any character string of up to eight characters. The SOS display shows the form type currently in use. DNOS uses the form name to tell the user when to mount a new form type.

8.1.2.3 Class Membership. Printers can be organized into a collection of similar devices according to any desired scheme. The names of these collections are class names. The MSD command assigns class names; enter the name(s) in response to the CLASS NAME(S) prompt.

For example, a system has two letter quality printers named LP01 and LP02 and three high-speed printers named LP03, LP04, and LP05. LP01 and LP02 are assigned to the class name LETTER. LP03, LP04, and LP05 are assigned the class name FAST. Letter quality output can be sent to either LP01 or LP02 by responding to the LISTING DEVICE OR CLASS prompt with LETTER. Similarly, other output can be sent to LP03, LP04, or LP05 by answering FAST to the LISTING DEVICE OR CLASS prompt. Output sent to either LETTER or FAST is queued and printed on the first available printer in that class.

8.2 PRINTING FILES USING THE SPOOLER

When a printer is available to the spooler, two methods use the spooler to print information. One method uses the Print File (PF) command to specify a file to print. When used with the spooler, PF places file names in an output queue file until the files can be printed. The other method uses the Assign Logical Name (ALN) command to assign a spooler logical name to a device available to the spooler and employs the logical name as an output device name. With the latter method, the output file is a temporary file that the spooler queues until a device becomes available.

The Assign Logical Name (ALN) command assigns a logical name to the spooler; the scope of the name can be either global or job local. Once defined, the logical name can be used as a response to the output access prompt for all SCI commands.

Using a spooler logical name can be a convenient way to redirect output when devices are frequently removed or exchanged. For example, if the spooler logical name PRINTER is assigned to LP01 and LP01 breaks, PRINTER can be reassigned to another working printer. If PRINTER is a global logical name, all output sent to PRINTER can be redirected from the broken printer to the working printer without having to inform everyone of the broken printer.

8.3 CONTROLLING OUTPUT

The following commands control output and enable the user to view the status of devices and output queues. The user can control only the output from his job, while the system operator can control the output from any job.

- Halt Output (HO) command — The HO command temporarily halts output queued to a given device or a given class. When a class is halted, files in the process of being printed continue to print, but no other files queued to the device can be printed until a Resume Output (RO) command is executed for the class.
- Resume Output (RO) command — The RO command resumes queued output that has been temporarily halted at a device or class by the HO command. After entry of an RO command, output continues from where it was halted.
- Show Output Status (SOS) command — The SOS command shows the status of queued output.
- Kill Output (KO) command — The KO command terminates queued output.
- Modify Output (MO) command — The MO command allows the user to change the output device or priority of a file on the print queue. In the event that a listing device fails while printing a file, a user can employ this command to continue printing the file at another device. An HO command followed by an MO command specifying the new device accomplishes this.

8.4 CHANGING FORMS

When the spooler selects the next file to be printed to a particular device, it will select one which needs the currently mounted form, if such a file is waiting to be printed on the device. If no such file is waiting for the device, the spooler then selects the file with the highest priority and sends a forms mount request to the operator interface. There are three ways to respond to the request:

- Change the form — Mount the requested form and use the Respond to Operator Interface Request (ROR) command to notify the spooler that the form has been mounted. The spooler then prints the file.
- Modify the print request — Use the Modify Output (MO) command when you do not want to mount the requested form, or do not want the selected file to print on that form and/or device. The MO command lets you specify the device or class, form, and/or priority for the selected file. The spooler then puts the selected file back on the waiting queue and selects the next file to be printed.

- Suspend the print request — Use the Kill Operator Interface Request (KOR) command when you do not want the selected file to be printed next, but you do not want to change the device or class, form, and or priority for the file. The spooler then puts the selected file back in the queue from which the file was selected and selects the next file to print.

Both the MO and KOR commands cause the spooler to put the selected file back in the queue to be printed, however if that file still has the highest priority and no other files are queued to be printed on the currently mounted form, the spooler will again select that file as the next file to be printed.

NOTE

> Both the Respond to Operator Interface Request (ROR) and Modify Spooler Device (MSD) commands tell the spooler a new form has been mounted, but only the ROR command causes the spooler to start printing the file.

8.5 HANDLING SPOOLER PROBLEMS

An unusual series of events could cause the spooler to stop functioning without any way to be restarted. In such a case the operator must reinitialize the spooler environment, taking the following steps:

1. Use the Show Output Status (SOS) command to see which files need to be printed. Write this down, since the spooler does not work. Note the class names associated with each device.

2. Use the List Jobs (LJ) command from the operator console to find the ID of the spooler job.

3. Use the Kill Job (KJ) command with the job ID of spooler job.

4. Use the Delete File (DF) command to delete the spooler. Specify the global logical name S$SDTQUE for the PATHNAME prompt.

5. Use the Execute Job (XJ) command to restart the spooler, giving the following responses to the prompts, unless your system uses different parameters for PARM1 and PARM2. See the discussion on spooling in the *DNOS System Programmers Guide* for details about other options.

```
EXECUTE JOB
            SITE NAME:
             JOB NAME: SPOOLER
PROGRAM FILE PATHNAME: S$UTIL
      TASK ID OR NAME: SP$DST
               PARM1: 1
               PARM2: 1
           STATION ID:
SYNONYM TABLE PATHNAME: .S$USER.SPOOLER.SYN
             PRIORITY: 10
             JCA SIZE: MEDIUM

EXECUTE JOB
  USE CURRENT USER ID: NO

EXECUTE JOB
              USER ID: SPOOLER
             PASSCODE:
           ACCOUNT ID:
```

6. Use the Modify Spool Device (MSD) command and the list made in step 1 to reassign all devices and classes to the spooler.

7. Use the Print File (PF) command and the list made in step 1 to put the pending output files back on the printer spool.

9

Using the Operator Interface

9.1 GENERAL INFORMATION

The DNOS operator interface provides commands to allow one or more users to serve as system operators. The operator interface receives messages from users requesting services and then routes those messages to the system operator. When the system operator answers the messages, the operator interface modifies its data structures as necessary and sends acknowledgements to the senders.

In addition to the ability to exchange messages with users, the system operator receives a number of privileges. Where the users manage only their own jobs, the system operator can manage the execution of all jobs in the system. The following commands enable the operator to control the execution, modify the priority, and examine the status of any or all jobs on the system:

- Halt Job (HJ) suspends the execution of jobs running on the system.
- Resume Job (RJ) resumes the execution of halted jobs.
- Kill Job (KJ) terminates the execution of jobs on the system.
- Modify Job Priority (MJP) changes the priorities of jobs.
- Show Job Status (SJS) shows the status of jobs running under a specified user ID.
- List Jobs (LJ) displays the status of all jobs in execution.
- Show Task Status (STS) shows the status of each task in a specified job or under a specified user ID.
- Execute Job Monitor (XJM) shows a dynamic display of the tasks in the job.

When a user issues one of these commands, it applies only to jobs running under that user's ID. The system operator may employ these commands on any job running on the system. The section Executing and Controlling Jobs explains each of these commands, as well as the commands used to execute jobs and control tasks.

Complete documentation of each of these operator commands appears in the *DNOS System Command Interpreter (SCI) Reference Manual.*

9.2 SINGLE OPERATOR SYSTEMS

Some sites have one person identified as the system operator. That person receives all messages sent to the operator, performs any functions requested, and replies to the messages. In such cases, the operator and terminal are identified to the system by the Execute Operator Interface (XOI) command.

Provided there is not already a system operator identified, the XOI command starts the operator task and identifies the user who entered it as the system operator. Messages to the system operator appear on that user's terminal in the following format:

```
OR Request-ID* FROM User-ID AT hh:mm -- Message
```

where:

OR is the message identifier indicating an operator request.

Request-ID is the number of the request, counting requests from when the system operator issues XOI. The asterisk appears whenever the requesting task has been suspended, awaiting a response from the operator.

User-ID is the ID of the user who made the request.

hh:mm is the hour and minute the request was made.

Message is the request sent by the user

The operator has two ways to respond to the request:

1. If the request can be honored, the operator does what is asked and lets the user know by issuing a Respond to Operator Interface Request (ROR) command.

   The system operator executes the ROR command and responds to the REQUEST ID: prompt with the request-ID following the OR in the operator request message. If the OR request-ID is followed by an asterisk, prompts are displayed and when the system enters the information, the suspended task resumes execution.

   If SCI is not active in the foreground, pressing the F4 key performs the same function as entering ROR and pressing the Return key.

2. If the request cannot be honored, the operator issues a Kill Operator Interface Request (KOR) command.

   The KOR command specifies the system operator cannot fulfill the request. The system operator executes the KOR command and responds to the REQUEST ID: prompt with the ID number following OR in the request message.

   If SCI is not active in the foreground, pressing the F5 key performs the same function as entering KOR and pressing the Return key.

Pressing the F4 and F5 keys to respond to operator request messages dedicates the operator's terminal to serve as the system console until the operator uses the CMD key to resume SCI execution.

The operator's terminal can be kept free for other uses while retaining the privileges (and obligations) of the system operator. The operator issues the Receive Operator Messages (ROM) command to have messages routed through the mailbox facility. When a message arrives, it waits in the mailbox until the operator presses the RETURN key. The message appears in mailbox format as follows:

```
I  MAIL--0001 RECEIVED time date message
```

The time and date tell when the message arrived. The message itself follows the same format as other DNOS messages.

To quit being the system operator or to change terminals, the operator issues the Quit Operator Interface (QOI) command.

```
[] QOI
```

9.3 MULTIPLE OPERATOR SYSTEMS

At sites with distributed resources or where no one can act as a full-time system operator, the DNOS operator interface can be shared among several users. In this arrangement, no single person uses the XOI command. Instead, they each use the Receive Operator Message (ROM) command to have the interface send them the message. The ROM command allows an operator to receive messages either from all users or from just those users with a specified user ID.

- In environments where equipment is clustered in several areas, all users in an area log on with the same user ID. Whoever issues the ROM command indicates the user ID for the area and becomes the area operator.

- In environments where users must share the system operator function, each one retains a personal user ID. They take turns serving as the system operator by issuing ROM commands specifying all user IDs.

In both environments the requests go to the operator via the mail facility. Pressing the Return key or issuing the List Operator Messages (LOM) command has the interface display any pending messages. Next, the operator decides whether to honor each request and issues either a Respond to Operator Interface Request (ROR) command or a Kill Operator Interface Request (KOR) command as appropriate. To surrender the system operator function, the user issues the Kill Operator Message (KOM) command.

Multiple operator systems do not provide privileged commands for the system operator or operators.

9.4 MESSAGES SENT TO THE SYSTEM OPERATOR

Messages to the system operator come from the following sources:

- The Create Operator Message (COM) command allows the user to enter a message text and sends it to the operator.
- The output spooler generates messages to the system operator whenever it needs to have forms mounted.
- User programs can generate messages using operator interface routines. These routines are described in the *DNOS System Programmer's Guide*.

10

Executing and Controlling Jobs and Programs

10.1 GENERAL INFORMATION

A job consists of one or more programs running under DNOS. Once activated, a program is called a task. Each job has its own set of resources, such as files and devices. The following commands allow the user to execute jobs and to perform various operations on jobs currently executing under a user ID:

- Execute Batch (XB)
- Execute Batch SCI Job (XBJ)
- Execute Job (XJ)
- Show Job Status (SJS)
- Halt Job (HJ)
- Resume Job (RJ)
- Kill Job (KJ)
- List Jobs (LJ)
- Modify Job Priority (MJP)
- Execute Job Monitor (XJM)

10.2 EXECUTING AND CONTROLLING JOBS

Two types of jobs exist in DNOS, interactive jobs and batch jobs. An interactive job is one that executes at a terminal and allows a user to request actions and receive responses interactively. A batch job executes independent of a terminal, getting its inputs from a file of commands and sending its outputs to a listing file.

In an interactive job, you always have a foreground task executing. Usually SCI is requesting and executing a command. You can also have one background task executing at the same time. SCI starts the background task from your terminal, but the background task continues to run without any need for input from your terminal.

A batch job executes without any exchange of information with a user. Usually batch jobs execute long streams of commands to perform standard operations that need no attention. Some examples include system log analysis, daily accounts billing, data base reorganization, and similar standard maintenance activities.

10.2.1 Executing an Interactive SCI Job

Interactive SCI jobs are started in two ways, logging on to SCI and using the Execute Job (XJ) command.

The XJ command can start an interactive job at another terminal. XJ could start a special application program running at one or more terminals, with your terminal as a central control point for a number of other jobs.

While in your interactive job, you can execute several of the SCI commands as background tasks. For example, the Copy Directory (CD) has an option allowing you to execute the program in either foreground or background. You can also start a background activity with the Execute Batch (XB) command.

10.2.2 Executing SCI in Background

The Execute Batch (XB) command activates SCI to run in the background mode. SCI runs without interacting with the terminal until finished, then SCI sends a message that the background task has been completed to the terminal that initiated the XB command. A batch command stream can be created by a text editor or with the Create Batch Stream (CB) command.

When executing a background task, press the Return key from time to time or enter the WAIT command. The background task termination message is displayed when the background task completes and the Return key is pressed. If the WAIT command was used, the background task termination message will be displayed automatically when the background task completes.

10.2.3 Executing Batch Jobs

The Execute Batch Job (XBJ) command creates a batch SCI job with operating parameters that may be different from those of the creating job. As with the XB command, jobs executed by the XBJ command use a batch stream input, but they run independently of a terminal. Since batch jobs are independent of a terminal, there is no limit on the number of batch jobs that can be started from a terminal.

10.2.4 Viewing Job and Task Status

The Show Job Status (SJS) and Show Task Status (STS) commands show the status of any or all jobs and tasks executing under a user ID. Both commands produce similar listings; the difference is SJS shows the status of jobs, while STS shows the status of tasks. Figure 10-1 shows an example of the SJS output listing. Figure 10-2 shows an example of the STS output listing.

```
USER-ID   JOB-NAME   ID    PRI  STATE  JCASIZE  CURRENT  MAXIMUM
KC0017    PRINT      0022  3    2        4000    2548      3477
```

Figure 10-1. Show Job Status Output Listing

```
USER-ID    JOB-NAME    ID    PRI   STATE  JCASIZE  CURRENT  MAXIMUM
SYSTEM00   PRINT      0001    20     2      2048      828      1042
      TASK    ID   RUN-ID  STN PRI R-PRI STATE WP     PC   FLAG1 FLAG2    CPU SECS
      FILMGR  05    02          0   0      24 590E  C06E  F100  0000          0.6
      SCI990  01    01      2   4   164    17 8796  3DD8  7000  0000          3.2
      SJSSTS  30    08      2   4   150    00 E0BC  DCF6  F000  0800          0.2
```

Figure 10-2. Show Task Status Output Listing

Tables in the Show Task Status (STS) paragraph in the *DNOS System Command Interpreter (SCI) Reference Manual* give detailed explanations for the columns in the SJS an STS output listings.

10.2.5 Stopping and Restarting Jobs in Execution

The Halt Job (HJ) command suspends the specified job currently executing under a specified user ID. The job is halted but not killed; this allows the user to stop and start his jobs as necessary. The system operator can stop and start any user's job in the system.

The Resume Job (RJ) command resumes execution of a job previously halted.

10.2.6 Terminating Jobs in Execution

The Kill Job (KJ) command terminates the execution of a specified job currently executing under a specific user ID. The user can kill any job running under his user ID. The system operator can kill any job in the system. A job stopped with the KJ command cannot be restarted with the RJ command.

10.2.7 Listing Jobs in Execution

For the system operator, the List Jobs (LJ) command displays the status of all jobs executing in the system. Other users can only list the status of jobs executing under their user IDs. Figure 10-3 shows an example of a listing produced by the LJ command when you answer YES to the TASK INFORMATION prompt. Since these are batch jobs, no station ID appears under the STN header.

```
USER-ID   JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
STRESS    SORT        000D   20     2       6144      2394      2844
      TASK       ID RUN-ID STN    PRI R-PRI STATE WP     PC    FLAG1 FLAG2   CPU SECS
      SORTMG     2A   1A           3   197    09  0006  26DC  3000  0000         0.0
      FILEMGR    05   02           0   0      24  906C  C05C  D100  0000         7.1
      SCI990     01   01          B4   192    17  89EE  4040  1000  0000         3.9
      SCI990     01   14          B4   202    17  89EE  4040  1000  0800         1.5
      TIME1      03   18          B4   241    09  5DA0  5B26  1000  0800        11.7
      SORTMG     2A   19           3   224    09  0006  041C  3000  0000        11.7

USER-ID   JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
STRESS    COMPARE     000D   20     2       6144      2394      2844
      TASK       ID RUN-ID STN    PRI R-PRI STATE WP     PC    FLAG1 FLAG2   CPU SECS
      FILEMGR    05   02           0   0      02  75CA  0264  D101  0000       403.5
      SCI990     01   01          B4   194    17  89EE  4040  1000  0000         2.5
      SCI990     01   0A          B4   201    17  89EE  4040  1000  0800         2.4
      SCI990     01   2D          B4   199    17  89EE  4040  1000  0800         8.2
      XCP        8A   40          B4   228    09  70BC  3684  1000  0400         5.6
```

Figure 10-3. List Jobs Output Listing

10.2.8 Modifying Job Priority

The Modify Job Priority (MJP) command, available only to the system operator, modifies the priority of a job during its execution. Job priorities can range from 1 through 31 with 1 being the highest priority.

10.2.9 Monitoring a Job

The Execute Job Monitor (XJM) command shows the user a dynamic display of the tasks running in his job. The system operator can see the display for each job in the system.

10.3 EXECUTING AND CONTROLLING PROGRAMS

Most programs are activated by SCI commands. Since different languages have different execution commands, users should consult the appropriate language guides for instructions on how to execute their programs.

Once activated, programs running under control of DNOS are called tasks. When activated, each receives a run-time ID from DNOS which can be used to reference the task during execution.

The user can view the status of a task by issuing the Show Task Status (STS) command, terminate the task by issuing the Kill Task (KT) command, suspend it by issuing the Halt Task (HT) command, and resume it by issuing the Resume Task (RT) command. The HT and RT commands are most useful when debugging a task. For additional details and detailed descriptions of the HT and RT commands, refer to the *DNOS System Command Interpreter (SCI) Reference Manual*.

10.3.1 Showing Task Status

The Show Task Status (STS) command lists the status of all tasks in a specified job or all jobs running under a user ID. Figure 10-4 shows an example of the output from the STS command.

Tables in the paragraph on the STS command in the *DNOS System Command Interpreter (SCI) Reference Manual* give specific details about the information in the STS output listing.

10.3.2 Killing Tasks

The Kill Task (KT) command terminates an active task within a user's job. Tasks that perform end action do so prior to termination. When the KT command completes, DNOS displays the state of the task when the task was terminated.

The operator cannot kill tasks in another user's job; he has to kill the entire job.

```
USER-ID    JOB-NAME    ID    PRI  STATE  JCASIZE  CURRENT  MAXIMUM
SYSTEM00   PRINT      0001    20    2      2048      828      1042
      TASK     ID  RUN-ID  STN PRI R-PRI STATE WP     PC   FLAG1 FLAG2    CPU SECS
      FILMGR  05    02          0   0        24 590E  C06E  F100  0000         0.6
      SCI990  01    01      2   4    164     17 8796  3DD8  7000  0000         3.2
      SJSSTS  30    08      2   4    150     00 E0BC  DCF6  F000  0800         0.2
```

Figure 10-4. Show Task Status Output Listing

11

Handling a System Crash

11.1 GENERAL INFORMATION

This section describes the procedures to be followed in the event of a system crash or lockup. DNOS contains internal consistency checks. If DNOS detects an error in the system during one of the checks, the system crashes.

The system operator knows a system crash has occurred when both of the following occurs:

1. No terminal in the system responds to keyboard input.

2. The POWER, FAULT, IDLE, and RUN indicator lights on the front panel of the minicomputer (Figures 2-1 and 2-2) are lit.

When the FAULT light is off and no terminal responds to keyboard input, the system is hung in a loop. A system crash can be forced to allow diagnosis of the problem.

The pattern in the data lights on the front panel of a Model 990 minicomputer and in the numeric display of a Business System computer after a system crash represents a hexadecimal crash code. The system crash codes and a description of their causes are listed in the *DNOS Messages and Codes Reference Manual*.

System crashes usually occur as the result of critical hardware errors or failures in system software.

11.2 DUMPING THE CONTENTS OF MEMORY TO .S$CRASH

When a system crash occurs, the system idles, waiting for action to be taken. To analyze the cause of the system crash, dump the system memory to the .S$CRASH file. Use the following procedure:

1. Halt the minicomputer:

   a. On Model 990 minicomputers, press HALT/SIE on the programmer panel.

   b. On Business Systems minicomputers, press HALT on the front panel.

2. Press RUN on the panel.

This causes the contents of memory to be written to the file named .S$CRASH on the system disk. When the dump is completed, the IDLE light is turned on again. The dump takes about a second. After the dump is completed, an initial program load can be performed. The crash dump can be examined with the XANAL command described in the *DNOS System Command Interpreter (SCI) Reference Manual* and the *DNOS Systems Programmer's Guide*.

On a Business System 300, DNOS automatically writes the crash dump to the .S$CRASH file. Wait a minute for this to happen, then turn the power off and back on to perform an IPL.

If immediate analysis of the crash dump is impossible, the contents of the file named .S$CRASH can be copied to a file in another directory with the Copy Directory (CD) command. Since .S$CRASH is an image file, only CD can copy it. This copy should be made as soon as possible after the initial program load is performed on the system. This allows another dump, if necessary, without destroying the earlier one.

If the problem occurs again, contact your customer representative. Send a copy of the crash file, system link map, and a description of what was happening at the time of the crash. Be sure the crash file contains the entire system memory image at the time of the crash. Use the Show Memory Status (SMS) command to see how much memory your system has. The Create System Files (CSF) command can be used to recreate the crash file if necessary.

11.3 FORCING A SYSTEM CRASH

A problem can occur in the system that does not result in a system crash, but prevents useful work on the system (the system malfunctions, but the FAULT lamp is not lit). For example, a system routine can hang in a loop or a deadlock condition may arise. In such cases, it is desirable to force a system crash in order to obtain the crash dump for analysis.

Model 990 and Business System minicomputers have slightly different procedures for forcing a system crash.

11.3.1 Model 990 Minicomputers

The following procedure forces a system crash on Model 990 minicomputers:

1. Press HALT twice.

2. Press the following in sequence:

    a. PC DISPLAY

    b. MA ENTER

    c. CLR

    d. MDE

    e. RUN

3. The system crashes with a crash code of >62.

4. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping The Contents of Memory to .S$CRASH.

5. Perform an initial program load.

In some cases, you cannot force a crash dump with this procedure. DNOS may be in a hang condition, the front panel may be locked out, or some other unusual condition may prevent the normal crash procedure from working. If this is the case, try the following set of steps to force the crash, with the crash code that you choose in step 4.

1. Press HALT, then press RESET.
2. Enter the value >00A6 in the front panel.
3. Press ENTER MA.
4. Enter the crash code of your choice into the front panel. (Use something unique, such as >FACE.)
5. Press MDE, then press MAI.
6. Enter the value >032C.
7. Press MDE, then press MAI.
8. Enter the value >020C.
9. Press MDE, then press MAI.
10. Enter the value >1FA0.
11. Press MDE, then press MAI.
12. Enter the value >1D03.
13. Press MDE, then press MAI.
14. Enter the value >10F8.
15. Press MDE, then press MAI.
16. Enter the value >00B4.
17. Press MDE, then MAI, then CLR.
18. Do the following 6 times: press MDE, then press MAI.

19. Press ENTER ST.

20. Enter the value > 009A.

21. Press ENTER WP.

22. Enter the value > 00A8.

23. Press ENTER PC.

24. Press RUN.

The crash code you chose in step 4 will soon appear on the front panel, signalling the crash has occurred. Proceed with the following steps:

1. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping The Contents of Memory to .S$CRASH.

2. Perform an initial program load.

If the crash code you chose does not appear, this procedure will not force a crash. Call your customer representative.

11.3.2 Business Systems Minicomputers

The following procedure forces a crash on Business Systems minicomputers:

1. Press HALT 11 times.

2. Press RUN.

3. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping the Contents of Memory to .S$CRASH.

4. Perform an initial program load.

11.4 PERFORMING AN INITIAL PROGRAM LOAD

After the contents of memory have been dumped following a system crash, an initial program load (IPL) must be performed to reactivate the system. Use the following procedure:

1. Halt the minicomputer:

   a. On Model 990 minicomputers, press HALT/SIE on the programmer panel of the minicomputer.

   b. On Business Systems minicomputers, press HALT on the front panel.

2. Press LOAD on the front panel of the minicomputer. DNOS is now loaded into memory. The FAULT indicator lights for several seconds, and then the terminal banner is displayed on all terminals.

3. Log on to a terminal.

4. Optionally, use the CD command to copy the system log files (.S$LOG1 and .S$LOG2) to other files to save log information concerning the crash.

5. Optionally, copy the system crash file (.S$CRASH) to another file using the CD command. See the paragraph Dumping the Contents of Memory to .S$CRASH in this section.

12

Recovering From Power Failure

12.1 GENERAL INFORMATION

The power failure recovery feature of DNOS provides for recovery on TILINE* disks and video display terminals (VDTs) after the occurrence of a short-term power loss. This feature makes it possible for long-running or one-time jobs to survive poor or unstable power generation environments.

Recovery from a power failure may not always be possible. Sometimes power fluctuations cause unpredictable results. Sometimes hardware-related problems prevent recovery from the power loss. In such cases, an initial program load must be performed on the system.

Power failure recovery occurs automatically when the following requirements are met before the power loss:

1. Battery support hardware is installed on the target system.
2. The power failure recovery option is selected during system generation.
3. Memory boards and disk controllers are in their correct locations.

12.2 VDT RECOVERY

The battery hardware supports main memory only and maintains that memory for about 15 minutes. Only the memory boards in the first six slots of the chassis receive standby power. Every VDT has a memory buffer associated with it and DNOS maintains a complete image of each screen within the buffer. The screen images of all VDT screens in use at the time of a power loss are rebuilt when power is restored.

12.3 TILINE DISK RECOVERY

Power failure recovery is supported for all TILINE disks. All DNOS disks shipped by Texas Instruments are TILINE disks.

* Trademark of Texas Instruments Incorporated.

When power is restored after a power failure, DNOS allows all TILINE disks installed at the time of power loss to spin back up to normal speed and become ready. Each type of computer that supports the power fail option has a maximum wait time for the disk drives to become ready before reporting an error. The Business System 300 does not support the power fail option. These are the maximum times for each type of computer:

- Model 990/10 — six minutes
- Model 990/10A and Business System 600 — five minutes
- Model 990/12 and Business System 800 — three minutes

If a disk drive does not come up after power is restored, error code >0004 (record lost due to power failure) is returned to any task attempting input/output operations to that device.

When power is restored after a power loss, any task performing input/output operations to a device other than TILINE disks and VDTs receives error code >0004 (record lost due to power failure). The power failure recovery feature does not work for TILINE disks connected in the expansion chassis.

13

Using the System Log

13.1 GENERAL INFORMATION

DNOS logs information about system operation, using two system files and optional devices. These devices are specified during system generation or by the Initialize System Log (ISL) command. This section describes how to enable the system logging device and how to dump the contents of the system log files. Refer to the *DNOS Messages and Codes Reference Manual* for a description of how to interpret the contents of the system log.

13.2 SYSTEM LOG FILES

DNOS automatically records the following information about system operation on a pair of mandatory disk files:

- Device hardware errors
- Input/output errors
- Task errors
- Cache memory errors
- Memory parity errors
- Messages generated by DNOS utilities
- Messages generated by user programs or system tasks

The system log files are maintained on the system disk under the names .S$LOG1 and .S$LOG2. The system begins recording the log messages on either .S$LOG1 or .S$LOG2. When one file is full, the system records messages on the other file and displays the following message at the device specified as the attention device:

```
******** LOG FILE  n  FULL
```

where:

n is the file number.

The system log full message tells the user that the contents of the log file (identified by number) should be copied to another file or device, or it will be overwritten when the other log file fills up. The Print File (PF) command, the Copy/Concatenate (CC) command, or the Copy Directory (CD) command can be used to copy the file, as follows:

- Print File writes a copy of the file to an output device.
- Copy/Concatenate copies the file to another file or sequential medium.
- Copy Directory with the INCLUDE option can copy the log file into a file created by the command. This allows the user to save the log file without having already created the destination file.

See the *DNOS System Command Interpreter (SCI) Reference Manual* details on these commands.

13.3 INITIALIZING THE SYSTEM LOG

The Initial System Log (ISL) command allows DNOS users to change the logging device or attention device from the ones specified when the system was generated. ISL can also be used to recreate the system log files after an error in logging occurs. For complete details and instructions on the ISL command, see the *DNOS System Command Interpreter (SCI) Reference Manual*.

14

Interpreting Error Messages

14.1 GENERAL INFORMATION

This section tells how to interpret the DNOS error messages and codes. DNOS reports the following classes of errors:

- Utility errors
- Compiler and run-time errors
- SCI errors
- SVC errors
- System log errors
- System crash errors

These errors generally result from device malfunctions or from the use of invalid or illegal parameters, procedures, program logic, or system logic.

The *DNOS Messages and Codes Reference Manual* describes all these errors except the compiler and run-time errors. The programmers guide for the language you are using discusses the compiler and run-time errors.

14.2 ERROR REPORTING

All DNOS error messages include the source of the error, the category of the subsystem reporting the condition, and a description of the problem. DNOS offers three levels of error reporting, as follows:

1. Internal error codes.
2. Short, descriptive messages with message categories and identifiers. These guide the user to further explanations in the *DNOS Messages and Codes Reference Manual.*
3. Expanded online explanations.

The selection of a reporting level depends on how much disk space can be devoted to messages.

14.2.1 Internal Error Codes

With the first level of error reporting available, DNOS formats its error messages as follows:

```
CCCCCCCC-INTERNAL CODE >MMMM     VVVVVVVV
```

CCCCCCCC is one of the following 1- to 8-character message categories:

Category	Message Type
ASSEMBLR	Macroassembler messages
CRASH	System crash codes and description
DEBUGGER	Task Debugger messages
EDITOR	Text Editor messages
LINKER	Link Editor messages
LOADER	Loader crash codes and description
SCI	SCI messages
STATUS	Task status messages
SVC	Supervisor Call (SVC) messages
UTILITY	Utility messages

MMMM is a 4-digit, hexadecimal, internal error code.

VVVVVVVV is an optional, variable-length text string. Semicolons separate logically unrelated portions of the string.

14.2.2 Short Messages

With the second level of error reporting available, DNOS formats its error messages as follows:

```
SSS CCCCCCCC NNNN  message message message message message
                message message message message message
                (up to five lines)
```

SSS is an error source code of up to three of the following characters:

Code	Source of Error
U	User
S	System
H	Hardware
I	Informative
W	Warning

CCCCCCCC is a 1- to 8-character message category. Additional categories support various programming languages, generally in pairs (one for the compiler messages and one for the run-time messages). The codes for each language are described in its reference manual.

NNNN is the message number, used to locate an explanation of the message in the section for its category (CCCCCCCC) in the *DNOS Messages and Codes Reference Manual* or appropriate language reference manual. Another category, MAIL, may appear. This category is used for messages created by users via the CM command or by system functions that use the mailbox facility to send messages to users.

14.2.3 Expanded Explanations Online

For systems supporting expanded message files, DNOS supplies the following information on request:

Explanation:	text that explains the probable cause of the error and what the system has done
User Action:	text that explains what the user can do to recover from the condition

On receiving an error message from the system, the user enters a question mark (?) to request the expanded error message. Also, the user can issue the Show Expanded Message (SEM) command to request expanded error messages. The SEM command prompts for a message category and an identifier or external error code, then displays a full explanation of a system message. On systems that do not support expanded message files, users must refer to the *DNOS Messages and Codes Reference Manual* for detailed descriptions of error messages. Messages produced by language processors are found in their own reference manuals, not in the *DNOS Messages and Codes Reference Manual.*

See the *DNOS System Command Interpreter (SCI) Reference Manual* for complete instructions on using the SEM command.

14.3 EXAMPLE OF MESSAGE DESCRIPTION

The following is an example of a message description as reported to the user at the terminal and in the *DNOS Messages and Codes Reference Manual*:

```
U  UTILITY—0080  SYS1 IS NOT THE NAME OF AN INSTALLED VOLUME
```

Explanation:	The specified volume name is not the name of any volume presently installed on the system.
User Action:	If the correct volume name was used, use the Install Volume (IV) command to install the volume and then try the operation again. Otherwise, try the operation using the correct volume name.

15

Running Online Diagnostics

15.1 GENERAL INFORMATION

DNOS online diagnostics provide a means of testing or exercising devices to determine whether the devices are operating properly. Running online diagnostics does not impact existing operations or data bases.

Online diagnostics are a powerful tool for provoking system errors, because they can run for long periods as low priority tasks. Adequate logging of errors can provide patterns of errors with minimal impact on system performance.

Online diagnostics are run as follows:

- Periodically — perhaps daily — to confirm that each device operates properly.
- Selectively, when a particular device is reported faulty.

Refer to the *DNOS Online Diagnostics and System Log Analysis Task User's Guide* for procedures to run the online diagnostics.

16

Status Commands

16.1 GENERAL INFORMATION

DNOS provides commands that display the system status of I/O devices, tasks and jobs, general system environment, and the software packages installed on the system.

16.2 INPUT OUTPUT STATUS

The following paragraphs discuss status commands that display information on terminals, disk volumes, printers, and Interprocess Communication Channels.

16.2.1 Show Terminal Information (STI) Command

The STI command shows the status of a terminal and the most recent operations performed at the terminal. Figure 16-1 shows an example of an output from the STI command.

16.2.2 List Terminal Status (LTS) Command

The LTS command lists the attributes of any one or of all terminals on the system. It also shows the ID of the user who logged on at that terminal. Figure 16-2 shows an output from the LTS command. See the description of the LTS command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

```
[] STI
TERMINAL INFORMATION...SITE: S05...TERMINAL: ST01...USER: JIM
    MOST RECENT TASK RUN ID: >86
MOST RECENT LUNO ASSIGNMENT:
      TEXT EDIT IN PROGRESS: N
      MOST RECENT EDIT FILE:
        TASK BEING DEBUGGED:
    SCU SESSION IN PROGRESS:
```

Figure 16-1. Show Terminal Information Output Listing

```
TERMINAL  USER ID   LOGON REQUIRED  MODE  DEFAULT
ST07      DAISY           Y          VDT    VDT
09:29:12 THURSDAY, NOVEMBER 03, 1983.
```

Figure 16-2. List Terminal Status Output Listing

16.2.3 Show I/O Status (SIS) Command

The SIS command displays the status of one or all global, job-local, and task-local LUNOs (LUNOs are displayed according to type). The system operator can execute the SIS command for jobs with any associated user ID and for all LUNOs in the system. Figure 16-3 shows an example of an output from the SIS command. See the description of the SIS command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

16.2.4 Show Volume Status (SVS) Command

The SVS command displays the status of a disk volume or of all volumes on the system. SVS shows which disk drives have volumes in them and provides information about the capacity of the volume. SVS also displays the number of controller errors encountered while using the volume. Figure 16-4 shows an example of the output from the SVS command. See the description of the SVS command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

16.2.5 Show Output Status (SOS) Command

The SOS command displays these types of status for one or more printers in your system:

- Files of one user identified by user ID
- All users' files
- Output queued for a particular device
- Output queued for all devices

```
SCOPE     OPN    TASK       JOB               RESOURCE
& LUNO    ACC    NAME       NAME         TYPE & ACCESS NAME
-------   --- ---------  --------      ------------------

 J  2D                      JC           LP:S    LP01
 J  38                      JC           SEQ.    .KC0017.MYFILE
 J  3F                      JC           911     ST01
```

Figure 16-3. Show I/O Status Output Listing

```
 VOLUME NAME: DISK6      ADUS: 4004    # BAD: 0    BYTES/ADU: 288
AVAILABLE: 1638   LARGEST AVAILABLE BLOCK: 1624   CONTROLLER ERRORS: 0
PRIMARY SYSTEM IMAGE:              SECONDARY SYSTEM IMAGE:
NAME INSTALLED: DISK6    DEVICE NAME: DS03
```

Figure 16-4. Show Volume Status Output Listing

Figure 16-5 shows an example of an output listing for the SOS command. See the description of the SOS command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

NOTE

If the output status of more than one device is listed, the class names are displayed after all devices are displayed.

16.2.6 Show Channel Status (SCS) Command

DNOS channels are paths through which data flows between two or more tasks. A single owner task controls each channel. One or more other tasks can exchange information with the owner task. Channels can be either symmetric or master/slave. The channel can have any one of the following scopes:

- Global — A channel potentially accessible to any task in the system
- Job-local — A channel accessible only to tasks within the job
- Task-local — A channel accessible only by a single requestor task and the channel owner task

```
DEVICE= LP01     STATUS: EXCLUSIVE        FORM: STANDARD
CLASS NAMES= (LP        SLP      )

ST/      USER      FORM        SPOOL        LOGICAL NAME OR
PRI       ID                    ID             FILE NAME
A/4     GEORGE   STANDARD     S00004      .FILMGR.LIST.MYFILE
W/4     GEORGE   STANDARD     S00005      .FILMGR.SRC.MYFILE
W/4     GEORGE   STANDARD     S00006      .FILMGR.OBJ.MYFILE
```

Figure 16-5. Show Output Status Output Listing

The SCS command displays the following information on the user's terminal about the channel in use and available to the current job:

- Channel owner
- Type of channel
- Scope of channel
- Maximum message length
- Access shared or not shared
- Number of current Assigns
- Number of current Opens

Only global channels and the channels used by the current job can be displayed.

If the SCS does not complete successfully, an error message describing the error appears on the user's terminal. See the *DNOS System Command Interpreter (SCI) Reference Manual* for instructions on using this command and the *DNOS Systems Programmer's Guide* for a complete discussion of DNOS channels.

16.3 TASK AND JOB STATUS

You can see what jobs are running with your user ID by using the Show Job Status (SJS) command, examine the dynamic execution of tasks in your job with the Execute Job Monitor (XJM) command, display the current state of tasks with the Show Task Status (STS) command, and use the Show Background Status (SBS) command to check the progress of background activity in your interactive job. The system operator can use the SJS and XJM commands to examine any one or all of the jobs in the system.

16.3.1 Show Job Status (SJS) Command

The SJS command shows the status of any or all jobs executing under a user ID. Figure 16-6 shows an example of the output from the SJS command and The *DNOS System Command Interpreter (SCI) Reference Manual* paragraph on the SJS command explains the SJS display headings.

```
USER-ID   JOB-NAME   ID   PRI  STATE  JCASIZE  CURRENT  MAXIMUM
KC0017    PRINT      0022  3     2       4000    2548      3477
```

Figure 16-6. Show Job Status Output Listing

16.3.2 Execute Job Monitor (XJM) Command

XJM displays information about jobs executing in the system. Initially, XJM displays the information about the job running at the station where the command is issued. For the system operator, pressing the F1 key steps through the jobs on the system, one job at a time. When all the jobs have been displayed, pressing the F1 key again displays the first job again. For any other user, the F1 key steps through the jobs running under that person's user ID. Figure 16-7 shows an example of the display produced by the XJM command. The first and third lines in the display are headings; the other lines are information about the job. The Print key can be used to copy the current screen to the file associated with the logical name SCREEN. See the description of the XJM command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

16.3.3 Show Task Status (STS) Command

The STS command produces a list of any or all jobs and tasks running under a user ID. Figure 16-8 shows an example of the output from the STS command. See the description of the STS command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

```
USER-ID   JOBNAME JOB-ID  ACCOUNT   ID      JCA JPRI PRIV CPU-SECS SYNONYM CPU-LOAD
LN052     SALES1   0011                     2048 0C    7    193.6     8704     .4%
TASKNAME  ID RID PR ST  WP   PC   CPU-SECS IO-TRANSFER   SVC-COUNT MEMORY CPU-LOAD
SCI990    01  7F 7C 17 7A86 7892       6.3       66142        1933  40032     .0%
XJM       74  CB 8C 00 C006 CF4E        .1       11200          67   7264     .4%
FILEMGR   05  02 00 24 90A4 C04C      26.9     2947990        5514   2080     .0%
SCI990    01  01 7C 09 9960 0BFA      47.4      545633       13848  40032     .0%
```

Figure 16-7. Execute Job Monitor Output Listing

```
USER-ID    JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
SYSTEM00   PRINT      0001   20     2       2048       828       1042
      TASK     ID   RUN-ID  STN  PRI  R-PRI  STATE  WP     PC    FLAG1  FLAG2    CPU SECS
      FILMGR   05    02           0   0        24  590E   C06E   F100   0000          0.6
      SCI990   01    01      2    4    164     17  8796   3DD8   7000   0000          3.2
      SJSSTS   30    08      2    4    150     00  E0BC   DCF6   F000   0800          0.2
```

Figure 16-8. Show Task Status Output Listing

16.3.4 Show Background Status (SBS) Command

The SBS command views the status of a program which you activated from your terminal and is currently executing in background mode. Status messages, which reflect task state codes, are produced by the SBS command when the background task is active. The SBS display appears in this format:

```
I   STATUS - XXXX message text
```

where:

I indicates an informative message and XXXX is a message number associated with the message text.

The Status Messages and Codes section of the *DNOS Status Messages and Codes Manual* explains the status message in detail.

SCI writes messages to a terminal local file (TLF); there are separate TLFs for both foreground and background activities. Use the SBS command to display the background TLF. The TLF is displayed by SBS when the background task has terminated and the TLF has been written in by the background task. When SCI is in batch mode, the background TLF is written to the listing file or device when each background command completes.

The background TLF is opened with an open extend opcode so that output written to the TLF is not lost if you forget to do an SBS between two background task executions. The WAIT command automatically displays the background TLF if it exists when the background task completes.

16.4 SYSTEM ENVIRONMENT AND PERFORMANCE STATUS

You can use the Show Date and Time (SDT) command to display the current date and time, examine the system memory and table sizes with the Show Memory Status (SMS) command, display a chart of the current memory allocation with the Show Memory Map (SMM) command, and examine the system performance with the Execute Performance Display (XPD) command. The SMM and XPD commands produce dynamic displays and will not generate output on hardcopy terminals.

16.4.1 Show Date and Time (SDT) Command

The SDT command displays the current date and time at the terminal where the SDT command is executed. In the batch mode, SDT writes the date and time to the batch listing file. The time is given according to the 24-hour clock in this manner:

```
13:34:10 TUESDAY, FEBRUARY 05, 1980.
```

16.4.2 Show Memory Status (SMS) Command

The SMS command shows the memory size, system size, and system table area sizes. Figure 16-9 shows an example of the output from the SMS command.

```
                         SHOW MEMORY STATUS

                   SYSTEM TABLE AREA = 6154 BYTES
CURRENT USAGE = 2880 BYTES             LARGEST AREA USED =3664 BYTES

                     USER JCA AREA = 2048 BYTES
CURRENT USAGE = 1042 BYTES             LARGEST AREA USED =1304 BYTES

                    SYSTEM JCA AREA = 4096 BYTES
CURRENT USAGE = 1042 BYTES             LARGEST AREA USED =1472 BYTES

              SEGMENT MANAGER AREA    1 = 2048 BYTES
CURRENT USAGE =  818 BYTES             LARGEST AREA USED = 868 BYTES

              FILE MANAGEMENT AREA    1 = 4096 BYTES
CURRENT USAGE =  518 BYTES             LARGEST AREA USED = 518 BYTES
```

Figure 16-9. Show Memory Status Output Listing

16.4.3 Show Memory Map (SMM) Command

The SMM command displays memory usage by system and user tasks. This information is displayed on the terminal, and is updated every two seconds. If any portion of the memory display is blank, that memory is currently not in use.

The F1, F2, and F3 function keys are used to show which blocks of memory are being used for system and user tasks. The use of these keys is defined as follows:

F1 Use the F1 function key to display the memory being used by the system. When you press the F1 key, the blocks of system memory in the display are replaced by the S character. Press the F1 key again to remove the S character(s) from the display.

F2 Use the F2 function key to display the memory being used by user tasks. When you press the F2 key, the blocks of user memory in the display are replaced by the U character. Press the F2 key again to remove the U character(s) from the display.

F3 Use the F3 function key to display the memory currently cached by DNOS in memory. This software cache holds blocks of memory that are not currently executing. It allows faster access time than retrieving the segments from disk the next time they are needed. When you press the F3 function key, the blocks of cached memory in the display are replaced by the C character. Press the F3 key again to remove the C character(s) from the display.

Figure 16-10 shows the initial display from the SMM command. See the description of the SMM command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

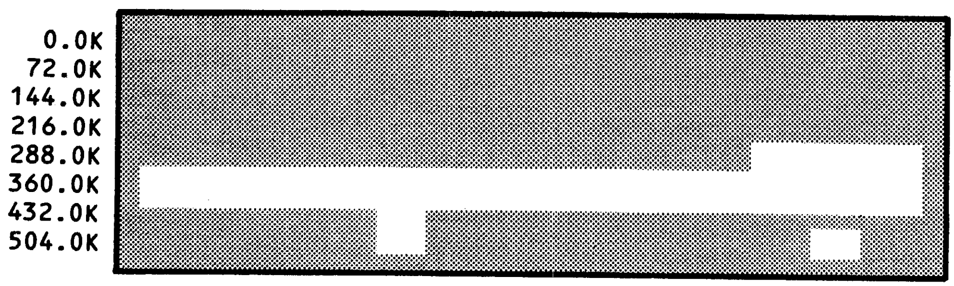
```
                    DNOS DYNAMIC MEMORY MAP

MEMORY SIZE = 576.0 K              MEMORY RESIDENT OS = 162.3 K

# OF SEGMENTS IN SOFTWARE CACHE = 70     TOTAL SIZE = 78.5 K

# OF SEGMENTS SWAPPED OUT = 35           TOTAL SIZE = 194.0 K

# OF AVAILABLE MEMORY BLOCKS = 28   TOTAL SIZE = 145.0 K   LARGEST = 37.3 K
```




```
                K = 1024 BYTES    X = 1152

       F1-STATIC MEMORY   F2-USED SEGMENT MEMORY   F3-CACHE MEMORY
```

2285321

Figure 16-10. Initial Show Memory Map Display

Press the F1 function key and the S character appears in the display representing the static system use within the memory map. Press the F2 key and the U character appears, representing the areas occupied by used user memory segments. Press the F3 key and cache memory area is filled with C characters. Figure 16-11 shows the memory map display after pressing the F1, F2, and F3 keys.

16.4.4 Execute Performance Display (XPD) Command

The XPD command displays system performance statistics; these statistics include task counts, job counts, and memory usage. Because the counters are sampled at specific intervals, not constantly, the percentages are estimates.

During execution, pressing the F1 key reinitializes the display. Pressing the Command key terminates the display and returns to the SCI command mode. By assigning the logical name SCREEN to a file, the Print key can copy the current screen to the file.

```
                          DNOS DYNAMIC MEMORY MAP

         MEMORY SIZE = 576.0 K              MEMORY RESIDENT OS = 162.3 K

         # OF SEGMENTS IN SOFTWARE CACHE = 70    TOTAL SIZE = 78.5 K

         # OF SEGMENTS SWAPPED OUT = 35          TOTAL SIZE = 194.0 K

 # OF AVAILABLE MEMORY BLOCKS = 28   TOTAL SIZE = 145.0 K   LARGEST = 37.3 K

               0.0K |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS|
              72.0K |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS|
             144.0K |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS|
             216.0K |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS|
             288.0K |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS            |
             360.0K |                                                      |
             432.0K |UUUUUUUUUUUUUUUUU   CCCCCCCCCCUUUUUUUUUUUUUUUUUUUUUUUU|
             504.0K |UUUUUUUUUUUUUUUUU   CCCCCCCCCCUUUUUUUUUUUUUUUUU  UUUUU|

                          K = 1024 BYTES   X = 1152

2285322          F1-STATIC MEMORY   F2-USED SEGMENT MEMORY   F3-CACHE MEMORY
```

Figure 16-11. Complete Show Memory Map Display

Figure 16-12 shows an example of the output from an XPD command. See the description of the XPD command in the *DNOS System Command Interpreter (SCI) Reference Manual* for an explanation of the information in the output.

16.5 SOFTWARE STATUS

The most recent modifications and updates to each unique software product are documented in a history file named .S$SYSTEM.S$HSTRY. Software package installations and patch batch streams supplied by your software representative follow a convention of updating the history file on the running system disk or, if specified, on a target system disk. If the history file is not modified by the user, it functions as a valuable modification record to assist the system manager and customer support representative in isolating system software problems.

```
                          D N O S   P E R F O R M A N C E

Number of Clock Ticks:       6685                               Count Active  Wom
      Number Ticks   %  Spot %  Counters:                Tasks:    36      1     0
DS01 U:         43   0     7   Jobs  Cmp:     0          Jobs :    10      1     0
CPU  U:        229   3    24   Tasks Cmp:     0      Memory:    Use     Max   Avail
Schd U:       6460  96    76   Seg   Mgr:     0   Sys Table:   5688    6772   18834
FM T U:         15   0     1   File  Mgr:   177   JCA Table:   2082    2524   12288
Ldr  U:          1   0     0   IPC Calls:     0    SM Table:   4832    5038   12288
Mp 1 U:         75   1     9   Roll Outs:     0    FM Table:   5660    6032   12288
FM X U:         41   0     5   FM Queues:    15    Buf Area:     2848          4096
DS02 U:          0   0     0   Ovly  Lds:     7    User Mem:   355680        956384
DS03 U:          0   0     0   Name  Mgr:     1       Rolled Out: Segments -      0
DS04 U:          0   0     0   IOU Calls:     1              Disk Records -      0
DS05 U:          0   0     0   WOT Calls:     0       Disk Res Tasks in Mem:     31
DS06 U:          0   0     0   JCA Expds:     0   Cache List: Buf -  61 Prg -    16
```

Figure 16-12. Execute Performance Display Output Listing

The List Software Configuration (LSC) command lists the most recent updates for each software package with entries in the history file. Figure 16-13 shows a sample listing from the LSC command. See the *DNOS System Command Interpreter (SCI) Reference Manual* for further instructions in using this command.

```
                    S O F T W A R E    U P D A T E    P R O F I L E

                                                RELEASE   INSTALL    PATCH    LAST
  SOFTWARE PACKAGE                    REVISION   DATE      DATE      DATE     PATCH

DNOS DBMS-990                          2.2.0    07/09/82            05/20/82  0000
DNOS TIFORM                            2.1.0    09/20/81  05/20/82  05/20/82  1480
DNOS (SEP23 KERNEL)                    1.1.1    01/13/83  01/15/83  02/16/83  2650
DNOS (SEP23 UTILITY)                   1.1.1    01/13/83            02/10/83  2632

11:06:10 THURSDAY, MAY 19, 1983.
```

Figure 16-13. List Software Configuration Output Listing

Appendix A

Keycap Cross-Reference

Generic keycap names that apply to all terminals are used for keys on keyboards throughout this manual. This appendix contains specific keyboard information to help you identify individual keys on any supported terminal. For instance, every terminal has an Attention key, but not all Attention keys look alike or have the same position on the keyboard. You can use the terminal information in this appendix to find the Attention key on any terminal.

The terminals supported are the 931 VDT, 911 VDT, 915 VDT, 940 EVT, the Business System terminal, and hard-copy terminals (including teleprinter devices). The 820 KSR has been used as a typical hard-copy terminal. The 915 VDT keyboard information is the same as that for the 911 VDT except where noted in the tables.

Appendix A contains three tables and keyboard drawings of the supported terminals.

Table A-1 lists the generic keycap names alphabetically and provides illustrations of the corresponding keycaps on each of the currently supported keyboards. When you need to press two keys to obtain a function, both keys are shown in the table. For example, on the 940 EVT the Attention key function is activated by pressing and holding down the Shift key while pressing the key labeled PREV FORM NEXT. Table A-1 shows the generic keycap name as Attention, and a corresponding illustration shows a key labeled SHIFT above a key named PREV FORM NEXT.

Function keys, such as F1, F2, and so on, are considered to be already generic and do not need further definition. However, a function key becomes generic when it does not appear on a certain keyboard but has an alternate key sequence. For that reason, the function keys are included in the table.

Multiple key sequences and simultaneous keystrokes can also be described in generic keycap names that are applicable to all terminals. For example, you use a multiple key sequence and simultaneous keystrokes with the log-on function. You log on by *pressing the Attention key, then holding down the Shift key while you press the exclamation (!) key.* The same information in a table appears as *Attention/(Shift)!*.

Table A-2 shows some frequently used multiple key sequences.

Table A-3 lists the generic names for 911 keycap designations used in previous manuals. You can use this table to translate existing documentation into generic keycap documentation.

Figures A-1 through A-5 show diagrams of the 911 VDT, 915 VDT, 940 EVT, 931 VDT, and Business System terminal, respectively. Figure A-6 shows a diagram of the 820 KSR.

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Table A-1. Generic Keycap Names

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
Alternate Mode	None	ALT	ALT	ALT	None
Attention[2]	[illegible]	SHIFT PREV FORM NEXT	■	[illegible]	CTRL S
Back Tab	None	SHIFT TAB	SHIFT ⇧ TAB	None	CTRL T
Command[2]	[illegible]	PREV FORM NEXT	CMD	[illegible]	CTRL X
Control	CONTROL	CTRL	CTRL	CTRL	CTRL
Delete Character	DEL CHAR	LINE DEL CHAR	DEL CHAR	DEL CHAR	None
Enter	[illegible]	SEND	ENTER	ENTER	CTRL Y
Erase Field	ERASE FIELD	EOS ERASE EOF	ERASE FIELD	ERASE FIELD	CTRL] [

Notes:

[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

[2]On a 915 VDT the Command Key has the label F9 and the Attention Key has the label F10.

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Table A-1. Generic Keycap Names (Continued)

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
Erase Input	ERASE INPUT	ALL ERASE INPUT	ERASE INPUT	ERASE INPUT	CTRL N
Exit	ESC	PREV PAGE NEXT	SHIFT ⇧ ESC	SHIFT ESC	ESC
Forward Tab	SHIFT TAB SKIP	TAB	TAB	SHIFT TAB SKIP	CTRL I
F1	F1	F1	F1	F1	CTRL A
F2	F2	F2	F2	F2	CTRL B
F3	F3	F3	F3	F3	CTRL C
F4	F4	F4	F4	F4	CTRL D

Notes:

[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

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Table A-1. Generic Keycap Names (Continued)

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
F5	F5	F5	F5	F5	CTRL E
F6	F6	F6	F6	F6	CTRL F
F7	F7	F7	F7	F7	CTRL V
F8	F8	F8	F8	F8	CTRL W
F9	CONTROL ! 1	F9	F9	SHIFT F1	CTRL] [
F10	CONTROL @ 2	F10	F10	SHIFT F2	CTRL Z

Notes:

[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

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Table A-1. Generic Keycap Names (Continued)

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
F11	CONTROL $ 4	F11	F11	SHIFT F3	CTRL | \
F12	CONTROL % 5	F12	F12	SHIFT F4	CTRL } {
F13	CONTROL ^ 6	SHIFT F1	SHIFT ⇧ F1	SHIFT F5	CTRL + =
F14	CONTROL & 7	SHIFT F2	SHIFT ⇧ F2	SHIFT F6	CTRL — –
Home	HOME	HOME	HOME	HOME	CTRL L
Initialize Input		SHIFT LINE INS CHAR			CTRL O

Notes:

[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

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Table A-1. Generic Keycap Names (Continued)

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
Insert Character	INS CHAR	LINE INS CHAR	INS CHAR	INS CHAR	None
Next Character	→ or SHIFT CHAR	→	►	→	None
Next Field	SHIFT FIELD	LINE FEED	SHIFT ⇧ FIELD	SHIFT FIELD	None
Next Line	↓	↓	▼	↓	CTRL J or LINE FEED
Previous Character	← or CHAR	←	◄	←	None
Previous Field	FIELD	SHIFT SKIP	FIELD	FIELD	None

Notes:
[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

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Table A-1. Generic Keycap Names (Continued)

Generic Name	911 VDT	940 EVT	931 VDT	Business System Terminal	820[1] KSR
Previous Line	↑	↑	▲	↑	CTRL U
Print	PRINT	PRINT	PRINT	PRINT	None
Repeat	REPEAT	See Note 3	See Note 3	See Note 3	None
Return	[redacted]	[redacted]	↵ RETURN	[redacted]	[redacted]
Shift	SHIFT	SHIFT	SHIFT ⇧	SHIFT	SHIFT
Skip	TAB SKIP	← SKIP →	SKIP	TAB SKIP	None
Uppercase Lock	UPPER CASE LOCK	UPPER CASE	CAPS LOCK	UPPER CASE LOCK	UPPER CASE

Notes:

[1]The 820 KSR terminal has been used as a typical hard-copy terminal with the TPD Device Service Routine (DSR). Keys on other TPD devices may be missing or have different functions.

[3]The keyboard is typamatic, and no repeat key is needed.

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Table A-2. Frequently Used Key Sequences

Function	Key Sequence
Log-on	Attention/(Shift)!
Hard-break	Attention/(Control)x
Hold	Attention
Resume	Any key

Table A-3. 911 Keycap Name Equivalents

911 Phrase	Generic Name
Blank gray	Initialize Input
Blank orange	Attention
Down arrow	Next Line
Escape	Exit
Left arrow	Previous Character
Right arrow	Next Character
Up arrow	Previous Line

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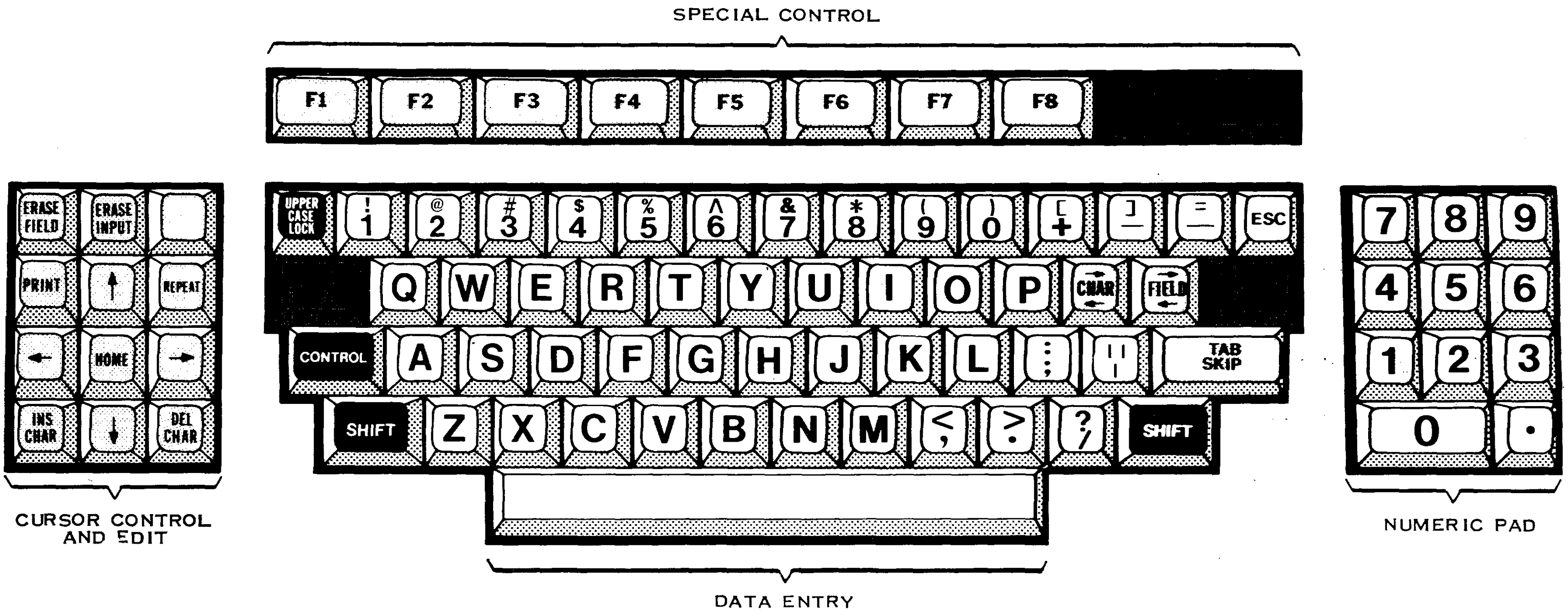

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Figure A-1. 911 VDT Standard Keyboard Layout

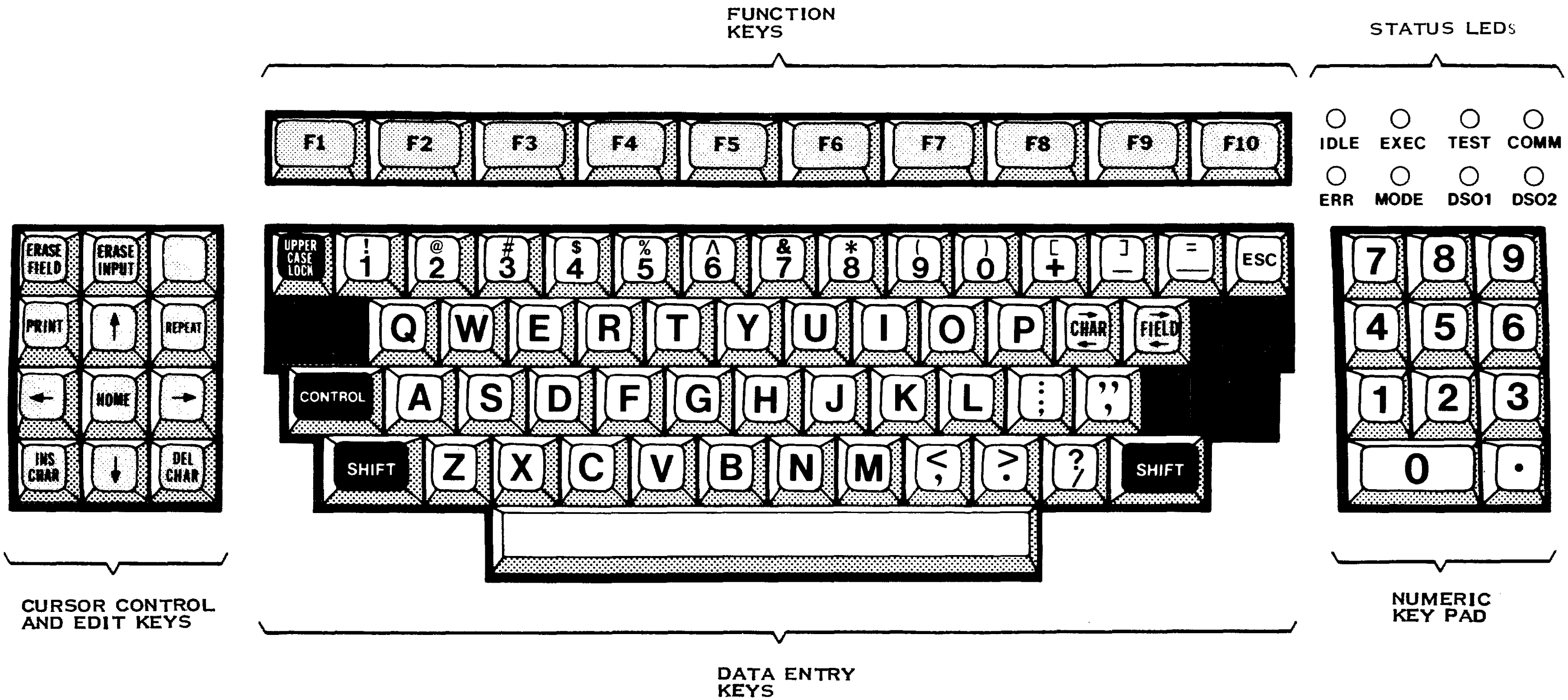

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Figure A-2. 915 VDT Standard Keyboard Layout

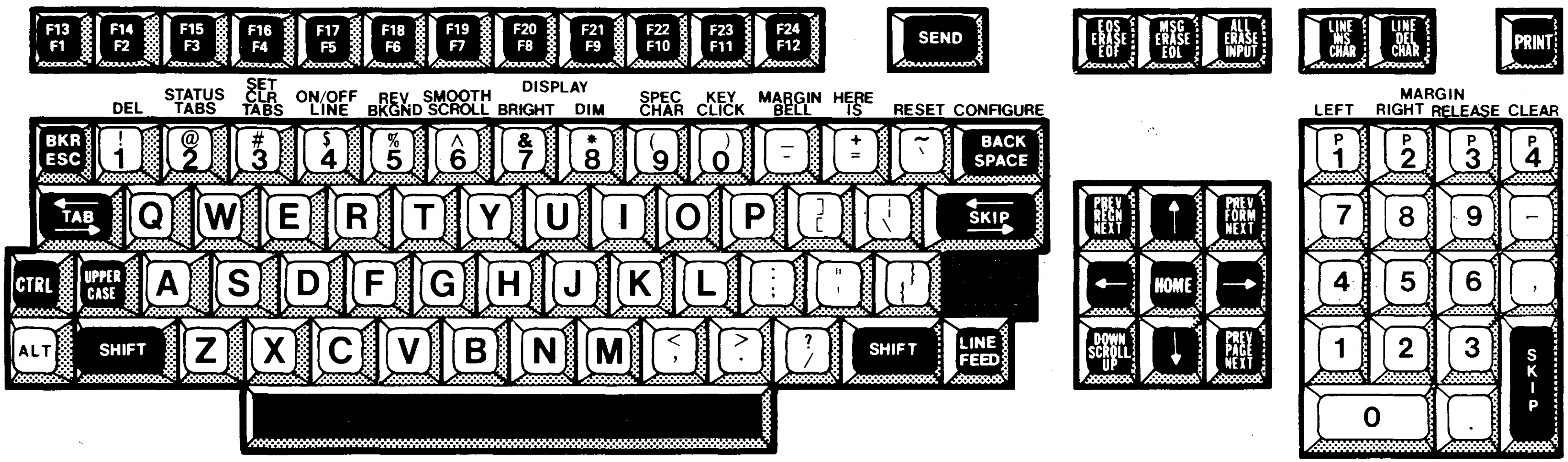

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Figure A-3. 940 EVT Standard Keyboard Layout

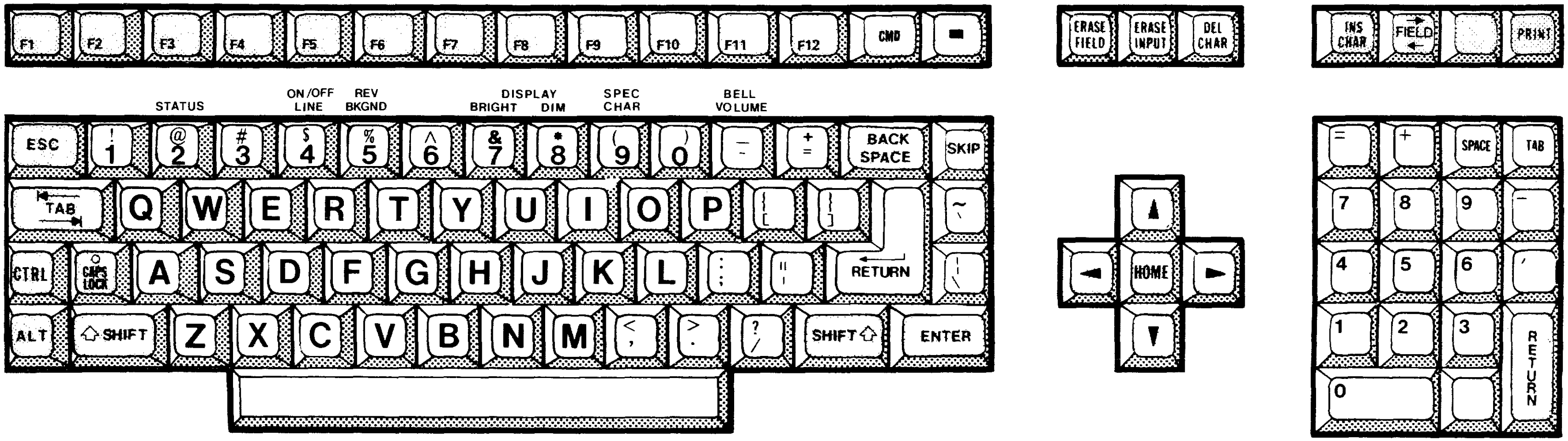

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Figure A-4. 931 VDT Standard Keyboard Layout

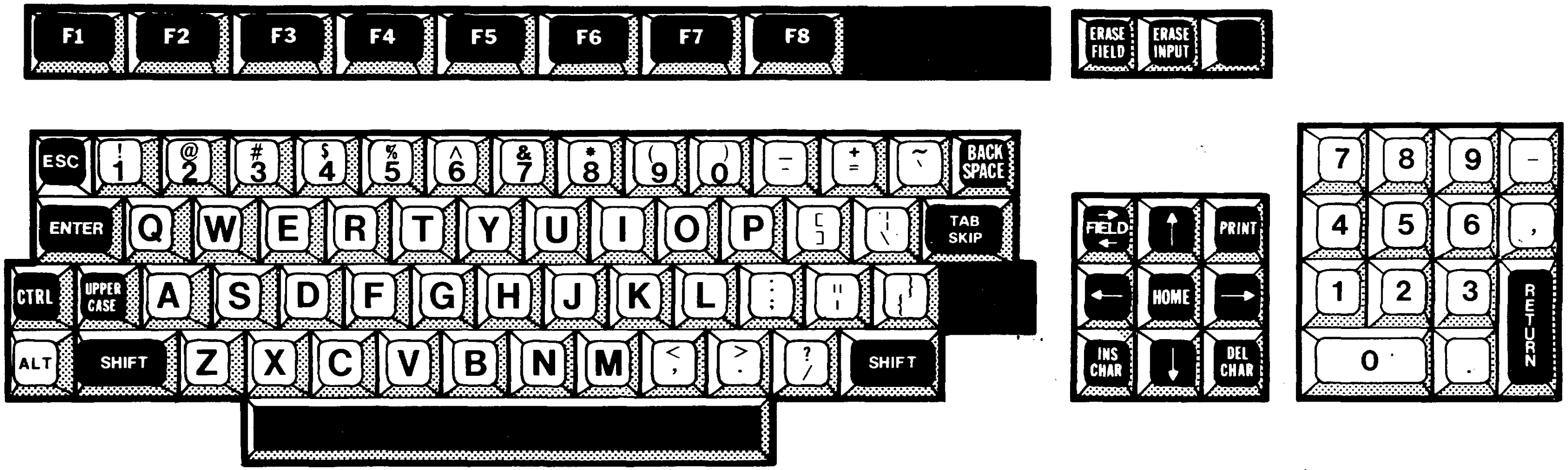

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Figure A-5. Business System Terminal Standard Keyboard Layout

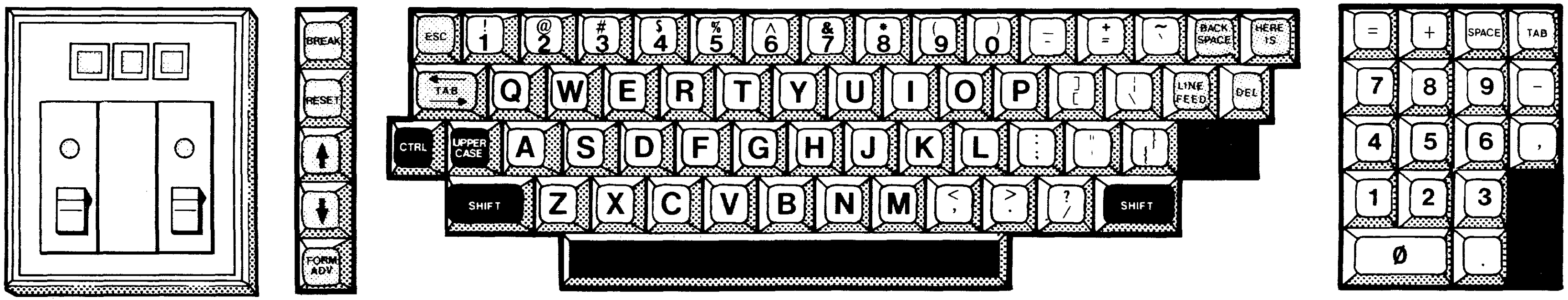

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Figure A-6. 820 KSR Standard Keyboard Layout

Appendix B

Model 733 ASR/KSR Terminal

B.1 GENERAL INFORMATION

This appendix describes the operation of Texas Instruments Model 733 ASR/KSR Data Terminals. For detailed information on installing and programming these terminals, refer to the *Model 733 ASR/KSR Data Terminal Installation and Operation* manual.

The Model 733 KSR (Keyboard Send/Receive), shown in the lower view of Figure B-1, consists of a keyboard/printer assembly. The Model 733 ASR (Automatic Send/Receive), shown in the upper view of Figure B-1, consists of an identical keyboard/printer plus a cassette tape transport assembly.

The Model 733 ASR Data Terminal is an automatic send-receive terminal that has a keyboard for manual input, a printer for hard copy output, and two magnetic tape cassette units for the automatic input and output of data. The data terminal also serves as a console for the Model 990 Computer.

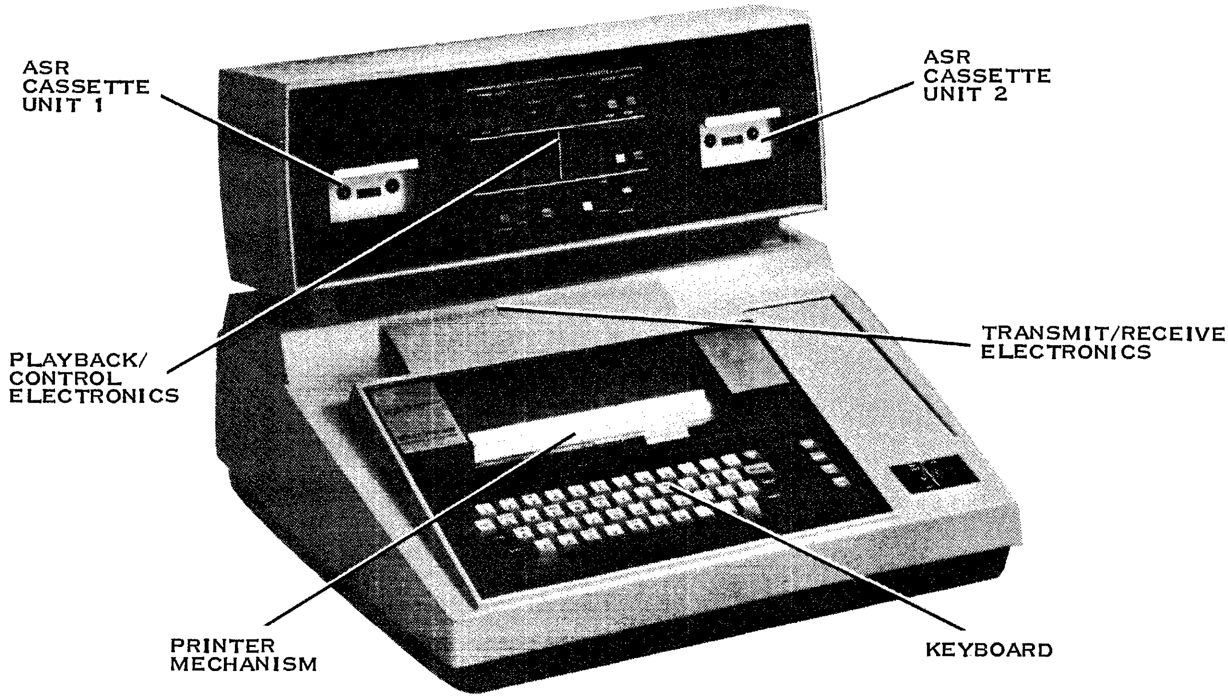
The printer produces hard-copy output from the computer, using a solid-state printhead to print silently on heat-sensitive paper. Data on cassettes may be read into the computer, and data output by the computer may be stored on cassettes. The keyboard, printer, and cassette units may be used online or in a local mode in any combination.

B.2 KEYBOARD

The standard keyboard (Figure B-2) is a limited ASCII keyboard and provides transmission of uppercase characters (64-character set). A 96-character keyboard (Figure B-3) is available as an option and provides transmission of both uppercase and lowercase characters. The numeric keyboard option is a separate keyboard that provides basic numerals and graphic symbols to facilitate rapid entry of numeric data.

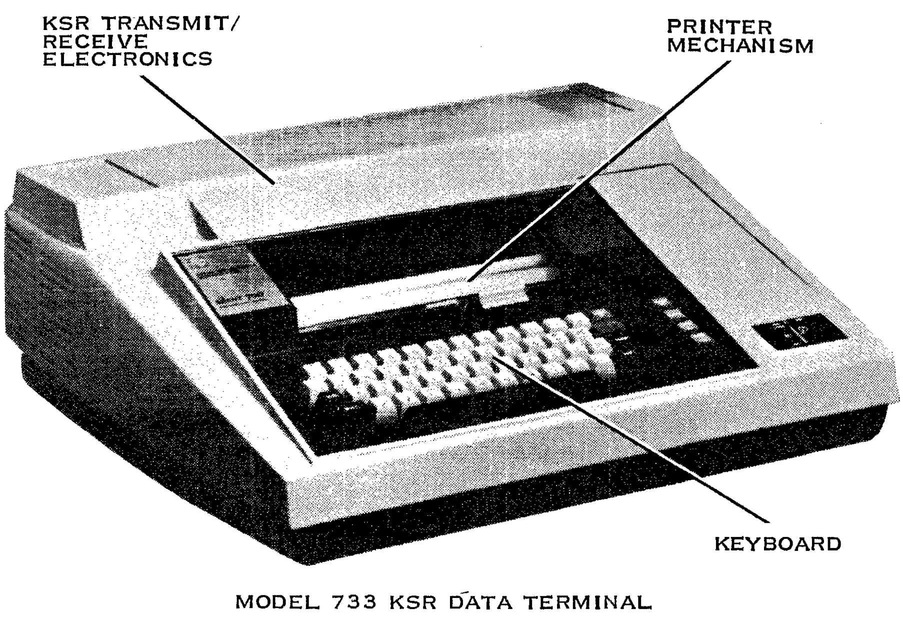
NOTE

Since this appendix contains information on a specific terminal, generic key names are not be used. The keys are referred to as they are labeled on the keyboard.



MODEL 733 ASR DATA TERMINAL

2277090



MODEL 733 KSR DATA TERMINAL

2277091

Figure B-1. Model 733 ASR/KSR Data Terminals

12

Recovering From Power Failure

12.1 GENERAL INFORMATION

The power failure recovery feature of DNOS provides for recovery on TILINE* disks and video display terminals (VDTs) after the occurrence of a short-term power loss. This feature makes it possible for long-running or one-time jobs to survive poor or unstable power generation environments.

Recovery from a power failure may not always be possible. Sometimes power fluctuations cause unpredictable results. Sometimes hardware-related problems prevent recovery from the power loss. In such cases, an initial program load must be performed on the system.

Power failure recovery occurs automatically when the following requirements are met before the power loss:

1. Battery support hardware is installed on the target system.

2. The power failure recovery option is selected during system generation.

3. Memory boards and disk controllers are in their correct locations.

12.2 VDT RECOVERY

The battery hardware supports main memory only and maintains that memory for about 15 minutes. Only the memory boards in the first six slots of the chassis receive standby power. Every VDT has a memory buffer associated with it and DNOS maintains a complete image of each screen within the buffer. The screen images of all VDT screens in use at the time of a power loss are rebuilt when power is restored.

12.3 TILINE DISK RECOVERY

Power failure recovery is supported for all TILINE disks. All DNOS disks shipped by Texas Instruments are TILINE disks.

* Trademark of Texas Instruments Incorporated.

When power is restored after a power failure, DNOS allows all TILINE disks installed at the time of power loss to spin back up to normal speed and become ready. Each type of computer that supports the power fail option has a maximum wait time for the disk drives to become ready before reporting an error. The Business System 300 does not support the power fail option. These are the maximum times for each type of computer:

- Model 990/10 — six minutes
- Model 990/10A and Business System 600 — five minutes
- Model 990/12 and Business System 800 — three minutes

If a disk drive does not come up after power is restored, error code >0004 (record lost due to power failure) is returned to any task attempting input/output operations to that device.

When power is restored after a power loss, any task performing input/output operations to a device other than TILINE disks and VDTs receives error code >0004 (record lost due to power failure). The power failure recovery feature does not work for TILINE disks connected in the expansion chassis.

13

Using the System Log

13.1 GENERAL INFORMATION

DNOS logs information about system operation, using two system files and optional devices. These devices are specified during system generation or by the Initialize System Log (ISL) command. This section describes how to enable the system logging device and how to dump the contents of the system log files. Refer to the *DNOS Messages and Codes Reference Manual* for a description of how to interpret the contents of the system log.

13.2 SYSTEM LOG FILES

DNOS automatically records the following information about system operation on a pair of mandatory disk files:

- Device hardware errors
- Input/output errors
- Task errors
- Cache memory errors
- Memory parity errors
- Messages generated by DNOS utilities
- Messages generated by user programs or system tasks

The system log files are maintained on the system disk under the names .S$LOG1 and .S$LOG2. The system begins recording the log messages on either .S$LOG1 or .S$LOG2. When one file is full, the system records messages on the other file and displays the following message at the device specified as the attention device:

```
******** LOG FILE  n  FULL
```

where:

n is the file number.

The system log full message tells the user that the contents of the log file (identified by number) should be copied to another file or device, or it will be overwritten when the other log file fills up. The Print File (PF) command, the Copy/Concatenate (CC) command, or the Copy Directory (CD) command can be used to copy the file, as follows:

- Print File writes a copy of the file to an output device.
- Copy/Concatenate copies the file to another file or sequential medium.
- Copy Directory with the INCLUDE option can copy the log file into a file created by the command. This allows the user to save the log file without having already created the destination file.

See the *DNOS System Command Interpreter (SCI) Reference Manual* details on these commands.

13.3 INITIALIZING THE SYSTEM LOG

The Initial System Log (ISL) command allows DNOS users to change the logging device or attention device from the ones specified when the system was generated. ISL can also be used to recreate the system log files after an error in logging occurs. For complete details and instructions on the ISL command, see the *DNOS System Command Interpreter (SCI) Reference Manual*.

14

Interpreting Error Messages

14.1 GENERAL INFORMATION

This section tells how to interpret the DNOS error messages and codes. DNOS reports the following classes of errors:

- Utility errors
- Compiler and run-time errors
- SCI errors
- SVC errors
- System log errors
- System crash errors

These errors generally result from device malfunctions or from the use of invalid or illegal parameters, procedures, program logic, or system logic.

The *DNOS Messages and Codes Reference Manual* describes all these errors except the compiler and run-time errors. The programmers guide for the language you are using discusses the compiler and run-time errors.

14.2 ERROR REPORTING

All DNOS error messages include the source of the error, the category of the subsystem reporting the condition, and a description of the problem. DNOS offers three levels of error reporting, as follows:

1. Internal error codes.
2. Short, descriptive messages with message categories and identifiers. These guide the user to further explanations in the *DNOS Messages and Codes Reference Manual*.
3. Expanded online explanations.

The selection of a reporting level depends on how much disk space can be devoted to messages.

14.2.1 Internal Error Codes

With the first level of error reporting available, DNOS formats its error messages as follows:

```
CCCCCCCC-INTERNAL CODE >MMMM    VVVVVVVV
```

CCCCCCCC is one of the following 1- to 8-character message categories:

Category	Message Type
ASSEMBLR	Macroassembler messages
CRASH	System crash codes and description
DEBUGGER	Task Debugger messages
EDITOR	Text Editor messages
LINKER	Link Editor messages
LOADER	Loader crash codes and description
SCI	SCI messages
STATUS	Task status messages
SVC	Supervisor Call (SVC) messages
UTILITY	Utility messages

MMMM is a 4-digit, hexadecimal, internal error code.

VVVVVVVV is an optional, variable-length text string. Semicolons separate logically unrelated portions of the string.

14.2.2 Short Messages

With the second level of error reporting available, DNOS formats its error messages as follows:

```
SSS CCCCCCCC NNNN  message message message message message
                message message message message message
                (up to five lines)
```

SSS is an error source code of up to three of the following characters:

Code	Source of Error
U	User
S	System
H	Hardware
I	Informative
W	Warning

CCCCCCCC is a 1- to 8-character message category. Additional categories support various programming languages, generally in pairs (one for the compiler messages and one for the run-time messages). The codes for each language are described in its reference manual.

NNNN is the message number, used to locate an explanation of the message in the section for its category (CCCCCCCC) in the *DNOS Messages and Codes Reference Manual* or appropriate language reference manual. Another category, MAIL, may appear. This category is used for messages created by users via the CM command or by system functions that use the mailbox facility to send messages to users.

```
USER-ID    JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
SYSTEM00   PRINT       0001   20     2       2048      828       1042
     TASK      ID   RUN-ID   STN  PRI  R-PRI  STATE WP     PC    FLAG1  FLAG2     CPU SECS
     FILMGR    05    02            0    0      24  590E   C06E   F100   0000          0.6
     SCI990    01    01       2    4    164    17  8796   3DD8   7000   0000          3.2
     SJSSTS    30    08       2    4    150    00  E0BC   DCF6   F000   0800          0.2
```

Figure 10-2. Show Task Status Output Listing

Tables in the Show Task Status (STS) paragraph in the *DNOS System Command Interpreter (SCI) Reference Manual* give detailed explanations for the columns in the SJS an STS output listings.

10.2.5 Stopping and Restarting Jobs in Execution

The Halt Job (HJ) command suspends the specified job currently executing under a specified user ID. The job is halted but not killed; this allows the user to stop and start his jobs as necessary. The system operator can stop and start any user's job in the system.

The Resume Job (RJ) command resumes execution of a job previously halted.

10.2.6 Terminating Jobs in Execution

The Kill Job (KJ) command terminates the execution of a specified job currently executing under a specific user ID. The user can kill any job running under his user ID. The system operator can kill any job in the system. A job stopped with the KJ command cannot be restarted with the RJ command.

10.2.7 Listing Jobs in Execution

For the system operator, the List Jobs (LJ) command displays the status of all jobs executing in the system. Other users can only list the status of jobs executing under their user IDs. Figure 10-3 shows an example of a listing produced by the LJ command when you answer YES to the TASK INFORMATION prompt. Since these are batch jobs, no station ID appears under the STN header.

```
USER-ID   JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
STRESS    SORT       000D   20     2        6144      2394      2844
       TASK       ID RUN-ID STN   PRI  R-PRI STATE WP      PC    FLAG1 FLAG2   CPU SECS
       SORTMG     2A   1A          3    197   09  0006   26DC   3000  0000        0.0
       FILEMGR    05   02          0    0     24  906C   C05C   D100  0000        7.1
       SCI990     01   01         B4    192   17  89EE   4040   1000  0000        3.9
       SCI990     01   14         B4    202   17  89EE   4040   1000  0800        1.5
       TIME1      03   18         B4    241   09  5DA0   5B26   1000  0800       11.7
       SORTMG     2A   19          3    224   09  0006   041C   3000  0000       11.7

USER-ID   JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
STRESS    COMPARE    000D   20     2        6144      2394      2844
       TASK       ID RUN-ID STN   PRI  R-PRI STATE WP      PC    FLAG1 FLAG2   CPU SECS
       FILEMGR    05   02          0    0     02  75CA   0264   D101  0000      403.5
       SCI990     01   01         B4    194   17  89EE   4040   1000  0000        2.5
       SCI990     01   0A         B4    201   17  89EE   4040   1000  0800        2.4
       SCI990     01   2D         B4    199   17  89EE   4040   1000  0800        8.2
       XCP        8A   40         B4    228   09  70BC   3684   1000  0400        5.6
```

Figure 10-3. List Jobs Output Listing

10.2.8 Modifying Job Priority

The Modify Job Priority (MJP) command, available only to the system operator, modifies the priority of a job during its execution. Job priorities can range from 1 through 31 with 1 being the highest priority.

10.2.9 Monitoring a Job

The Execute Job Monitor (XJM) command shows the user a dynamic display of the tasks running in his job. The system operator can see the display for each job in the system.

10.3 EXECUTING AND CONTROLLING PROGRAMS

Most programs are activated by SCI commands. Since different languages have different execution commands, users should consult the appropriate language guides for instructions on how to execute their programs.

Once activated, programs running under control of DNOS are called tasks. When activated, each receives a run-time ID from DNOS which can be used to reference the task during execution.

The user can view the status of a task by issuing the Show Task Status (STS) command, terminate the task by issuing the Kill Task (KT) command, suspend it by issuing the Halt Task (HT) command, and resume it by issuing the Resume Task (RT) command. The HT and RT commands are most useful when debugging a task. For additional details and detailed descriptions of the HT and RT commands, refer to the *DNOS System Command Interpreter (SCI) Reference Manual.*

10.3.1 Showing Task Status

The Show Task Status (STS) command lists the status of all tasks in a specified job or all jobs running under a user ID. Figure 10-4 shows an example of the output from the STS command.

Tables in the paragraph on the STS command in the *DNOS System Command Interpreter (SCI) Reference Manual* give specific details about the information in the STS output listing.

10.3.2 Killing Tasks

The Kill Task (KT) command terminates an active task within a user's job. Tasks that perform end action do so prior to termination. When the KT command completes, DNOS displays the state of the task when the task was terminated.

The operator cannot kill tasks in another user's job; he has to kill the entire job.

```
USER-ID    JOB-NAME    ID    PRI   STATE   JCASIZE   CURRENT   MAXIMUM
SYSTEM00   PRINT      0001    20     2       2048      828       1042
      TASK     ID   RUN-ID   STN  PRI  R-PRI  STATE  WP     PC    FLAG1  FLAG2    CPU SECS
      FILMGR   05     02           0    0       24  590E   C06E   F100   0000          0.6
      SCI990   01     01      2    4   164      17  8796   3DD8   7000   0000          3.2
      SJSSTS   30     08      2    4   150      00  E0BC   DCF6   F000   0800          0.2
```

Figure 10-4. Show Task Status Output Listing

11

Handling a System Crash

11.1 GENERAL INFORMATION

This section describes the procedures to be followed in the event of a system crash or lockup. DNOS contains internal consistency checks. If DNOS detects an error in the system during one of the checks, the system crashes.

The system operator knows a system crash has occurred when both of the following occurs:

1. No terminal in the system responds to keyboard input.

2. The POWER, FAULT, IDLE, and RUN indicator lights on the front panel of the minicomputer (Figures 2-1 and 2-2) are lit.

When the FAULT light is off and no terminal responds to keyboard input, the system is hung in a loop. A system crash can be forced to allow diagnosis of the problem.

The pattern in the data lights on the front panel of a Model 990 minicomputer and in the numeric display of a Business System computer after a system crash represents a hexadecimal crash code. The system crash codes and a description of their causes are listed in the *DNOS Messages and Codes Reference Manual.*

System crashes usually occur as the result of critical hardware errors or failures in system software.

11.2 DUMPING THE CONTENTS OF MEMORY TO .S$CRASH

When a system crash occurs, the system idles, waiting for action to be taken. To analyze the cause of the system crash, dump the system memory to the .S$CRASH file. Use the following procedure:

1. Halt the minicomputer:

   a. On Model 990 minicomputers, press HALT/SIE on the programmer panel.

   b. On Business Systems minicomputers, press HALT on the front panel.

2. Press RUN on the panel.

This causes the contents of memory to be written to the file named .S$CRASH on the system disk. When the dump is completed, the IDLE light is turned on again. The dump takes about a second. After the dump is completed, an initial program load can be performed. The crash dump can be examined with the XANAL command described in the *DNOS System Command Interpreter (SCI) Reference Manual* and the *DNOS Systems Programmer's Guide*.

On a Business System 300, DNOS automatically writes the crash dump to the .S$CRASH file. Wait a minute for this to happen, then turn the power off and back on to perform an IPL.

If immediate analysis of the crash dump is impossible, the contents of the file named .S$CRASH can be copied to a file in another directory with the Copy Directory (CD) command. Since .S$CRASH is an image file, only CD can copy it. This copy should be made as soon as possible after the initial program load is performed on the system. This allows another dump, if necessary, without destroying the earlier one.

If the problem occurs again, contact your customer representative. Send a copy of the crash file, system link map, and a description of what was happening at the time of the crash. Be sure the crash file contains the entire system memory image at the time of the crash. Use the Show Memory Status (SMS) command to see how much memory your system has. The Create System Files (CSF) command can be used to recreate the crash file if necessary.

11.3 FORCING A SYSTEM CRASH

A problem can occur in the system that does not result in a system crash, but prevents useful work on the system (the system malfunctions, but the FAULT lamp is not lit). For example, a system routine can hang in a loop or a deadlock condition may arise. In such cases, it is desirable to force a system crash in order to obtain the crash dump for analysis.

Model 990 and Business System minicomputers have slightly different procedures for forcing a system crash.

11.3.1 Model 990 Minicomputers

The following procedure forces a system crash on Model 990 minicomputers:

1. Press HALT twice.
2. Press the following in sequence:
   a. PC DISPLAY
   b. MA ENTER
   c. CLR
   d. MDE
   e. RUN
3. The system crashes with a crash code of >62.

4. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping The Contents of Memory to .S$CRASH.

5. Perform an initial program load.

In some cases, you cannot force a crash dump with this procedure. DNOS may be in a hang condition, the front panel may be locked out, or some other unusual condition may prevent the normal crash procedure from working. If this is the case, try the following set of steps to force the crash, with the crash code that you choose in step 4.

1. Press HALT, then press RESET.
2. Enter the value >00A6 in the front panel.
3. Press ENTER MA.
4. Enter the crash code of your choice into the front panel. (Use something unique, such as >FACE.)
5. Press MDE, then press MAI.
6. Enter the value >032C.
7. Press MDE, then press MAI.
8. Enter the value >020C.
9. Press MDE, then press MAI.
10. Enter the value >1FA0.
11. Press MDE, then press MAI.
12. Enter the value >1D03.
13. Press MDE, then press MAI.
14. Enter the value >10F8.
15. Press MDE, then press MAI.
16. Enter the value >00B4.
17. Press MDE, then MAI, then CLR.
18. Do the following 6 times: press MDE, then press MAI.

19. Press ENTER ST.

20. Enter the value >009A.

21. Press ENTER WP.

22. Enter the value >00A8.

23. Press ENTER PC.

24. Press RUN.

The crash code you chose in step 4 will soon appear on the front panel, signalling the crash has occurred. Proceed with the following steps:

1. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping The Contents of Memory to .S$CRASH.

2. Perform an initial program load.

If the crash code you chose does not appear, this procedure will not force a crash. Call your customer representative.

11.3.2 Business Systems Minicomputers

The following procedure forces a crash on Business Systems minicomputers:

1. Press HALT 11 times.

2. Press RUN.

3. Dump the contents of memory to the .S$CRASH file by pressing HALT and then RUN. See the paragraph in this section titled Dumping the Contents of Memory to .S$CRASH.

4. Perform an initial program load.

11.4 PERFORMING AN INITIAL PROGRAM LOAD

After the contents of memory have been dumped following a system crash, an initial program load (IPL) must be performed to reactivate the system. Use the following procedure:

1. Halt the minicomputer:

    a. On Model 990 minicomputers, press HALT/SIE on the programmer panel of the minicomputer.

    b. On Business Systems minicomputers, press HALT on the front panel.

2. Press LOAD on the front panel of the minicomputer. DNOS is now loaded into memory. The FAULT indicator lights for several seconds, and then the terminal banner is displayed on all terminals.

3. Log on to a terminal.

4. Optionally, use the CD command to copy the system log files (.S$LOG1 and .S$LOG2) to other files to save log information concerning the crash.

5. Optionally, copy the system crash file (.S$CRASH) to another file using the CD command. See the paragraph Dumping the Contents of Memory to .S$CRASH in this section.

10

Executing and Controlling Jobs and Programs

10.1 GENERAL INFORMATION

A job consists of one or more programs running under DNOS. Once activated, a program is called a task. Each job has its own set of resources, such as files and devices. The following commands allow the user to execute jobs and to perform various operations on jobs currently executing under a user ID:

- Execute Batch (XB)
- Execute Batch SCI Job (XBJ)
- Execute Job (XJ)
- Show Job Status (SJS)
- Halt Job (HJ)
- Resume Job (RJ)
- Kill Job (KJ)
- List Jobs (LJ)
- Modify Job Priority (MJP)
- Execute Job Monitor (XJM)

10.2 EXECUTING AND CONTROLLING JOBS

Two types of jobs exist in DNOS, interactive jobs and batch jobs. An interactive job is one that executes at a terminal and allows a user to request actions and receive responses interactively. A batch job executes independent of a terminal, getting its inputs from a file of commands and sending its outputs to a listing file.

In an interactive job, you always have a foreground task executing. Usually SCI is requesting and executing a command. You can also have one background task executing at the same time. SCI starts the background task from your terminal, but the background task continues to run without any need for input from your terminal.

A batch job executes without any exchange of information with a user. Usually batch jobs execute long streams of commands to perform standard operations that need no attention. Some examples include system log analysis, daily accounts billing, data base reorganization, and similar standard maintenance activities.

10.2.1 Executing an Interactive SCI Job

Interactive SCI jobs are started in two ways, logging on to SCI and using the Execute Job (XJ) command.

The XJ command can start an interactive job at another terminal. XJ could start a special application program running at one or more terminals, with your terminal as a central control point for a number of other jobs.

While in your interactive job, you can execute several of the SCI commands as background tasks. For example, the Copy Directory (CD) has an option allowing you to execute the program in either foreground or background. You can also start a background activity with the Execute Batch (XB) command.

10.2.2 Executing SCI in Background

The Execute Batch (XB) command activates SCI to run in the background mode. SCI runs without interacting with the terminal until finished, then SCI sends a message that the background task has been completed to the terminal that initiated the XB command. A batch command stream can be created by a text editor or with the Create Batch Stream (CB) command.

When executing a background task, press the Return key from time to time or enter the WAIT command. The background task termination message is displayed when the background task completes and the Return key is pressed. If the WAIT command was used, the background task termination message will be displayed automatically when the background task completes.

10.2.3 Executing Batch Jobs

The Execute Batch Job (XBJ) command creates a batch SCI job with operating parameters that may be different from those of the creating job. As with the XB command, jobs executed by the XBJ command use a batch stream input, but they run independently of a terminal. Since batch jobs are independent of a terminal, there is no limit on the number of batch jobs that can be started from a terminal.

10.2.4 Viewing Job and Task Status

The Show Job Status (SJS) and Show Task Status (STS) commands show the status of any or all jobs and tasks executing under a user ID. Both commands produce similar listings; the difference is SJS shows the status of jobs, while STS shows the status of tasks. Figure 10-1 shows an example of the SJS output listing. Figure 10-2 shows an example of the STS output listing.

```
USER-ID   JOB-NAME   ID   PRI  STATE  JCASIZE  CURRENT  MAXIMUM
KC0017    PRINT      0022  3     2      4000     2548      3477
```

Figure 10-1. Show Job Status Output Listing

9.4 MESSAGES SENT TO THE SYSTEM OPERATOR

Messages to the system operator come from the following sources:

- The Create Operator Message (COM) command allows the user to enter a message text and sends it to the operator.
- The output spooler generates messages to the system operator whenever it needs to have forms mounted.
- User programs can generate messages using operator interface routines. These routines are described in the *DNOS System Programmer's Guide*.

Pressing the F4 and F5 keys to respond to operator request messages dedicates the operator's terminal to serve as the system console until the operator uses the CMD key to resume SCI execution.

The operator's terminal can be kept free for other uses while retaining the privileges (and obligations) of the system operator. The operator issues the Receive Operator Messages (ROM) command to have messages routed through the mailbox facility. When a message arrives, it waits in the mailbox until the operator presses the RETURN key. The message appears in mailbox format as follows:

```
I  MAIL--0001 RECEIVED time date message
```

The time and date tell when the message arrived. The message itself follows the same format as other DNOS messages.

To quit being the system operator or to change terminals, the operator issues the Quit Operator Interface (QOI) command.

```
[] QOI
```

9.3 MULTIPLE OPERATOR SYSTEMS

At sites with distributed resources or where no one can act as a full-time system operator, the DNOS operator interface can be shared among several users. In this arrangement, no single person uses the XOI command. Instead, they each use the Receive Operator Message (ROM) command to have the interface send them the message. The ROM command allows an operator to receive messages either from all users or from just those users with a specified user ID.

- In environments where equipment is clustered in several areas, all users in an area log on with the same user ID. Whoever issues the ROM command indicates the user ID for the area and becomes the area operator.

- In environments where users must share the system operator function, each one retains a personal user ID. They take turns serving as the system operator by issuing ROM commands specifying all user IDs.

In both environments the requests go to the operator via the mail facility. Pressing the Return key or issuing the List Operator Messages (LOM) command has the interface display any pending messages. Next, the operator decides whether to honor each request and issues either a Respond to Operator Interface Request (ROR) command or a Kill Operator Interface Request (KOR) command as appropriate. To surrender the system operator function, the user issues the Kill Operator Message (KOM) command.

Multiple operator systems do not provide privileged commands for the system operator or operators.

9.2 SINGLE OPERATOR SYSTEMS

Some sites have one person identified as the system operator. That person receives all messages sent to the operator, performs any functions requested, and replies to the messages. In such cases, the operator and terminal are identified to the system by the Execute Operator Interface (XOI) command.

Provided there is not already a system operator identified, the XOI command starts the operator task and identifies the user who entered it as the system operator. Messages to the system operator appear on that user's terminal in the following format:

```
OR Request-ID* FROM User-ID AT hh:mm -- Message
```

where:

OR is the message identifier indicating an operator request.

Request-ID is the number of the request, counting requests from when the system operator issues XOI. The asterisk appears whenever the requesting task has been suspended, awaiting a response from the operator.

User-ID is the ID of the user who made the request.

hh:mm is the hour and minute the request was made.

Message is the request sent by the user

The operator has two ways to respond to the request:

1. If the request can be honored, the operator does what is asked and lets the user know by issuing a Respond to Operator Interface Request (ROR) command.

   The system operator executes the ROR command and responds to the REQUEST ID: prompt with the request-ID following the OR in the operator request message. If the OR request-ID is followed by an asterisk, prompts are displayed and when the system enters the information, the suspended task resumes execution.

   If SCI is not active in the foreground, pressing the F4 key performs the same function as entering ROR and pressing the Return key.

2. If the request cannot be honored, the operator issues a Kill Operator Interface Request (KOR) command.

   The KOR command specifies the system operator cannot fulfill the request. The system operator executes the KOR command and responds to the REQUEST ID: prompt with the ID number following OR in the request message.

   If SCI is not active in the foreground, pressing the F5 key performs the same function as entering KOR and pressing the Return key.

9

Using the Operator Interface

9.1 GENERAL INFORMATION

The DNOS operator interface provides commands to allow one or more users to serve as system operators. The operator interface receives messages from users requesting services and then routes those messages to the system operator. When the system operator answers the messages, the operator interface modifies its data structures as necessary and sends acknowledgements to the senders.

In addition to the ability to exchange messages with users, the system operator receives a number of privileges. Where the users manage only their own jobs, the system operator can manage the execution of all jobs in the system. The following commands enable the operator to control the execution, modify the priority, and examine the status of any or all jobs on the system:

- Halt Job (HJ) suspends the execution of jobs running on the system.
- Resume Job (RJ) resumes the execution of halted jobs.
- Kill Job (KJ) terminates the execution of jobs on the system.
- Modify Job Priority (MJP) changes the priorities of jobs.
- Show Job Status (SJS) shows the status of jobs running under a specified user ID.
- List Jobs (LJ) displays the status of all jobs in execution.
- Show Task Status (STS) shows the status of each task in a specified job or under a specified user ID.
- Execute Job Monitor (XJM) shows a dynamic display of the tasks in the job.

When a user issues one of these commands, it applies only to jobs running under that user's ID. The system operator may employ these commands on any job running on the system. The section Executing and Controlling Jobs explains each of these commands, as well as the commands used to execute jobs and control tasks.

Complete documentation of each of these operator commands appears in the *DNOS System Command Interpreter (SCI) Reference Manual.*

```
EXECUTE JOB
            SITE NAME:
             JOB NAME: SPOOLER
PROGRAM FILE PATHNAME: S$UTIL
      TASK ID OR NAME: SP$DST
                PARM1: 1
                PARM2: 1
           STATION ID:
SYNONYM TABLE PATHNAME: .S$USER.SPOOLER.SYN
             PRIORITY: 10
             JCA SIZE: MEDIUM

EXECUTE JOB
  USE CURRENT USER ID: NO

EXECUTE JOB
              USER ID: SPOOLER
             PASSCODE:
           ACCOUNT ID:
```

6. Use the Modify Spool Device (MSD) command and the list made in step 1 to reassign all devices and classes to the spooler.

7. Use the Print File (PF) command and the list made in step 1 to put the pending output files back on the printer spool.

The following characters are on the numeric keyboard:

- Numerals zero through nine (0 – 9)
- Number sign (#)
- Slash (/)
- Comma (,)
- Period (decimal point) (.)
- Hyphen (minus) (–)
- Plus (+)

The numeric keyboard also provides line feed (LF) and carriage return (CR) keys.

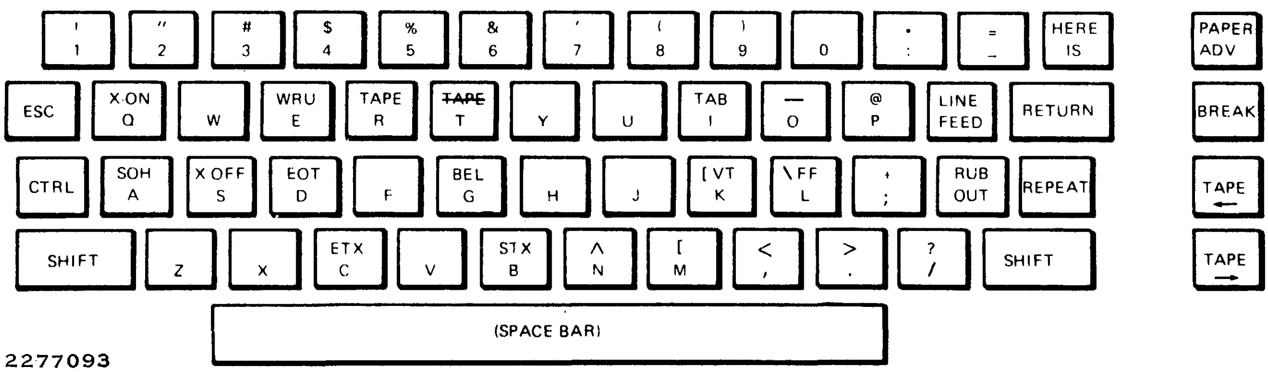


Figure B-2. Model 733 ASR/KSR Standard 64-Character Keyboard Layout

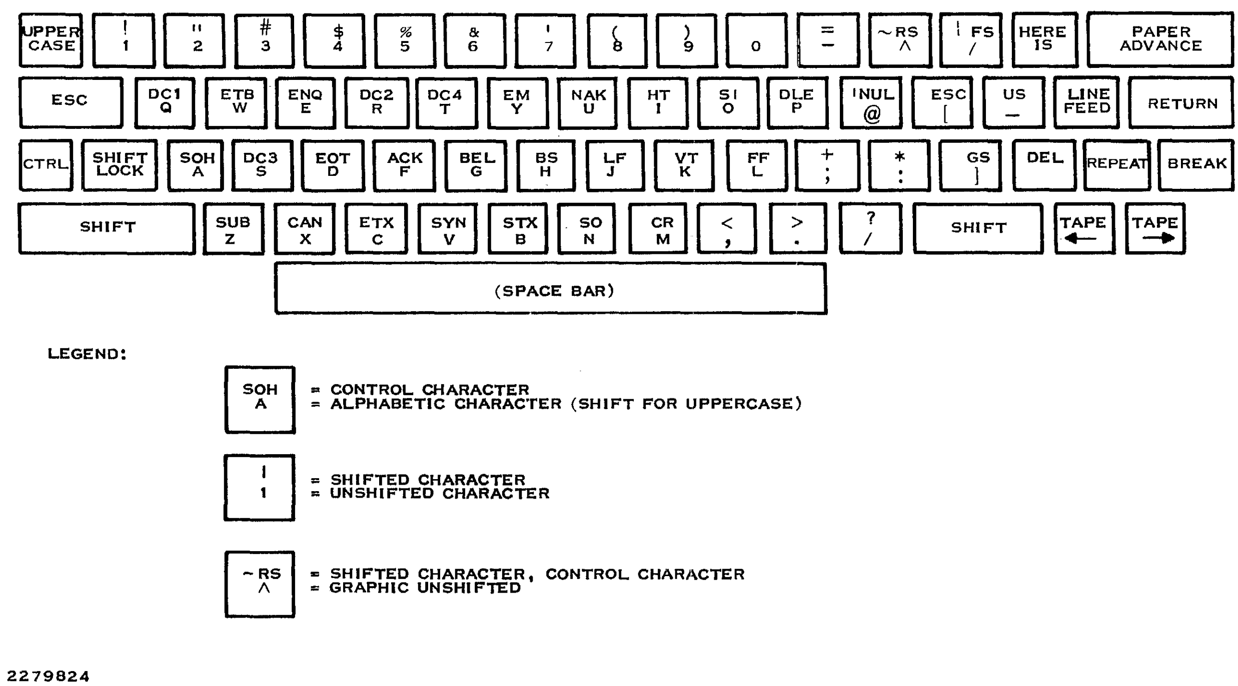


Figure B-3. Model 733 ASR/KSR Optional 96-Character Keyboard Layout

B.3 CONTROLS AND INDICATORS

The primary control areas of the data terminal are as follows:

- The ON LINE/OFF and master POWER switch
- The keyboard controls
- The upper switch panel

B.3.1 ON LINE/OFF Switch

When the ON LINE/OFF switch (Figure B-4) is in the ON LINE position, it enables the terminal to communicate with an external device through the interface module. The terminal transmits to the outside line from the keyboard or playback tape unit and receives data on the printer or recorder tape unit.

Local operation of the 733 ASR Data Terminal is normally controlled from the upper switch panel LINE/OFF/LOCAL switches (Figure B-5). Setting the ON LINE/OFF switch to the OFF position disconnects the entire terminal from the communications line. When this switch is set to OFF, the printer and keyboard switches are set to either LINE or LOCAL. The playback and record switches, however, are held in the off state unless the bottom row LINE/OFF/LOCAL switches are set to LOCAL.

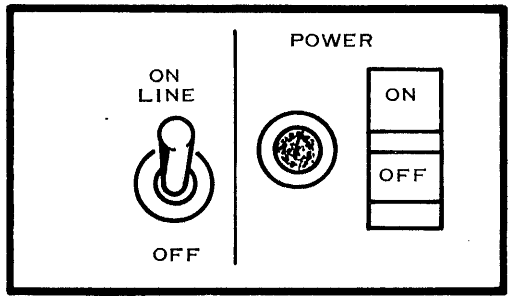


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Figure B-4. Model 733 ASR/KSR Data Terminal ON LINE/OFF and POWER Switches

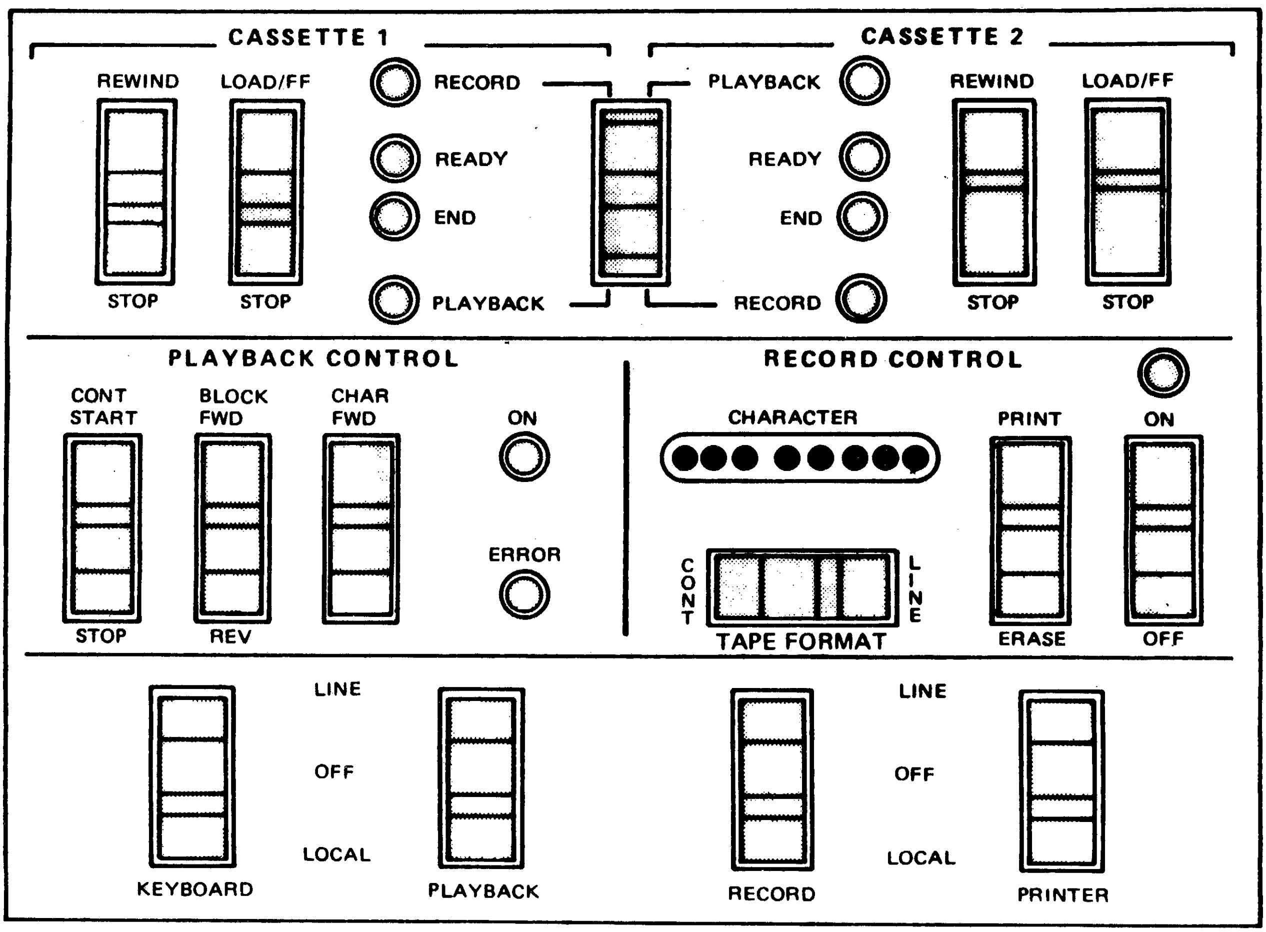

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Figure B-5. Model 733 ASR/KSR ASR Upper Switch Panel Controls and Indicators

B.3.2 Keyboard Controls

The standard ASCII keyboard special function keys are as follows:

$\underleftarrow{\mathrm{TAPE}}$, $\underrightarrow{\mathrm{TAPE}}$

Using these keys in the local mode allows editing of data in the record buffer. After placing characters in the record buffer, use the Tape Reverse ($\underleftarrow{\mathrm{TAPE}}$) key to backspace one character at a time to the selected character. The character can then be changed from the keyboard. To return to the point where the tape was started, press the Tape Forward ($\underrightarrow{\mathrm{TAPE}}$) key as many times as necessary. If the PRINTER switch is in the LOCAL mode, the printhead moves to help locate the character. Code is not transmitted under these conditions.

HERE IS

Pressing this key activates the optional answer-back memory. However, this option is not standard with Model 990 Computers.

B.3.3 Upper Switch Panel

The upper switch panel (Figure B-5) controls the major devices (keyboard, playback cassette, record cassette, and printer) of the data terminal. The switch panel is divided into three rows, each corresponding to a major function, as follows:

1. Top row: Cassette tape mode and motion control
2. Middle row: Record and playback control and editing
3. Bottom row: Device functions (keyboard, record, playback, and printer) and their connections with an outside line or local loop

B.3.3.1 Top Row Tape Cassette Controls. The cassette controls perform the following functions:

- Select the tape cassette for playback or recording
- Rewind, wind (fast forward), and load (ready) the cassettes
- Describe tape position and readiness using indicators

Table B-1 lists the functions of each top row switch. Figure B-6 shows these controls.

Table B-1. Model 733 ASR/KSR Tape Control Switches and Indicators (Switch Panel Top Row)

Switch/Indicator	Function
REWIND/STOP Switch*	REWIND causes the tape to wind toward the beginning-of-tape marker and continues until the clear leader is sensed or STOP is pressed.
LOAD/FF/STOP Switch*	After a tape is rewound to the beginning, load the cassette by pressing LOAD/FF (Load/Fast Forward), which causes the tape to move forward to the beginning-of-tape marker and stop. Pressing LOAD/FF again causes the tape to wind forward at high speed to the end of the tape or until STOP is pressed. Fast forward is useful in advancing the tape to the end or in performing a local tape search for editing purposes.
PLAYBACK/RECORD Switch	Used to select which cassette (cassette 1 or 2) is to be in playback mode or record mode. Cassettes automatically switch to opposite modes.
PLAYBACK/RECORD Indicator	Indicates which cassette is in playback or record mode.
END Indicator	Lights when clear leader is sensed at either end of tape.
READY indicator	Lights when cassette is ready for applicable record or playback operation.

Note:

* REWIND and LOAD/FF are inoperative when RECORD CONTROL or PLAYBACK CONTROL (second row of switches) is on.

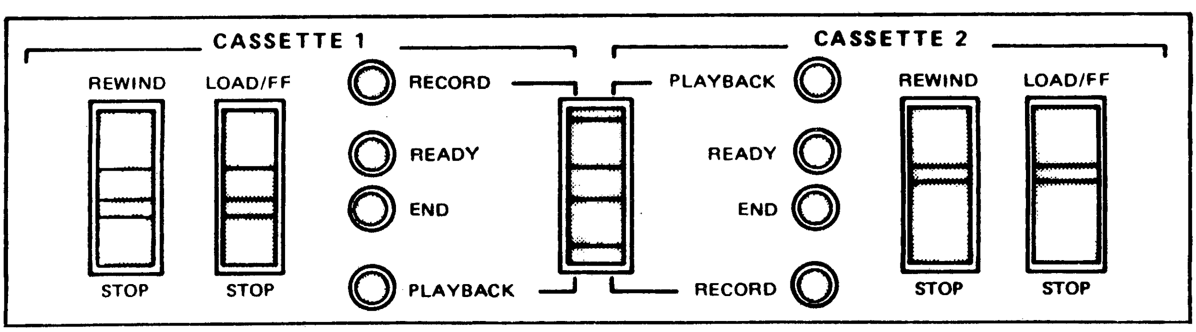

Figure B-6. Model 733 ASR/KSR Tape Control Switches (Switch Panel Top Row)

B.3.3.2 Middle Row Playback and Record Controls. Some of the functions performed by the PLAYBACK and RECORD controls are as follows:

- Allow printing or erasing of blocks while recording
- Start and stop tapes during recording and playback
- Select line format or continuous tape format recording
- Perform the edit functions. Editing is conducted in the LOCAL mode only (OFF-LINE).

Table B-2 lists the functions of each middle row switch and Figure B-7 shows the controls.

Table B-2. Model 733 ASR/KSR Playback/Record Control Switches and Indicators (Switch Panel Middle Row)

Switch/Indicator	Function
CONT START/STOP Switch	Momentarily pressing CONT START (Continuous Start) begins continuous playback of the cassette designated by the illuminated PLAYBACK light. Tape stops when clear leader is sensed or STOP is momentarily pressed.
BLOCK FWD/REV Switch	Momentarily pressing BLOCK FWD (Block Forward) causes the next block on tape to be read and played back or the remainder of a block to be stopped in the middle. Momentarily pressing REV (Reverse) causes the tape to back up one block and stop (used in block locating).
CHAR FWD Switch	Momentarily pressing CHAR FWD (Character Forward) allows reading of the playback buffer one character at a time. If the buffer is empty, the next block is entered in the buffer from the tape and the first character is read. A character can be read on the CHARACTER display (if duplicating a tape) or on the printer.
ON Indicator	Lights when PLAYBACK CONTROL is in use.
ERROR Indicator	Lights when a parity error (missing flux reversal) on the tape is found during playback.
CHARACTER Indicator	Shows 7-bit ASCII code of the character being addressed in the record buffer. Bits 0 to 7 read from left to right. Bit 7 is used internally by the terminal.
LINE/CONT Switch	This two-position switch controls the recording tape format. When the switch is in the LINE position, recording on tape is started by the ASCII carriage return character or by the 86th character of each block. Therefore, each block of data normally corresponds to one line of printout. This format is especially helpful when preparing and/or editing a tape on the recorder.

Table B-2. Model 733 ASR/KSR Playback/Record Control Switches and Indicators (Switch Panel Middle Row) (Continued)

Switch/Indicator	Function
	With the TAPE FORMAT switch in the continuous (CONT) position, recording on tape is initiated only by the 86th character of each block. Therefore, each block of data on tape can contain several lines of printout on the printer. This format is especially useful when maximum tape storage is desired. Tapes recorded in one format may be easily converted to the other format through the tape duplicating process.
PRINT/ERASE Switch	This switch is used to check record buffer contents during editing. The PRINTER and RECORD switches must be set to LOCAL. Contents of the record buffer are printed (but not recorded on tape) when PRINT is pressed and the buffer content is not affected. Pressing ERASE erases the record buffer contents but does not affect data recorded on the tape.
ON/OFF Switch	This switch turns on the recorder and RECORD CONTROLLER, allowing reception of data into the record buffer and transferring the contents of the record buffer (if any) to tape. If ERASE is pressed before or during actuation of OFF and OFF is released first, tape erase is initiated and continues until OFF is pressed again.
ON Indicator	Lights when RECORD CONTROL is in use.

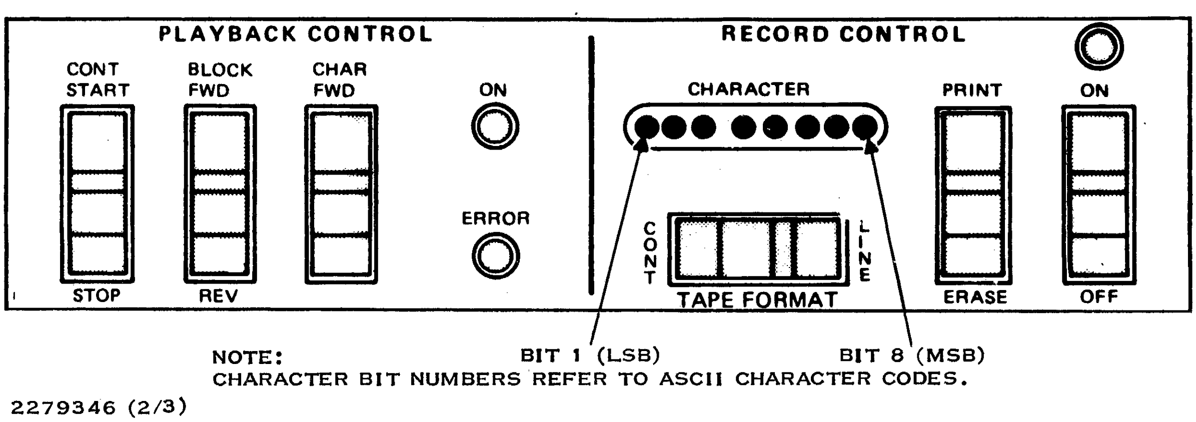

Figure B-7. Model 733ASR/KSR PLAYBACK/RECORD CONTROL Switches

B.3.3.3 Bottom Row, Device Controls. The major 733 ASR devices are controlled by the bottom row of switches, which perform the following functions:

- Select whether to connect the devices to the local loop or to the outside communications line (LINE,LOCAL)
- Disconnect the devices from both the local loop and the outside communications line (OFF).

Table B-3 lists the functions of each bottom row device mode switch and Figure B-8 shows these controls.

Table B-3. Model 733 ASR/KSR Device Function Switches (Switch Panel Bottom Row)

Switch	Function
KEYBOARD, PLAYBACK, RECORD, PRINTER	These switches may be operated in any of the following positions: LINE/OFF/LOCAL. To connect the keyboard, the playback cassette, the record cassette, or the printer to the computer system, set the corresponding switch to the LINE position. Those switches not needed for line operaton should be set to either OFF or LOCAL. When more than one of these switches are set to LOCAL, the associated functions are interconnected. For example, by placing the KEYBOARD and PRINTER switches to LINE, the user may communicate with the computer from the keyboard and the printer. At the same time, by placing the RECORD and PLAYBACK switches in the LOCAL position, a cassette tape may be copied offline. Devices set to OFF are disconnected from both line and local loops.

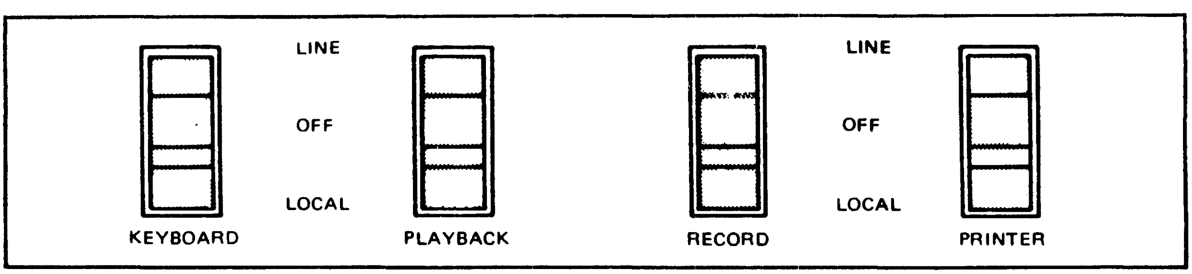

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Figure B-8. Model 733 ASR/KSR Device Function Switches

B.4 OPERATING THE DATA TERMINAL

Verify that the data terminal is properly installed as described in the *Model 733 ASR/KSR Data Terminal Installation and Operation* manual. This includes installing the equipment, installing the interface module in the proper chassis location, connecting the cable, and verifying the interrupt address. Then, perform the following steps:

1. Set the ON LINE/OFF switch to ON LINE.
2. Set the following switches to the LINE position: KEYBOARD, PLAYBACK, RECORD, and PRINTER.
3. Set the TAPE FORMAT switch to CONT.
4. See that the computer is on.
5. Carefully lift the keyboard cover and verify the following switch positions:
    a. SPEED HI
    b. DUPLEX FULL
    c. LINE FEED 1
    d. PARITY ODD
6. Ensure that the POWER switch on the terminal is OFF. Connect the AC power cord to the power source.

When these preliminary procedures are completed, install paper in the data terminal printer and install cassette tapes in the tape transport as described in the following paragraph.

B.4.1 Loading Paper

The data terminal printer must be loaded with a roll of paper before turning it on. Refer to Figure B-9 and use the following procedure to install the paper:

1. Open the data terminal cover and lift the pinch roller. Do not turn the drive roller (platen) unless the pinch roller has been lifted.
2. Place the roll of paper on the paper holders. Ensure that the roll can be turned freely.
3. Feed the paper down the paper chute and then between the paper chute and drive roller. Ensure that the paper is centered in the paper chute.
4. Lower the pinch roller, making sure that the paper is between the pinch roller and the drive roller.
5. Set the POWER switch to ON and press the PAPER ADV (Paper Advance) key. Ensure that paper feed is smooth and straight.
6. Close the data terminal cover. Feed the paper through the slot in the cover.

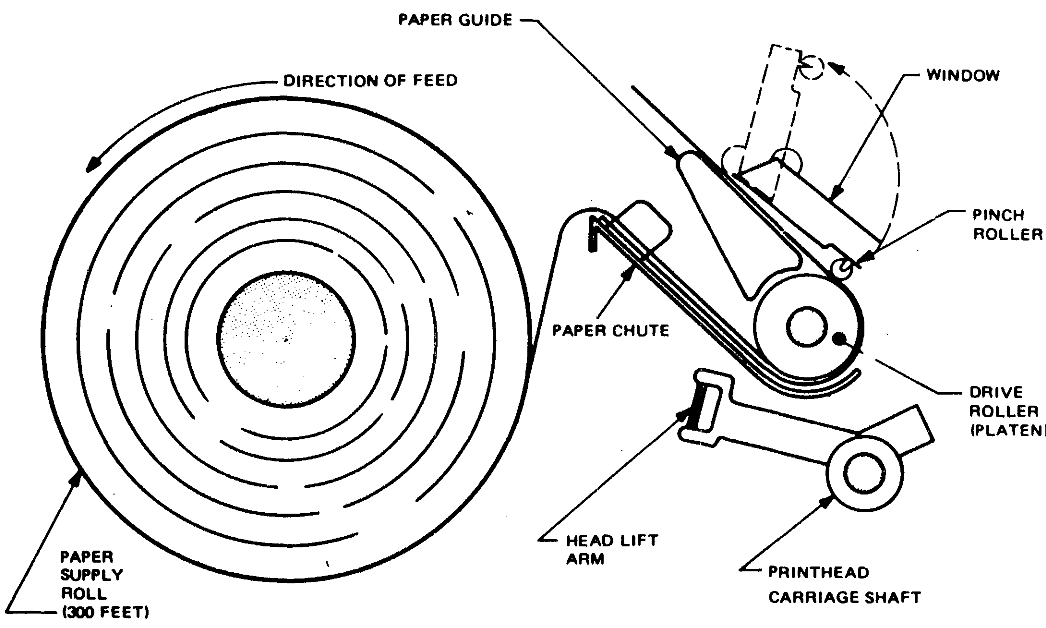

Figure B-9. Model 733 ASR/KSR Loading Paper in the Terminal

B.4.2 Installing a Cassette

To install or remove a tape cassette, refer to Figure B-10 and proceed as follows:

1. Open the transport door.

NOTE

> The letter that designates the chosen side of the cassette must face the operator when the cassette is installed.

2. Insert the cassette with the tape side up (Part A of Figure B-10)
3. Press the cassette down and into the transport (Part B of Figure B-10). Be sure that the capstan and reel rotors fit into the proper holes.
4. Close the transport door.
5. To remove a cassette from the transport, open the door to the first stop. A quick downward motion from this point causes the cassette to eject from the tape transport.

To rewind a tape that is positioned on a clear leader with the take-up reel (reel on the left) full and the END indicator lit, press the REWIND switch until the END indicator goes out. The tape is then past the clear leader and the END indicator goes on again when the tape is rewound.

NOTE

A tape must be rewound completely at the following times:

- After a cassette tape is installed in a tape transport.
- After every initialization of power.
- Before removing a cassette tape from a tape transport.
- Before switching off the power to the data terminal.

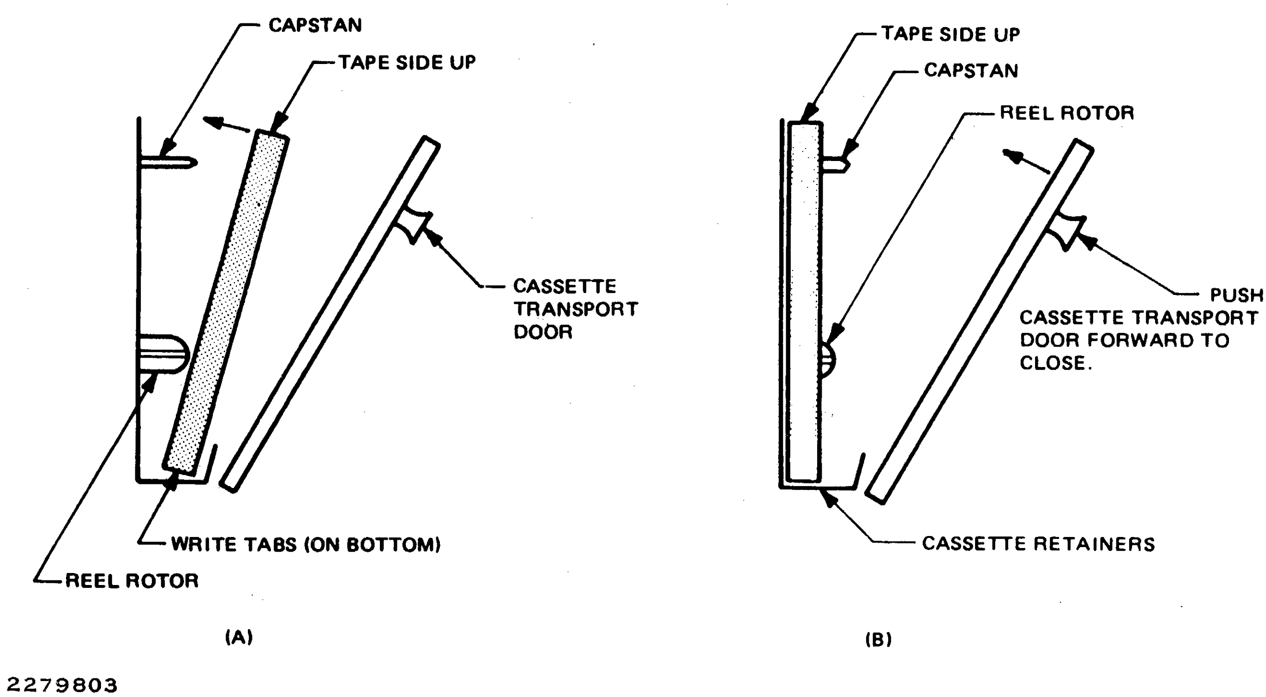

Figure B-10. Model 733 ASR/KSR Installing the Cassette

B.4.3 Copying the Master Cassette Tape

To copy the software programs from a master cassette onto another tape, perform the following steps:

1. Load the master cassette tape and a scratch cassette. Place the write protect tab of the scratch cassette in the write position, toward the outside of the cassette. (See Figure B-11.)
2. Close the tape transport doors.
3. Set the POWER switch to ON. The POWER indicator to the left of the switch should light.
4. Set the PLAYBACK and RECORD switches to LOCAL.
5. Raise the cover and set the ADC switch to the OFF position.
6. Press the appropriate end of the center switch in the upper row (PLAYBACK-RECORD) to place the scratch cassette in the record mode.
7. Press the REWIND switch for the master cassette and release. The END indicator should light when the tape is completely rewound.
8. Press the LOAD/FF switch for the master cassette and release. The READY indicator should light when the tape moves to the beginning-of-tape marker.
9. Press the REWIND switch for the scratch cassette and release. The END indicator should light when the tape is completely rewound.
10. Press the LOAD/FF switch for the scratch cassette and release. The READY indicator should light when the tape moves to the beginning-of-tape marker.
11. In the RECORD CONTROL section in the middle row, place the TAPE FORMAT switch in the LINE position and move the ON/OFF switch to ON.
12. Press the CONT START switch in the PLAYBACK CONTROL section. The master cassette begins to copy data to the recording scratch cassette. The character lights flash, indicating the data transfer. When the flashing stops, the copying process has completed.
13. Press the STOP switch in the PLAYBACK CONTROL section and the OFF switch in the RECORD CONTROL section.
14. Rewind and remove both cassettes from the cassette unit. Label the newly-recorded cassette and place the write protect tab in the protect position.

B.4.4 Placing the 733 ASR Online

To place the 733 ASR online, perform the following steps:

1. Verify that printer paper and cassette tapes are properly installed.
2. Set the POWER switch to ON. The indicator should light.
3. Set the ON LINE/OFF switch to ON LINE.
4. Raise the cover and set the ADC switch to the ON position.
5. Refer to Table B-3 and set the following switches to the LINE position: KEYBOARD, PLAYBACK, RECORD, and PRINTER.
6. When software is to be executed, set the TAPE FORMAT switch to LINE or CONT, depending on software requirements.
7. When either of the cassette units is not in the proper mode (RECORD or PLAYBACK), change the mode by pressing the PLAYBACK-RECORD switch. (Press the top of the switch to place cassette 1 in RECORD, or press the bottom of the switch to place cassette 2 in RECORD.)

B.4.5 Using a Tape Cassette

To properly use a tape cassette, the user should be aware of the purpose of the write tabs and observe some precautions when positioning or rewinding the tape.

B.4.5.1 Write Tabs. Movable tabs on the cassette case can be positioned to either allow or prevent writing data onto the tape. Both positions permit reading data from the tape.

Two holes in the cassette can be covered by the write tabs. Each hole corresponds to one side of the tape. When the desired tape side of a cassette is facing up, the hole for that side is on the bottom right of the cassette Figure B-11). To allow writing on the tape, the tab must cover the hole; to prevent writing, the tab must not cover the hole.

B.4.5.2 Cassette Positioning and Rewinding. When a tape is in record mode and the write tab is set to permit writing, the tape can be positioned with the load and fast forward switch but not with the playback control switches. When a tape is in record mode and the write tab is set to inhibit writing, the tape cannot be positioned with the load and fast forward switch. To position the tape with any of these switches, place the cassette drive for that tape in playback mode.

A tape should always be rewound completely at any of the following times:

- After a cassette tape is installed in a tape transport
- After every initialization of power
- Before removing a cassette tape from a tape transport
- Before switching off the power to the data terminal

To rewind a tape which is on clear leader with the take-up reel (the reel on the left) full and the END indicator lit, the REWIND switch must be pressed until the END indicator goes out. The tape is then past the clear leader and the END indicator goes on again when the tape is rewound.

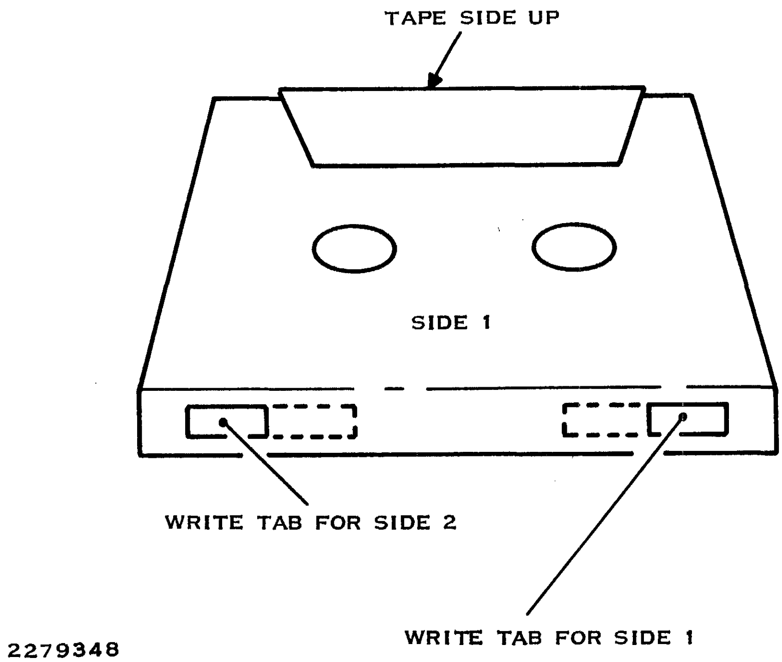

Figure B-11. Model 733 ASR/KSR Tape Cassette Write Tabs

B.4.6 Printing Tape Cassette Contents Offline

To print the contents of a cassette tape offline, perform the following steps:

1. Load the master cassette tape into one of the tape transports.
2. Close the transport door.
3. Set the POWER switch to ON. The POWER indicator to the left of the switch should light.
4. Set the KEYBOARD and RECORD switches to OFF and the PLAYBACK and PRINTER switches to LOCAL.
5. Press the REWIND switch for the master cassette and release. The END indicator should light when the tape is completely rewound.
6. Press the LOAD/FF switch for the master cassette and release. The READY indicator should light when the tape moves to the beginning-of-tape marker.

7. Set the PLAYBACK/RECORD switch in the center of the top row to place the master cassette in the PLAYBACK mode.

8. Press the CONT START switch in the PLAYBACK CONTROL section. The master cassette will begin to transfer data to the printer.

NOTE

To stop the print process, press the STOP side of the CONT START/STOP switch. If the cassette encounters an X-OFF character, it stops automatically. To continue printing, press CONT START.

9. Press the STOP side of the CONT START/STOP switch in the PLAYBACK CONTROL section.

10. Rewind and remove the cassette from the tape transport.

Appendix C

Model 743 KSR Data Terminal

C.1 GENERAL INFORMATION

This appendix describes how to operate a Texas Instruments Model 743 Keyboard Send/Receive (KSR) Data Terminal as part of a Model 990 Computer System with DNOS. For more detailed information about this terminal, refer to the *Model 743 KSR Data Terminal Installation and Operation* manual.

The Model 743 KSR Data Terminal is a data entry/inquiry terminal providing half- or full-duplex communication at 30 characters per second. The terminal transfers data to or from a computer in either the local or the remote mode of operation. The terminal consists of a standard ASCII keyboard and a thermal printer (see Figure C-1).

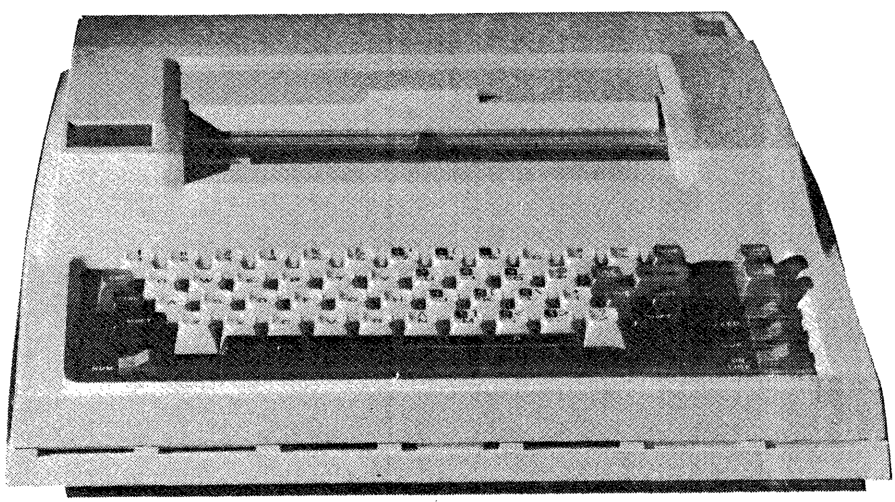

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Figure C-1. Model 743 KSR Data Terminal

C.2 CONTROLS AND INDICATORS

The Model 743 Data Terminal has the following controls and indicators that are described in the paragraphs that follow:

- AC power switch
- Print contrast control
- Transmit level control
- Keyboard control keys
- Carrier detect indicator
- Bell indicator

C.2.1 AC Power Switch

The ac power switch is a rocker switch located on the top right rear corner of the KSR unit as shown in Figure C-2. When the switch is pushed to the rear of the unit, the unit is ON.

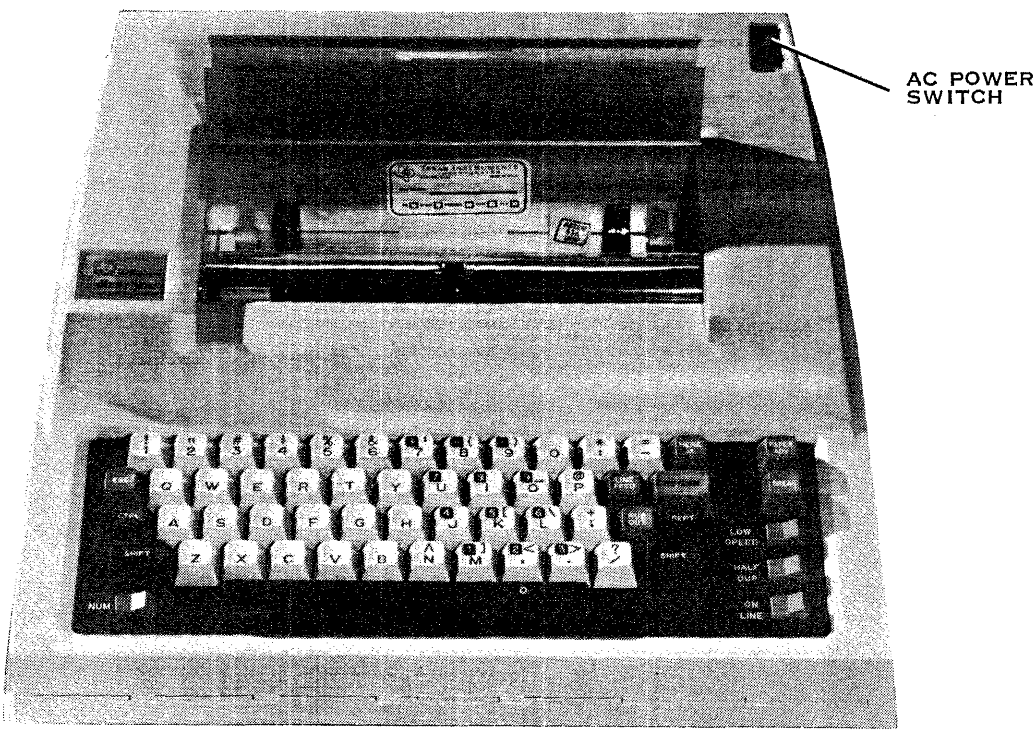

Figure C-2. Model 743 KSR AC Power Switch

C.2.2 Print Contrast Adjustment

The CONTRAST control is accessible through a hole on the right side of the KSR unit as shown in Figure C-3. The control is operated by a narrow-blade standard screwdriver inserted through the hole into the control shaft slot. Turn the control clockwise for darker printing, counterclockwise for lighter printing. Blurred print usually indicates the need for a lighter setting.

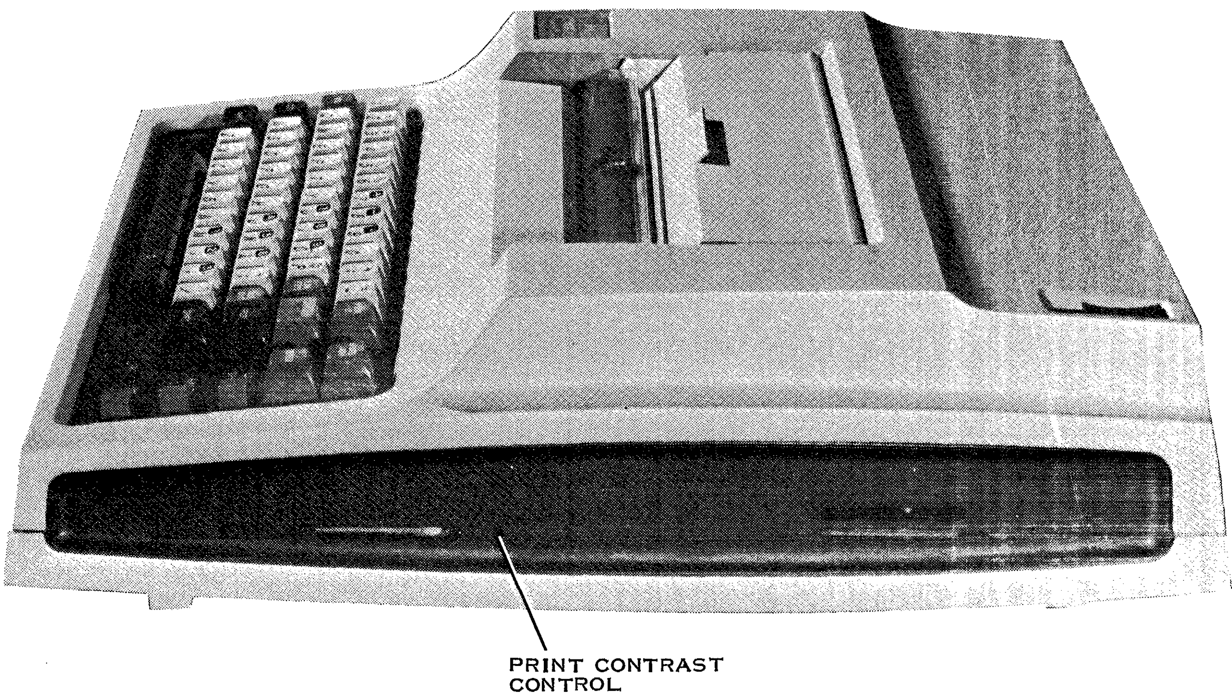

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Figure C-3. Model 743 KSR Print CONTRAST Control

C.2.3 Transmit Level Adjustment

The TRANSMIT LEVEL control access hole, located on the left side of the KSR unit, is not used with the Model 990 Computer.

C.2.4 Keyboard Controls

The keyboard has 12 control keys, which perform the following functions:

- Select data transfer or printing rate
- Select half- or full-duplex mode of operation
- Select online or local operation
- Advance the paper
- Control local typing and data transfer keyboard operation

NOTE

Since this appendix contains information on a specific terminal, generic key names are not used. The keys are referred to as they are labeled on the keyboard.

The individual control keys are shown in Figure C-4 and perform the following:

PAPER ADV (Paper Advance)
Pressing and holding this key returns the printhead to the left margin. The terminal continuously feeds paper until the key is released.

BREAK
Pressing this key when the terminal is set to online transmits a continuous stream of ASCII blanks over the communications line as long as the key is held down. Generally, the BREAK key is used in full-duplex communications networks to interrupt transmission from the remote equipment.

LOW SPEED
Pressing and locking this key sets the data transmission and reception speeds to 10 characters per second. Releasing the key sets the transmission and reception speeds to 30 characters per second.

HALF DUP (Half Duplex)
Pressing and locking this key sets the operating mode to half-duplex; releasing the key sets the operating mode to full-duplex.

In half duplex operation, data transmitted from the keyboard and data recieved from the host computer are both printed. If the keyboard and the receiver require the printer simultaneously, the keyboard has priority.

In full duplex operation, data can be transmitted to the host computer while the printer is receiving data from the host computer. Data sent to the host computer is not printed.

ONLINE
Pressing and locking this key connects the terminal to the communications line (online mode). Releasing the key disconnects the terminal from the communications line (local mode).

HERE IS
Pressing this key transmits the contents of the operational answer-back memory (if installed) to the communications line.

LINE FEED
Pressing this key advances the paper one line. The printhead does not move.

RETURN
Pressing this key returns the printhead to the left margin. The paper is not advanced.

NOTE

Both LINE FEED and RETURN must be pressed to obtain the equivalent of a conventional typewriter carriage return.

REPT (Repeat)
Pressing and holding this key while momentarily pressing another character key repeats that character until either the REPT key is released or another character key is pressed.

SHIFT
Pressing and locking this key permits generation of the characters shown in Figure C-5. Releasing this key permits generation of the characters shown in Figure C-4.

CTRL (Control)
Pressing this key permits generation of the control characters shown in Figure C-6.

NUM (Number)
Pressing this key permits generation of the characters shown in Figure C-7.

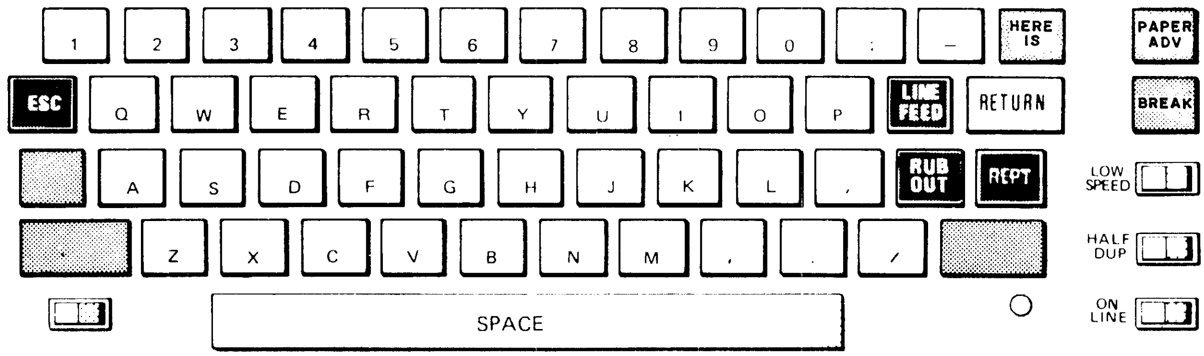

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Figure C-4. Model 743 KSR Codes Generated With No Mode Key Depressed

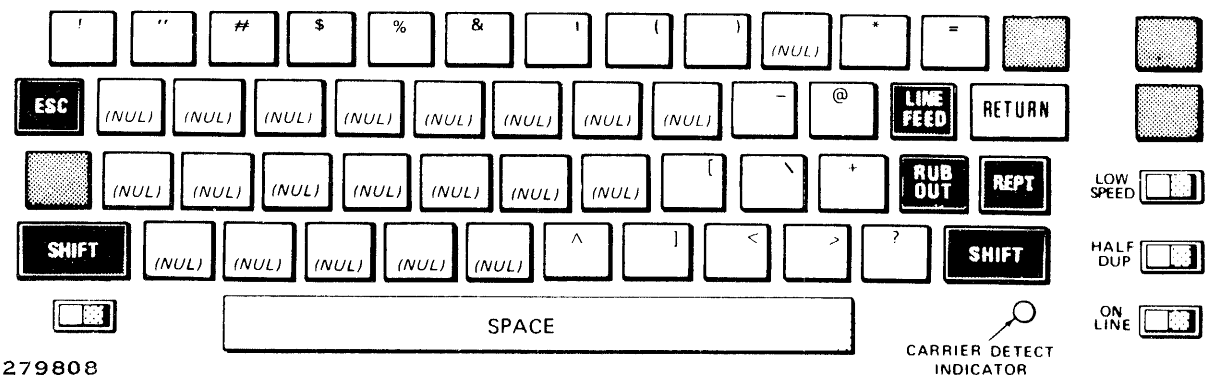

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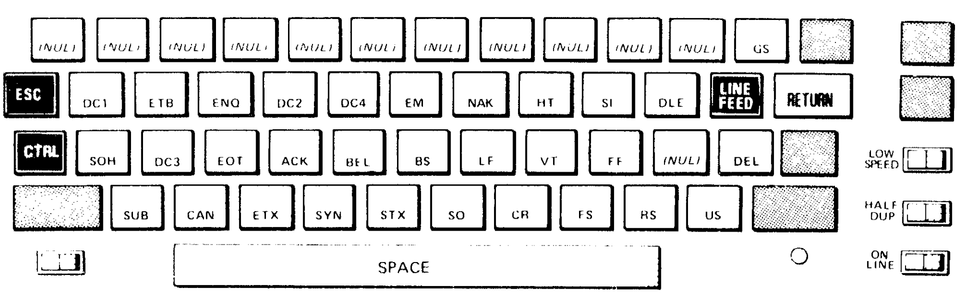
Figure C-5. Model 743 KSR Codes Generated With the SHIFT Key Depressed



NOTE: The CTRL (Control) key overrides the SHIFT key.

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Figure C-6. Model 743 KSR Codes Generated With the CTRL Key Depressed

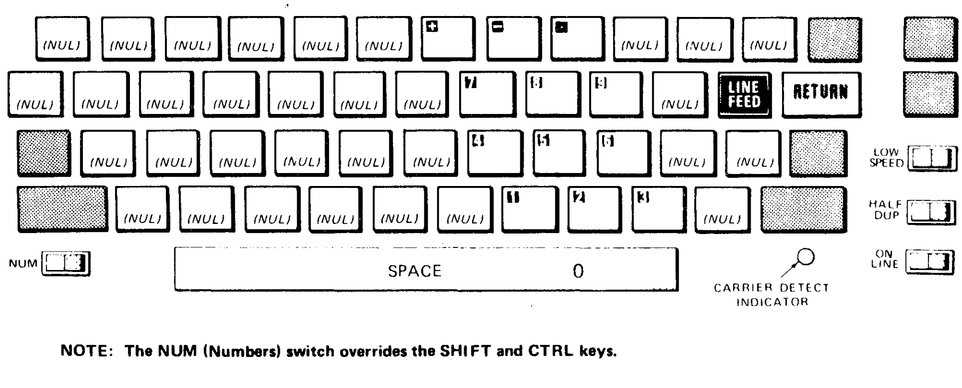

Figure C-7. Model 743 KSR Codes Generated With the NUM Key Depressed

C.2.5 Indicators

The Model 743 Data Terminal provides one visual and one audible indicator. These indicators are as follows:

Carrier Detect

When illuminated, this green lamp indicates the presence of the receive-data carrier frequency.

Bell Indicator

An audible sound is emitted when the BEL code is received from the keyboard or the communications line.

C.3 CLEANING THE PRINTHEAD

The printhead should be cleaned each time a new roll of thermal paper is loaded into the terminal and cleaned more often if the printed image begins to fade because of residue accumulating on the printhead. To clean the printhead, do the following:

1. Remove all thermal paper from the paper chute.
2. Insert in the paper chute a sheet of good quality bond paper that has been moistened (not wet) with denatured alcohol. Proceed as if loading thermal paper as described in the next paragraph.
3. Print five lines on the bond paper. Use the REPT key to accelerate the process. The printhead will not print a visible image on bond paper.
4. Press and hold the PAPER ADV key until the bond paper is ejected from the paper chute.

C.4 LOADING PAPER

The terminal must be loaded with paper before power is turned on. To load paper, refer to Figure C-8 and Figure C-9 and proceed as follows:

1. Open the keyboard/printer unit paper compartment.
2. Place the roll of paper on the holders. Ensure that the roll can turn freely.
3. Feed the paper over the dancing roller and down through the paper chute until it appears behind the window. Ensure that the paper is centered in the paper chute, and feeds straight into the chute.
4. Turn the power switch to ON by pushing it toward the rear. Press the PAPER ADV key. Ensure that the paper feed is smooth and straight.
5. Close the door of the paper compartment.

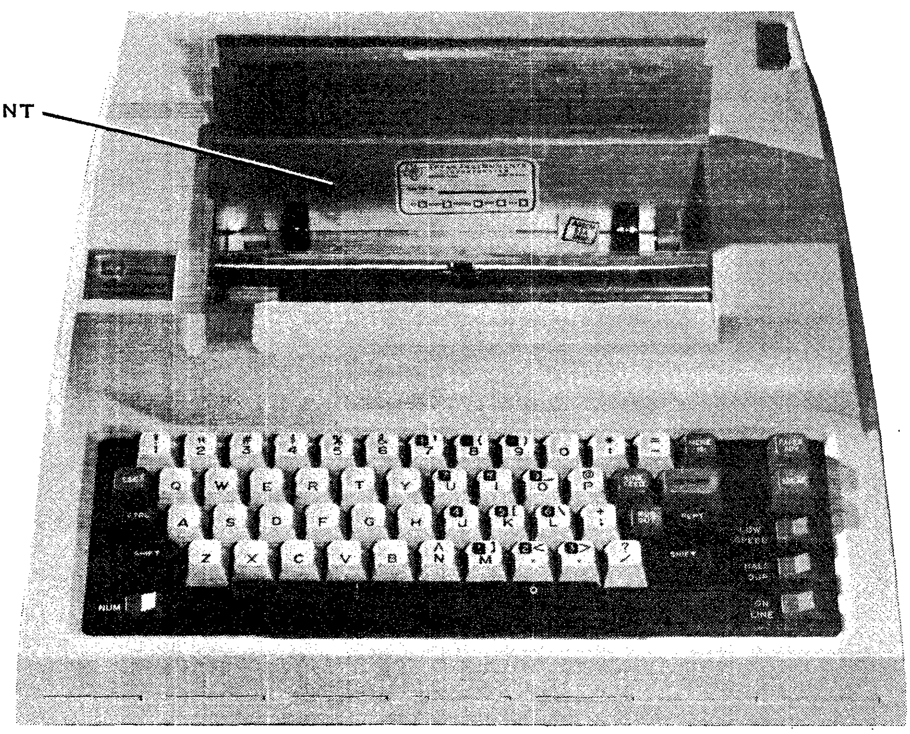

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Figure C-8. Model 743 KSR Paper Compartment

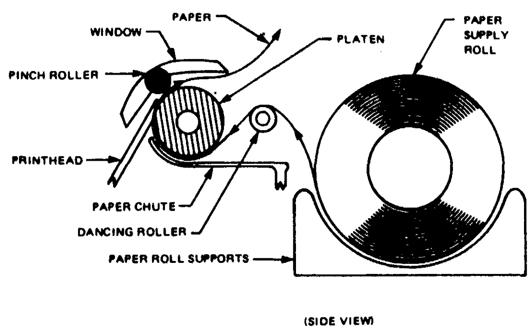

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Figure C-9. Model 743 KSR Paper Loading Diagram

Appendix D

Model 820 KSR Data Terminal

D.1 GENERAL INFORMATION

The Model 820 KSR Data Terminal is a send-receive, forms-programmable terminal with an impact printer (see Figure D-1). This appendix describes how to operate the 820 Terminal. For more detailed information, refer to the *Model 820 KSR Data Terminal Installation and Operation* manual.

Operator reference cards are located at the lower left corner of each terminal. These cards provide rapidly accessible information that aids an experienced person in operating the terminal.

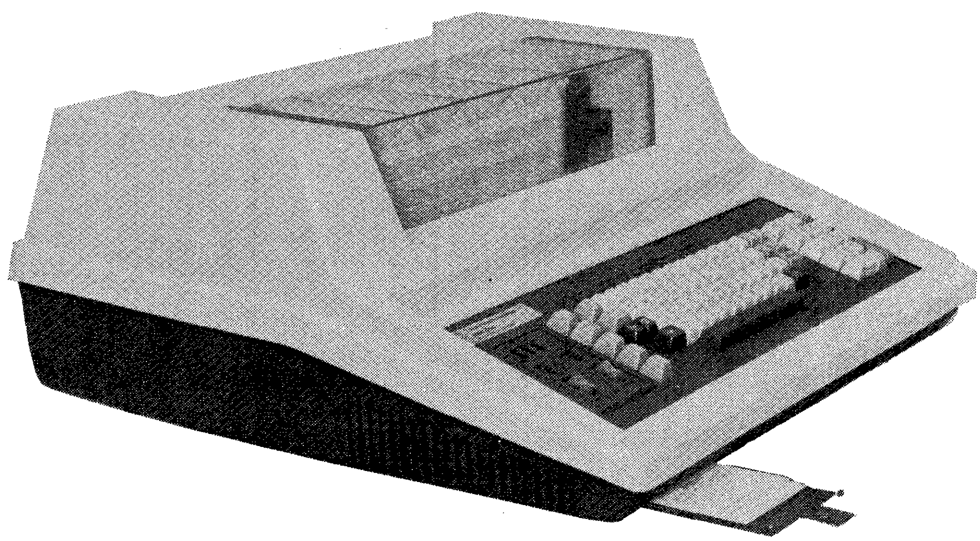

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Figure D-1. Model 820 KSR Data Terminal

D.2 CONTROLS AND INDICATORS

The controls and indicators of the 820 terminal are the ON/OFF switch, the CONFIGURE/OPERATE switch, controls for forms width and thickness, the Paper Out signal, the alarm, the control panel, the typewriter keyboard, and the numeric keypad. The locations of the controls and indicators are shown in Figure D-2 and Figure D-3.

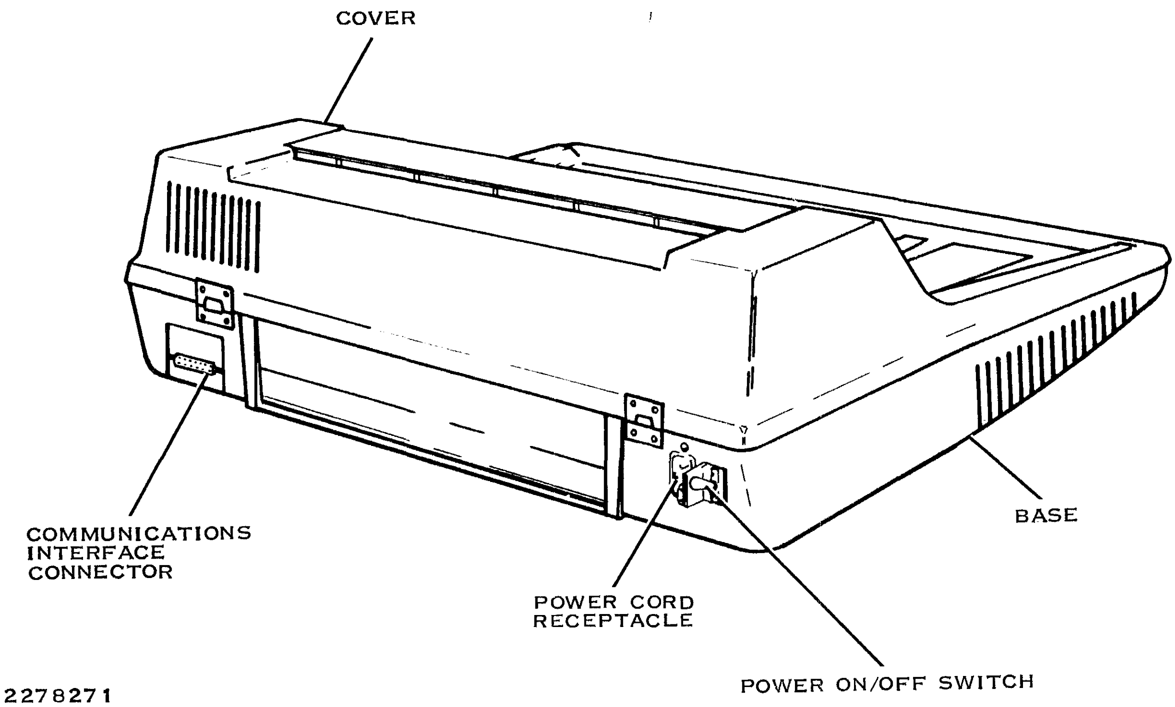

Figure D-2. Model 820 External Controls, Rear View

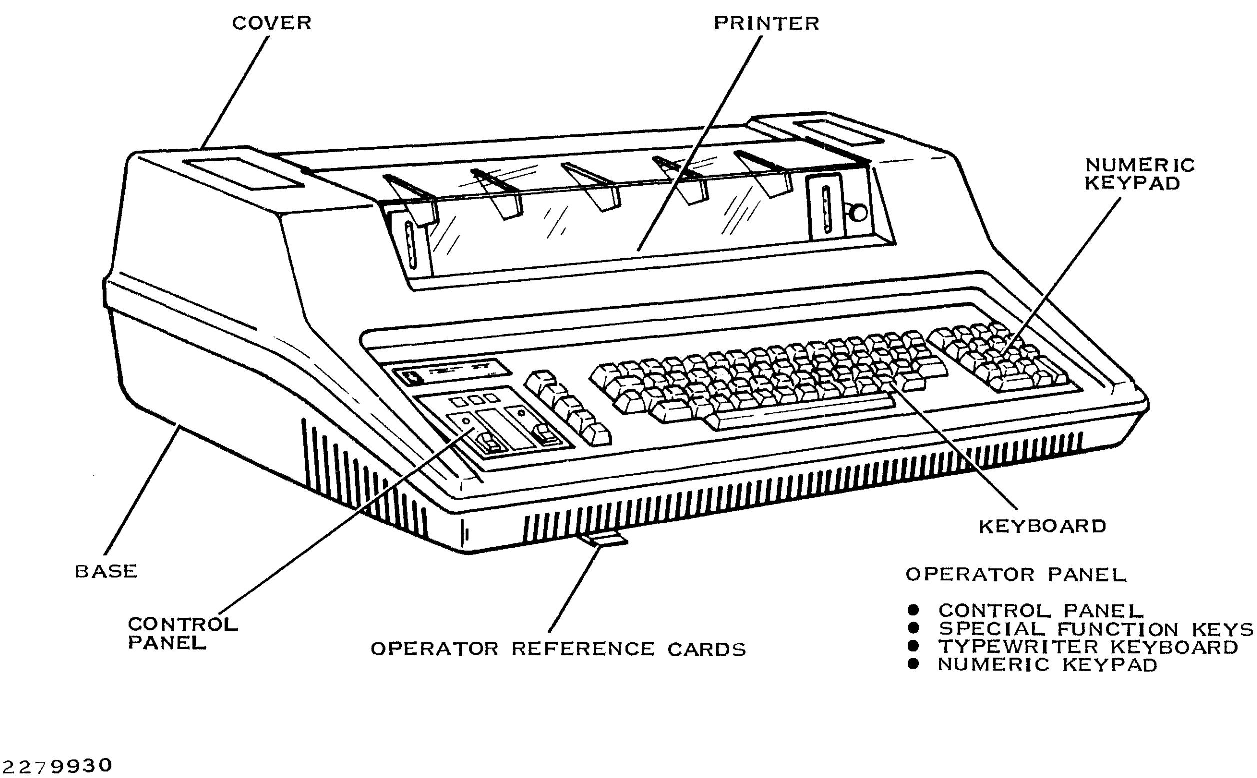

Figure D-3. Model 820 External Controls, Front View

D.2.1 Power ON/OFF Switch

The power ON/OFF switch is a rocker switch located on the left rear of the terminal. It controls ac power to the terminal.

D.2.2 Control Panel

The 820 control panel (Figure D-4) is located to the left of the keyboard as shown in Figure D-5

NOTE

Since this appendix contains information on a specific terminal, generic key names are not used. The keys are referred to as they are labeled on the keyboard.

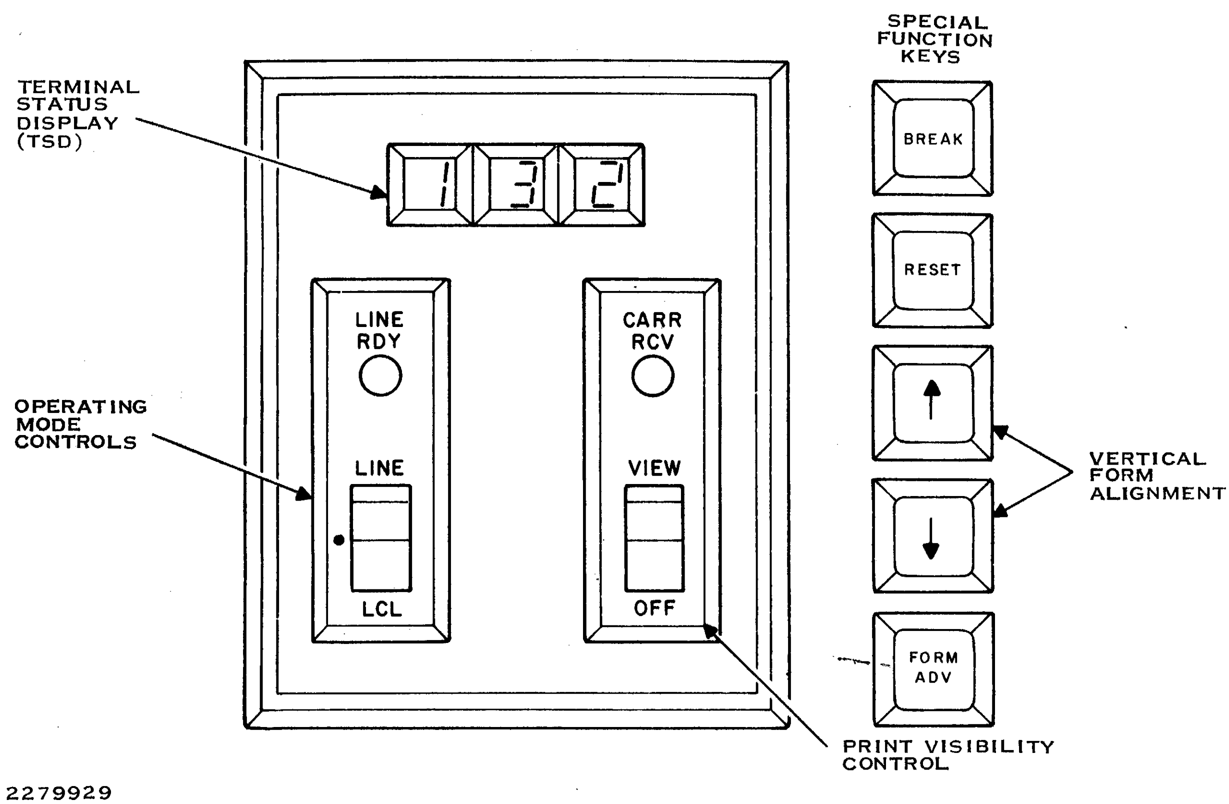

Figure D-4. Model 820 Control Panel

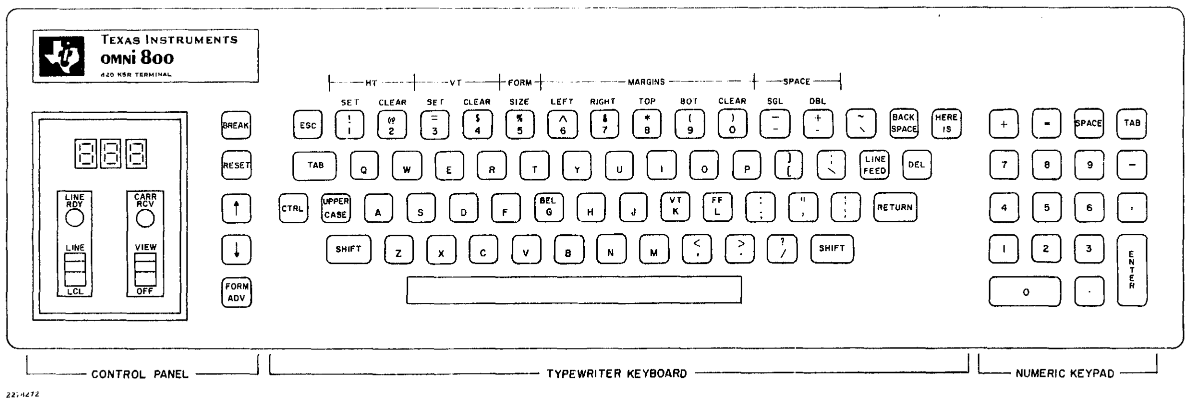

Figure D-5. Model 820 KSR Keyboard

D.2.2.1 LINE/./LCL Switch. The LINE/./LCL switch is used to select three of the four operating modes available on the 820 terminal. The three modes are line, standby, and local.

LINE mode
: When the LINE/./LCL switch is set to the LINE position, the keyboard and printer operate in conjunction with the communications interface as defined by the terminal configuration.

Standby mode
: When the LINE/./LCL switch is set to "." (the standby position), the printer and keyboard are disconnected from the communications interface. The standby position is used to change the ribbon or paper.

Local mode
: When the LINE/./LCL switch is set to the LCL position, the terminal operates in the same manner as a typewriter with the keyboard connected to the printer. When the switch is in this position, the user can operate the terminal in the configure mode by using the CONFIGURE/OPERATE switch (Figure D-10). The configure mode is described elsewhere in this appendix.

NOTE

Certain combinations of the CONFIGURE/OPERATE switch and LINE/./LCL switch are invalid. If one of these invalid combinations is entered, the terminal sounds a rapidly repeating alarm. Operations remain suspended and the alarm continues until a valid combination is entered.

Valid switch combinations are as follows:

LINE/./LCL switch	CONFIGURE/OPERATE Switch
LCL	CONFIGURE
LCL	OPERATE
.(Standby)	OPERATE
LINE	OPERATE

Invalid switch combinations are as follows:

.(Standby)	CONFIGURE
LINE	CONFIGURE

D.2.2.2 VIEW/OFF Switch. The VIEW/OFF switch controls initialization of the print visibility feature. When this switch is in the VIEW position and no printable or control characters have been received for more than one second, the printhead moves to the right to permit the last character printed to be viewed. When the printhead is positioned to the right, a small pointer affixed to the left side of the printhead indicates the column where the next printable character will be printed. The printhead automatically returns to its previous position when a new character is received for printing.

When the VIEW/OFF switch is in the OFF position, the printhead advances to the right as printable characters are received and the last character printed remains obscured by the printhead.

D.2.2.3 LINE RDY and CARR RCV Indicators. These indicators provide status information for reference when the LINE/./LCL switch is set to either the LINE or the standby position. Table D-1 describes how to interpret the LINE RDY (Line Ready) and CARR RCV (Carrier Signal Received) indicators.

Table D-1. Model 820 CARR RCV and LINE RDY Indicators

Communication Mode	CARR RCV Indicator	LINE RDY Indicator
Full Duplex	ON: Ready to Receive	Flashing: In Standby Mode or Communications Line not Connected
	OFF: Receive not Ready; no Carrier	ON: Communications Line Ready
		OFF: Communications Line not Connected

D.2.2.4 TSD Indicator. The Terminal Status Display (TSD) indicator is a 3-digit numeric indicator that normally displays the number of the next print column. For example, if the last character was printed in column 100, the TSD indicator displays 101. The TSD indicator also displays information such as error status and line number. Figure D-6 describes how to interpret the TSD indicator codes.

When the TSD indicator is flashing, an abnormal condition exists. The specific condition is indicated by the displayed code. These codes are prioritized in a descending numeric sequence. Code 00 has the highest priority. Code 39 has the lowest priority. When multiple conditions exist, the code with the highest priority is displayed first. The first displayed code is cleared by pressing the RESET key on the control panel. When the first code is cleared, it is replaced by the next higher priority until all conditions are displayed and cleared. Table D-2 lists the status codes and the recommended actions to be taken.

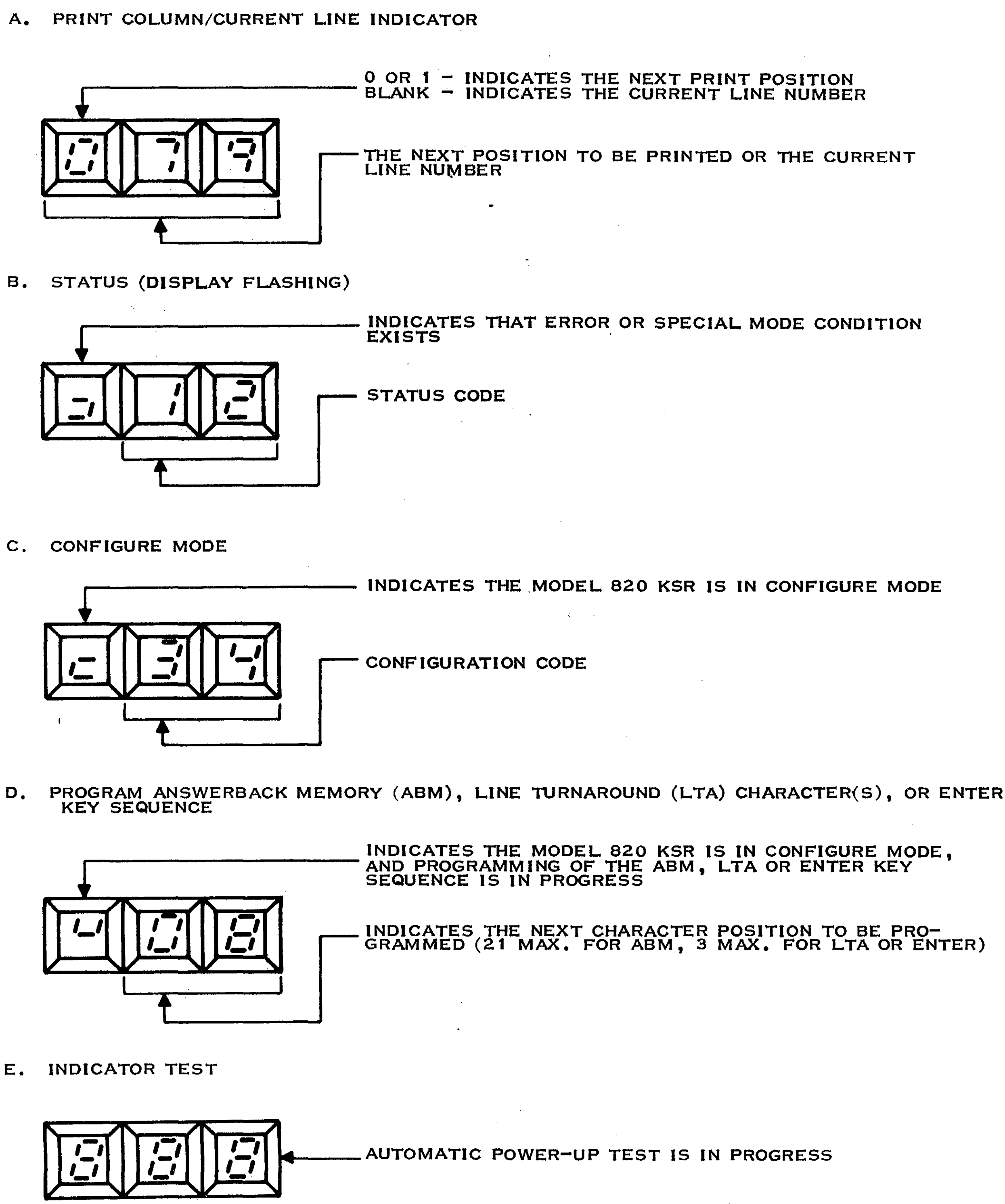

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Figure D-6. Model 820 Interpreting the TSD Indicator Display

Table D-2. Model 820 Status Codes

Type	Code	Definition	Action Required
I		Permanent Terminal Failures:	
	00	RAM memory	Equipment problem. Cycle power. If condition repeats, call for service. Errors of this type require that the 820 KSR be reconfigured.
	01	ROM memory I	
	02	ROM memory II	
	03	Nonvolatile memory	
II		Operator-correctable:	
	10	Leaving configure mode with half-duplex set but no LTA specified	Go into configure mode and specify LTA character or set full-duplex operation. Clear jam and reset Load paper and reset
	11	Carriage jam	
	12	Paper out	
III		Abnormal communications:	
	20	Clear-to-send time-out	Reset[1]
	21	Loss-of-carrier time-out	Reset[1]
	22	Wrong number time-out	Reset[1]1
	23	Receive buffer overflow	Reset[2]
	24	Parity error	Reset/Change parity[4]
	25	Transmit buffer overflow	Reset[1]
	29	Invalid ESC sequence[3] from communication line	None
IV		Special operating mode:	
	30	Keyboard locked	Reset
	31	Printer off	Reset
	39	Test in progress	Reset
V	ccc	Operator Error: Invalid ESC Sequence from keyboard	Reset and type valid command sequence

Notes:

[1] Automatically reset when the EIA Data Set Ready (DSR) turns on. If the problem persists after resetting the terminal, contact your service representative about possible data set failure.

[2] Automatically reset when the status report is transmitted in response to a request from the line.

[3] This code is not displayed, but it is transmitted as part of the status report.

[4] If resetting the terminal does not solve the parity error, refer to the *Model 820 KSR Data Terminal Installation and Operation* manual.

D.2.2.5 BREAK Key. When the BREAK key is pressed and released, the 820 terminal responds by generating a spacing signal. When data is received in the half-duplex mode, this signal turns off the reverse channel transmitter for 256 milliseconds. While the key is held down, the spacing signal continues to be sent.

D.2.2.6 RESET Key. When the RESET key is pressed and released, the 820 terminal returns to normal operation. This occurs after an abnormal status condition, indicated by a diagnostic code displayed on the TSD indicator, has been corrected.

D.2.2.7 FORM ADV Key. When pressed and released, the Form Advance (FORM ADV) key advances the paper one line. If pressed for longer than 0.25 second, this key advances the paper and positions the printhead to the top left margin of the next form.

D.2.2.8 Up Key. The up key is used for upward vertical forms alignment. Each time the up key is pressed, the paper advances 1/8 of a line space. Continuously pressing this key causes this advancement to proceed at an increased rate.

D.2.2.9 Down Key. The down key is used for vertical forms alignment. Each time the down key is pressed, the paper moves downward 1/8 of a line space. Continuously pressing this key causes continuous reverse line feeds of 1/8 of a line space each.

D.2.3 Model 820 Typewriter Keyboard

The standard typewriter keyboard for the 820 terminal is shown in Figure D-7. The following paragraphs describe the control keys on the typewriter keyboard.

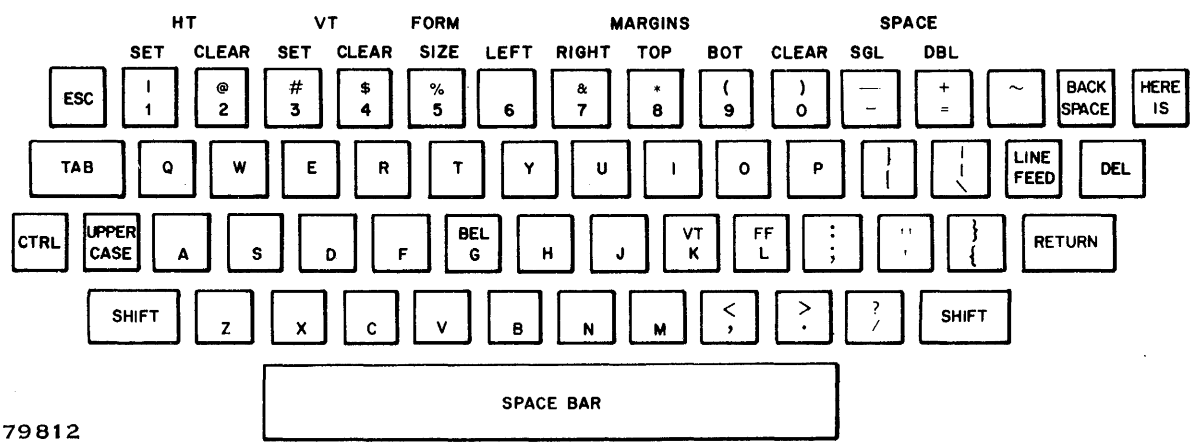

Figure D-7. Model 820 Typewriter Keyboard

D.2.3.1 SHIFT and UPPERCASE Keys. The SHIFT key is used in the same manner on the 820 terminal as on a typewriter. If the operator presses one of the alphabetic keys (A through Z) while pressing the SHIFT key, the keyboard generates uppercase characters. Pressing an alphabetic key without pressing the SHIFT key generates lowercase letters. If one of the nonalphabetic, two-function keys (such as the 1/! key) is pressed while the SHIFT key is pressed, the character or function appearing on the upper half of the key is generated. Pressing a nonalphabetic, two-function key without pressing the SHIFT key generates the character or function that appears on the lower half of the key.

The UPPERCASE key is an alternate-action locking key. If this key is locked in the down position, the keyboard cannot generate lowercase letters. Only letters A through Z are affected by the UPPERCASE key.

D.2.3.2 CTRL Key. The Control (CTRL) key is used primarily in communication operations. It is also used in some of the self-test features of the terminal. When the operator presses and holds the CTRL key in the down position, certain keyboard keys generate the ASCII control character codes shown in Figure D-8, regardless of the positions of the SHIFT and UPPERCASE keys.

D.2.3.3 ESC Key. The Escape (ESC) key is used in the local mode to initiate the various commands when using the device forms control feature.

D.2.3.4 TAB Key. The TAB key is used in the local mode to initiate special sequences that cause the printhead to advance to predetermined tab stops.

D.2.3.5 BACKSPACE Key. When used in the local or standby mode, the BACKSPACE key causes the printhead to move one character space to the left. When the BACKSPACE key is used in the line mode, its action depends on the computer software.

D.2.3.6 HERE IS Key. The HERE IS key is used in the line mode to initiate the transmission of a predefined answer-back memory (ABM) message.

D.2.3.7 LINE FEED Key. The LINE FEED key is used in the local or standby mode to advance the paper one line space when pressed and released. If the LINE FEED key is pressed and held, the printer continues to advance the paper at an increased rate until the key is released.

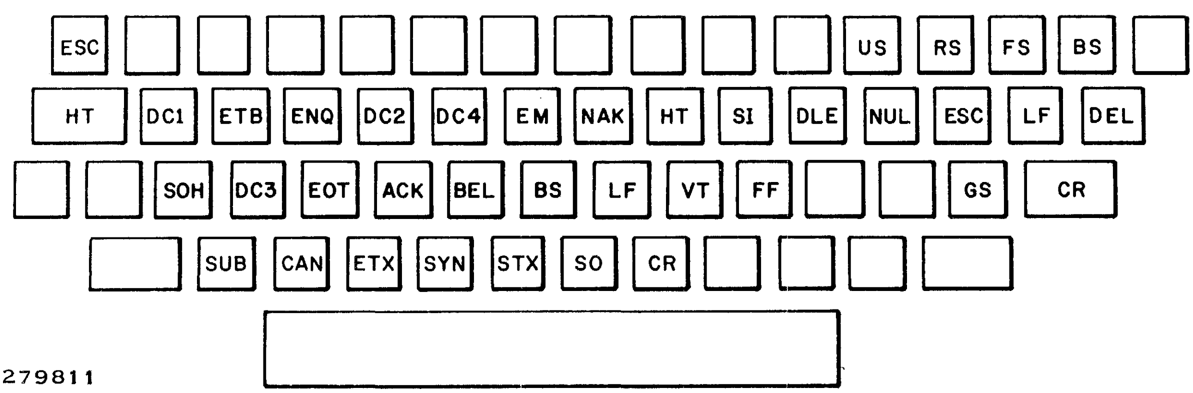

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Figure D-8. Model 820 Control Character Keyboard Layout

D.2.3.8 DEL Key. The Delete (DEL) key is used when the 820 KSR terminal is in the line or configure modes. The function of the DEL key when used in the line mode is determined by the computer software. In the configure mode, the DEL key is used to eliminate and change the line control, transmission control, and terminal control configurations.

D.2.3.9 RETURN Key. The function of the RETURN key depends on the operating mode of the terminal. If the terminal is operated in the Local or Standby mode, the RETURN key is used to move the printhead to the left margin if it is not already in column 1. If the terminal is in the configure mode, the RETURN key is used as a special command key that must be pressed after an instruction is given to the terminal. If the RETURN key is not pressed in this case, the terminal does not execute the instruction. When used in the line mode, the function of the RETURN key is determined by the computer software.

D.2.4 Numeric Keypad

The numeric keypad provides the 18 keys shown in Figure D-9. The ENTER key, user-programmable from the keyboard, can be set to generate a sequence of up to three characters. The SPACE and TAB keys operate in the same manner as the corresponding keys on the typewriter keyboard.

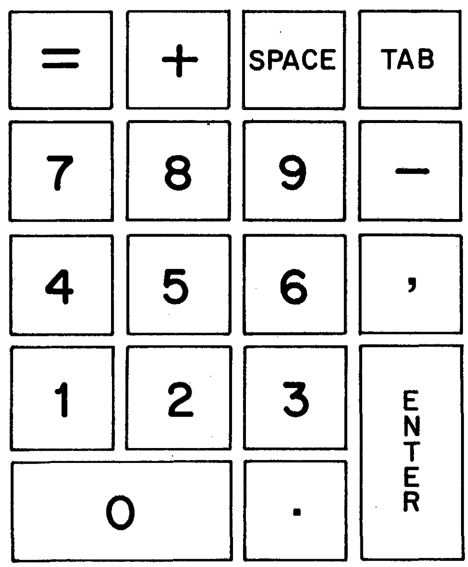

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Figure D-9. Model 820 Numeric Keypad

D.3 CONTROLS AND INDICATORS NOT ON THE OPERATOR PANEL

The following paragraphs describe controls and indicators that are not on the 820 operator panel. These include the following:

- CONFIGURE/OPERATE Switch
- Forms Width Adjustment Control
- Forms Thickness Adjustment Control
- Paper Out Signal
- Audio Alarm

Figure D-10 shows the location of three of the five controls and indicators (the internal controls).

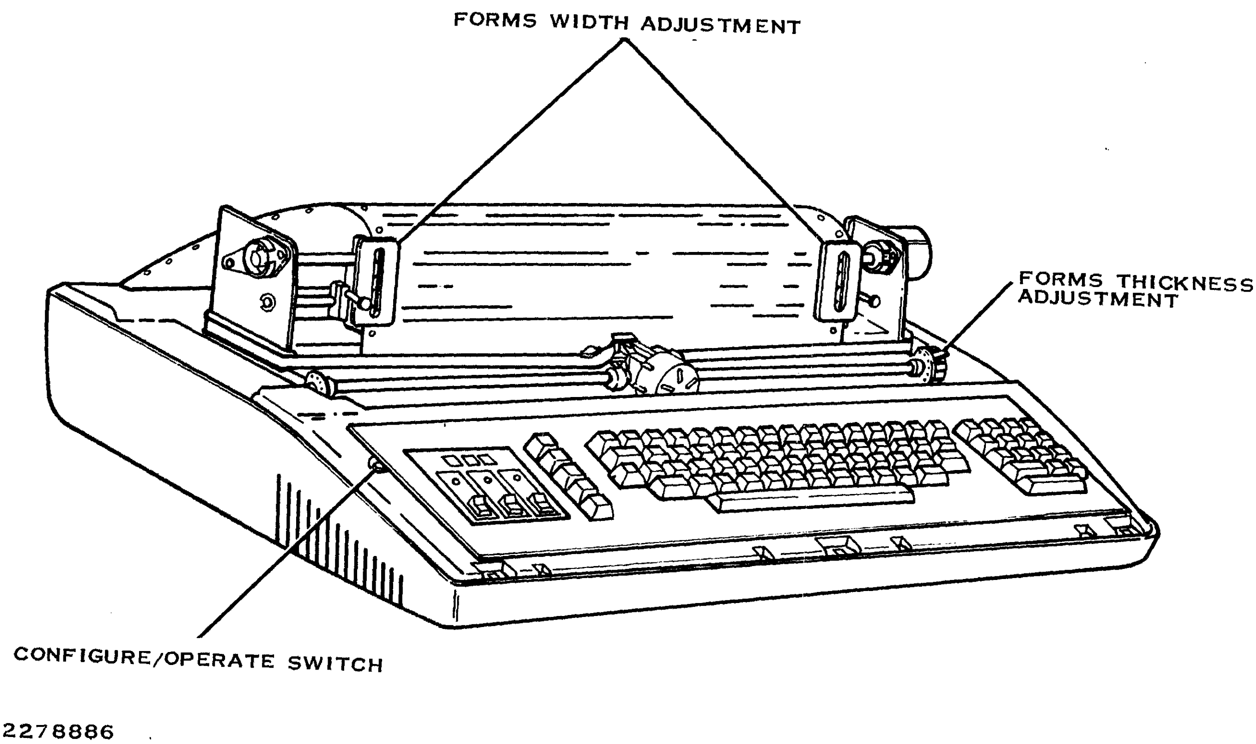

Figure D-10. Model 820 Internal Control Locations

D.3.1 CONFIGURE/OPERATE Switch

The CONFIGURE/OPERATE switch (Figure D-10) is located to the left of the LINE/./LCL switch, under the top cover, and is partially obscured by the keyboard mask overlay. In conjunction with the LINE/./LCL switch, the CONFIGURE/OPERATE switch enables the user to program the terminal to accept certain host-dependent variables (configuration or operating parameters) when in the configure mode. These variables are controlled by an internal computer (microprocessor). The special configure mode enables the user to communicate directly with the internal computer in order to set up or change the operating parameters. All commands are simple sequences entered via the terminal keyboard. When the command entries are completed and the CONFIGURE/OPERATE switch is returned to the OPERATE position, any one of the three normal operating modes (local, standby, or line) is available to the user.

D.3.2 Forms Width Adjustment

The 820 printer mechanism can be adjusted to accept paper widths of from 76 to 378 millimeters (3 to 14.9 inches). Forms width adjustment is accomplished by repositioning one or both of the tractor mechanisms that engage the holes in the paper (see Figure D-10). The procedure for adjusting the forms width is discussed in the paper loading instructions in Figure D-12.

D.3.3 Forms Thickness Adjustment

The printhead may be adjusted for various forms or paper thicknesses by moving the lever of the forms thickness adjustment control toward the front for thicker (multiple-part) forms or toward the rear for thinner form sets or for a single sheet, as shown in Figure D-11.

To check for satisfactory positioning of the lever, type some characters with the LINE/./LCL switch set to LCL and observe the printed results. If the characters are not fully formed or appear too light, move the lever toward the rear of the terminal. If the characters are extremely dark or ribbon smudging occurs, move the lever toward the front of the terminal.

D.3.4 Paper Out Signal

When about one inch of paper remains in the printer, an audible alarm is sounded and a paper-out error code is displayed in the Terminal Status Display (TSD) indicator. It is the user's responsibility to avoid printing beyond the limits of the paper. If the user reloads paper and then actuates the RESET key, the error code in the TSD is turned off and all characters in the buffer memory are printed.

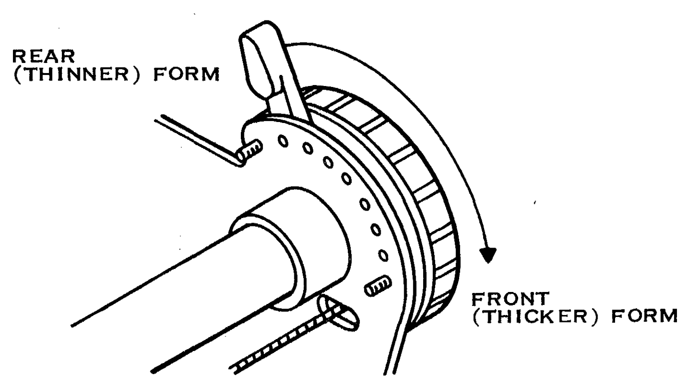

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Figure D-11. Model 820 Forms Thickness Adjustment Control

D.3.5 Audio Alarm

The 820 sounds a beep to indicate the completion of terminal activity. There are three different types of tones:

1. A short tone (1/12 second) signifies completion of a normal operation
2. A rapidly repeating short tone indicates that an attempt to go to configure mode has been made while the 820 is in the line or standby mode or an attempt to go to line mode has been made while the 820 is in the configure mode.
3. A long tone (one second) signifies that an error condition has been identified.

D.4 LOADING PAPER

The 820 terminal uses continuous form paper with standard perforations on each edge. Paper widths from 76 to 378 millimeters (3 to 14.9 inches) can be accommodated. Using either the rear chute or the bottom chute (see Figure D-12), single- or multiple-part forms (one original and up to five copies) can be printed on paper with the following weight specifications:

Single-part forms:

6.8-kilogram (15-pound) stock minimum

Multiple-part forms:

Original — 5.4-kilogram (12-pound) stock maximum
Copies — 5.4-kilogram (12-pound) stock maximum
Carbon Paper — 3.4-kilogram (7.5-pound) stock maximum

Card stock of up to 0.254 millimeter (0.010 inch) thick can be used for either single-part forms or last-copy-only using the bottom chute. In any case, the total form thickness should not exceed 0.533 millimeter (0.021 inch).

The power need not be turned off when paper is being loaded. Before loading, raise the cover of the terminal and note that the paper loading instructions also appear inside the cover. To load paper in the printer, refer to Figure D-12.

CAUTION

To prevent possible damage to the printhead, do not attempt to print without paper and ribbon installed.

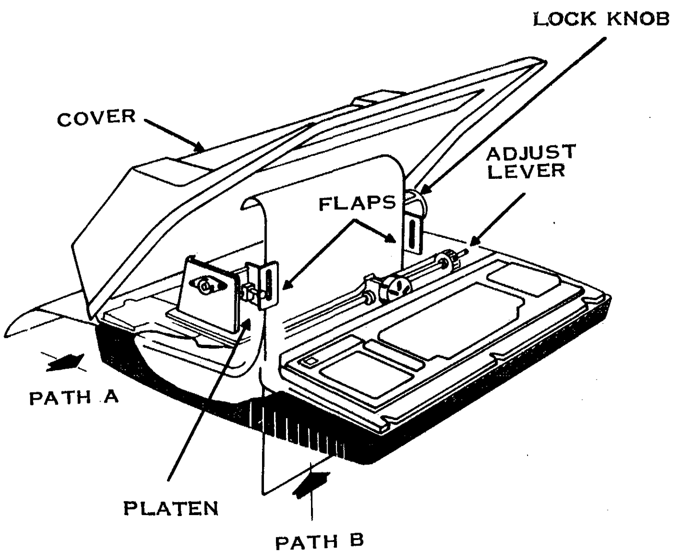


Figure D-12. Model 820 Paper Loading

D.5 INSTALLING THE RIBBON

The 820 printer uses a nylon ribbon mounted on two spools. The length of the ribbon can be either 54.9 meters (60 yards) or 36.6 meters (40 yards). The width is 12.7 millimeters (0.5 inch). The part number for the ribbon is 996704-0001, 996241-0001, or equivalent. Before installing the ribbon, lift the top cover and observe that the ribbon loading instructions shown in Figure D-13 also appear inside the cover.

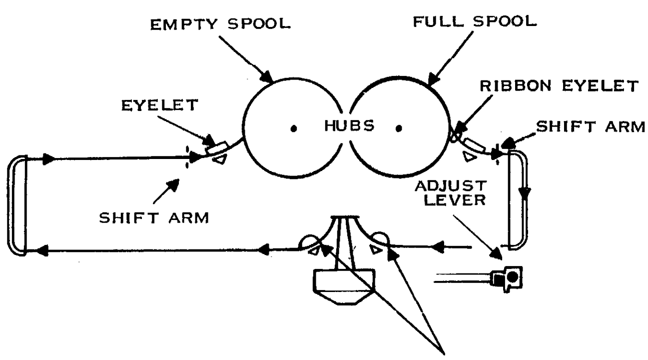


Figure D-13. Model 820 Ribbon Installation Instructions

D.6 POWERING UP THE TERMINAL

To power up the 820 terminal, proceed as follows:

NOTE

When applying power to an 820 terminal for the first time, check the configuration label to be sure the proper voltage is being applied.

1. Ensure that the LINE/./LCL switch is set to the LCL position (lower edge pressed).
2. Ensure that the internal CONFIGURE/OPERATE switch is in the OPERATE position (pushed toward the upper edge of the keybcard).
3. Set the power ON/OFF switch (located on the rear panel next to the power cord) to the ON (up) position.

Observe that all control panel indicators light for about one second, the Terminal Status Display (TSD) indicator displays an 888 code, and the printhead aligns with the left margin.

The normal termination of this sequence is indicated when the terminal generates a short, audible tone. At this time, the TSD displays the number of the column where the printhead is positioned (the left margin).

If a failure occurs during the power-up procedure, the terminal sounds a long, audible tone and flashes an error condition code in the TSD.

NOTE

A failure in the power-up procedure changes the terminal configuration parameters and makes it necessary to reconfigure the terminal.

- The terminal is offline.
- The standard 820 configuration parameters are stored in nonvolatile memory.
- The buffer memory is empty.

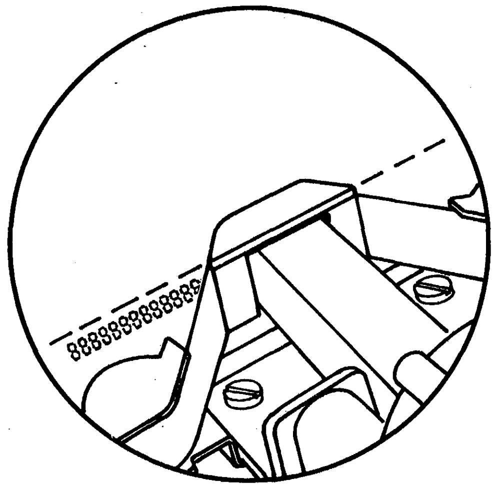
This completes the power-up procedure if the following conditions are true:

- The forms (paper) are aligned as desired and the ribbon is properly installed.
- The specific communication I/O interface cable has been installed.
- No changes to the previously mentioned initial conditions are desired.

D.6.1 Setting the Top-of-Form

With the power on, use the following procedure to set the top of form:

1. Using the LINE FEED, UP, and DOWN keys, position the paper so that the printhead prints characters just below the perforated line, as in the following illustration:



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2. Determine the form length in lines. To determine the length in lines, multiply the form length (in inches) by six. (If the form length in inches is not known, proceed to step 4.) For example, if a form is 11 inches long, the form length in lines is 66 lines. A 14-inch form (84 lines) is the maximum form length that can be accommodated by the terminal.

3. Enter the form length (in lines) by pressing and releasing the following keys in sequence:

   ESC 5 n n ;

   nn is the two-digit number representing the form length in lines. For example, if an 11-inch (66-line) form is used enter the following sequence:

   ESC 5 6 6 ;

   If the form length is less than ten lines, only one number need be entered. For example, if the form length is seven lines, enter the following:

   ESC 5 7 ;

4. If the length of the form (in inches) is not known, an alternative method for setting the form length is as follows:

   a. After completing step 1, press the following keys in sequence:

      ESC 5 8 4 ;

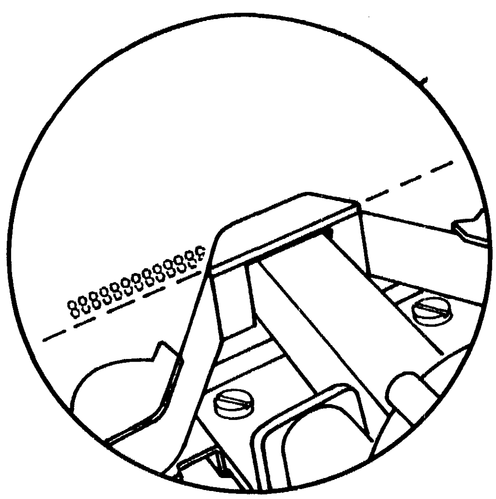
      This sequence sets the form length at the maximum number of lines.

   b. Press the following keys in sequence:

      ESC 5 ;

      This establishes the top of the form.

   c. Using the LINE FEED key, advance the paper to position the printhead so that it prints on the line above the perforation at the bottom of the form (as shown below).



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   d. Press the following keys in sequence:

      ESC 5 0 ;

      This establishes the bottom of the form and completes the process of entering the form length into the terminal.

5. Once the form length has been entered, each time the FORMS ADV key is pressed or the CTRL and FF keys are pressed simultaneously, the terminal printer advances the paper one form length.

D.6.2 Setting Left and Right Margins

The procedure for setting the left and right margins is as follows:

1. Press the ESC key and then the space bar. This causes the TSD to display the column number.
2. Press the space bar to position the printhead to the column where the first character is to be printed.
3. Press the ESC key and then the 6 key; this sets the left margin.
4. Press the space bar to position the printhead to the selected right-margin column.
5. Press the ESC key and then the 7 key; this sets the right margin.

Refer to Figure D-14 for a pictorial representation of form margins.

D.6.3 Setting Top and Bottom Margins

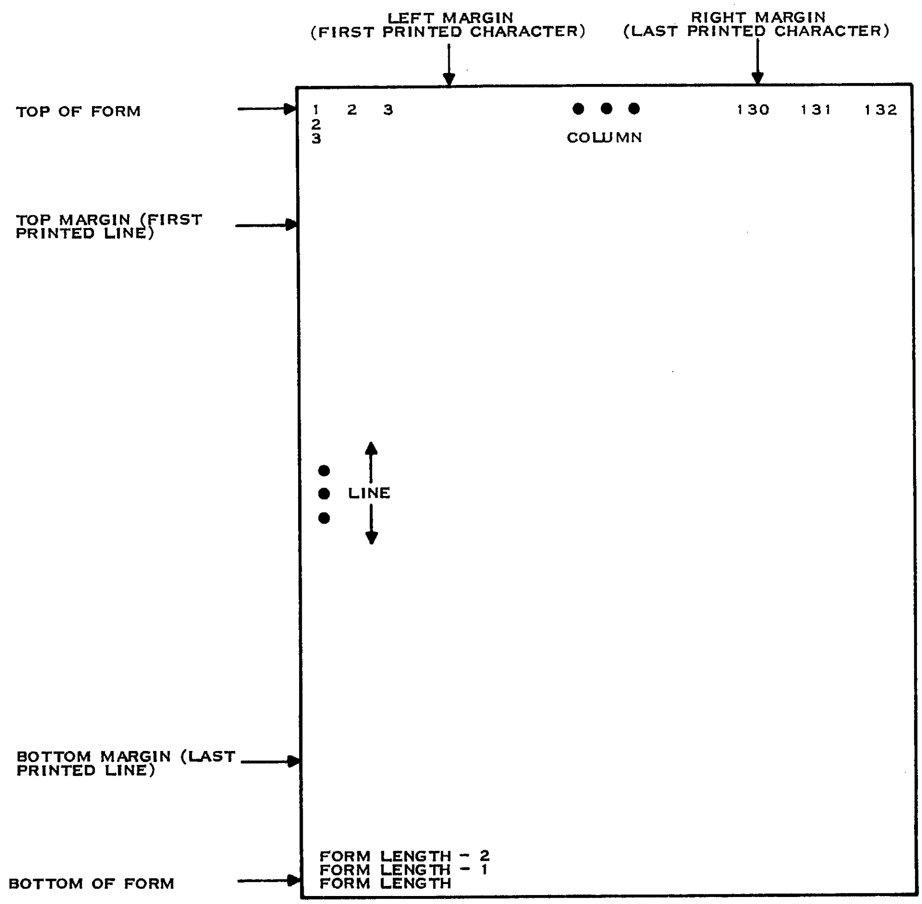
The top and bottom margins establish the area in which data may be printed on the form. When the bottom margin is reached, the terminal advances the paper to the top margin of the next form. Use the following procedure to set the top and bottom margins:

1. Press the ESC key and then the LINE FEED key; this causes the TSD to display the line number.
2. Press the FORM ADV key to advance the paper to the top of the next form.
3. Press the LINE FEED key to position the printhead to the line where the first line is to be printed.
4. Press the ESC key and then the 8 key; this sets the top margin.
5. Press the LINE FEED key to position the printhead to the line where the last line is to be printed.
6. Press the ESC key and then the 9 key; this sets the bottom margin.

D.6.4 Changing Margins

To reduce margin limits, simply repeat the steps given in the two previous paragraphs. Reducing the margins will set the left or top margin to a greater value and will set the right or bottom margins to a lesser value.

To establish margins outside the previously set bounds, clear the margins (by pressing the ESC key and then the 0 key) before trying to set new margins.



TOP OF FORM = LINE 1
1 ≤ FORM LENGTH ≤ 84
1 ≤ TOP MARGIN ≤ BOTTOM MARGIN ≤ FORM LENGTH
1 ≤ LEFT MARGIN ≤ RIGHT MARGIN ≤ 132

DEFAULT VALUES (NO DFC OPTION)
BOTTOM MARGIN = FORM LENGTH = 66
TOP MARGIN = TOP OF FORM = 1
LEFT MARGIN = 1
RIGHT MARGIN = 132 (OR 80, IF CONFIGURED)

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Figure D-14. Model 820 Form Margin Reference

D.6.5 Clearing Margins

Typing the ESC 0 sequence causes the existing margins to be replaced by the following default margins:

Top	Line 01
Bottom	Line 66
Left	Column 001
Right	Column 132 or 80 (depending on the terminal configuration)

D.6.6 Setting the Tab Stops

Two types of tab stops can be set: horizontal and vertical. The horizontal and vertical tab stops are controlled by the following ESC sequences:

Sequence	Meaning
ESC1	Set horizontal tab at present position
ESC2	Clear horizontal tab at present position
ESC3	Set vertical tab at present position
ESC4	Clear vertical tab at present position

D.6.7 Character and Line Spacing

Four command sequences are available to set printer-line and character-spacing parameters:

Sequence	Meaning
ESC –	Set 6 lines per inch (single space)
ESC =	Set 3 lines per inch (double space)
SC>	Set 10 characters per inch (standard font)
ESC<	Set 16.5 characters per inch (compressed font)

The compressed print feature permits printing 16.5 characters per inch in addition to the standard 10 characters per inch. The 16.5 characters-per-inch mode permits printing 132 column lines on forms that are 215.9 millimeters (8.5 inches) wide. (The maximum line length is 132 columns.)

NOTE

Selecting compressed print on an 820 terminal that does not have the compressed print feature causes an abnormal printing operation.

The compressed print feature may be downloaded from the communications line or entered from the keyboard by using the appropriate ESC sequences. Use the following procedure to enter the standard/compressed print selection commands via the keyboard:

- To select the compressed print feature via the keyboard, press the following keys in sequence:

  ESC C P D \

- To select the standard print via the keyboard, press the following keys in sequence:

  ESC C P C \

D.7 TURNING OFF THE TERMINAL

Turning off the 820 terminal requires only that the power ON/OFF switch (at the rear left of the terminal when facing the front) be set to OFF. When power is again applied, the terminal returns to the conditions that were present when the power was turned off.

Appendix E

Model 840 RO Terminal

E.1 GENERAL INFORMATION

The Model 840 Receive Only (RO) terminal is a friction-feed, multicopy, impact printer. The 840 RO communicates in the serial asynchronous mode at data rates of 110 to 600 bits per second (bps) for standard configuration, up to 9600 bps optionally. The terminal prints at 75 characters per second and has a 256-character receive buffer.

This appendix describes the Model 840 RO and gives an overview of terminal operation. For more detailed information concerning any of the topics covered, refer to the *Model 840 RO Printer Installation and Operation Manual*, part number 2302695-9701.

E.2 SYSTEM DESCRIPTION

The 840 RO terminal is a compact, self-contained unit, similar to standard office printers, and is well suited for computer output operations. The following paragraphs discuss the 840 RO components for printing and the controlling of terminal activities.

E.2.1 Printing

The 840 RO prints by means of a serial wire-matrix impact printhead that uses a 9-dot or 7-dot column to form a 9-by-9 or 9-by-7 dot matrix for character generation. The printer uses fan-fold or roller paper and features a wide carriage and tractor drive. The printer is capable of being driven by output from a computer, a video terminal, or other data processing equipment in applications that require hard-copy output of data.

E.2.2 Control Electronics

The control electronics in the 840 RO consist of a stored-program microprocessor that controls all character recognition, printing, and paper movement. Basic operating, data processing, and self-test routines for the system are stored in read-only memory (ROM). Random-access memory (RAM) is used to store vertical format control routines. These routines are programmed in one of the following ways:

- Locally by the user
- Remotely by the computer system over the communications line if the device forms control (DFC) option is installed

Elements of the stored program can be altered from the keypad of the 840 RO terminal. This eliminates the need for most hardware-configurable options and minimizes the number of special operating controls.

E.3 SYSTEM CONFIGURATION

The 840 RO terminal system operating under DNOS can be configured to operate via a TTY/EIA interface module or an external auxiliary port. The following paragraphs discuss these configurations.

E.3.1 TTY/EIA Interface Module

The TTY/EIA interface module can be installed in a model 990 or Business Systems computer to provide interface between the computer and an 840 RO terminal. Using a data cable to connect to the computer system, this module (part number 945075-0001) is the standard configuration for the 840 RO terminals. The module installs into a communications register unit (CRU) slot in either the computer main chassis or a CRU expansion chassis.

E.3.2 External Auxiliary Port

The 840 RO printer can be connected directly to an asynchronous communications port on the Model 940 or 931 VDT. Operation in this manner permits hard-copy output to be made from the terminal. This configuration allows the printer to be programmed from the terminal.

E.3.3 Configuration Parameters

The terminal configuration controls a number of parameters that affect the ability of the 840 RO and the computer system to communicate. These parameters are baud rate, parity, and ready/busy indication. In each case, the terminal configuration must match that of the computer hardware and interface. The recommended configuration for the 840 RO is as follows:

- Computer configuration codes
  - Interface = TTY/EIA
  - Communications mode = 13
  - Baud rate = 27
  - Parity = 31, 32, 36, or 37
  - DC1/DC3 = 83
  - Other = 41, 96
- 940 and 931 terminal configuration codes
  - Interface = auxiliary port
  - Communications mode = 14
  - Baud rate = 27
  - Parity = 38
  - DC1/DC3 = 83
  - Other = 41, 96

The Terminal Operation paragraph in this appendix provides instructions on altering the default configuration of the 840 RO terminal parameters. Values for these configuration codes are found in the Quick Reference Chart on the underside of the printhead cover. Remove the printhead cover by grasping and lifting the cover up and toward you. Table E-1 shows the Quick Reference Chart.

E.4 TERMINAL DESCRIPTION

The 840 RO terminal is available in two printer models. The first is a basic printer without options, containing a standard friction-feed paper drive used with roll paper and a 256-character receive buffer. The second model is a more advanced version, with a tractor paper drive, a 2048-character receive buffer, DFC, and enhanced print.

A significant feature of the 840 RO terminal is its mechanical simplicity. Mechanical functions have been replaced with electronic functions wherever possible. The electronic components for these functions are mounted on the main and memory circuit boards located on the base plate of the printer. Many field-replaceable parts (such as the paper feed, printhead, and carriage motors) are connected electrically to the main board by cable and plug-in connectors. The printer includes self-testing capability.

The printer provides an interface for entry of serial communications codes into a 2048-character input buffer. The interface line notes the operation to be performed and initiates the appropriate printer action. The standard printer prints 10 characters per inch (cpi); with the DFC option, it prints 5, 8 1/3, or 16 2/3 cpi. On typical sequential text, the printer attains print speeds of up to 75 characters per second (cps). With the optional enhanced print feature enabled, print quality is equal to the basic office typewriter.

A battery located on the main board maintains the memory when ac power is interrupted or disconnected. Power connections to the printer are made through a single connector that attaches to the right rear of the printer (as viewed from the front). Other features of the printer are discussed in the following paragraphs.

E.4.1 Ribbon Cartridge

The ribbon is contained in an easy-to-handle reinking cartridge that snaps into place around the printhead.

E.4.2 Self-Tests

The 840 RO terminal has two types of self-tests, power-up and user-initiated. The power-up tests are executed each time the printer power is turned on. The user-initiated tests can be executed from the keypad of the printer when required. In the power-up tests, the microprocessor in the printer performs a test of the primary RAM and ROM. Test in progress is indicated when both the control panel indicator lights are illuminated and the printhead is positioned at the left margin of the terminal. Successful completion of the power-up test is indicated by a short tone. A long tone indicates failure of the test. The user-initiated tests involve several tests that check operation of the printer. See the Tests paragraph in this appendix for descriptions of these tests.

E.4.3 Format

The horizontal format provides 132 columns at 10 cpi. The number of characters per inch can be altered from the keypad through program commands to vary the column width. The vertical format line spacing is 6 lines per inch (lpi). Line spacing can be varied in 1/72-inch increments by program commands.

Table E-1. Model 840 RO Quick Reference Chart

STATUS / ERROR LIST

	Number	Explanation
	02	ROM Expansion Fault
	03	Battery Failure
	04	UART Fault
	05	RAM Expansion Fault
Note	−11	Ribbon or Printhead Jam
Note	−12	Paper Out
	21	Loss of Carrier Time-Out
	22	Wrong Number Time-Out
	23	Receive Buffer Overflow
	24	Parity Error
	25	Transmit Buffer Overflow
	26	No Activity Time-Out
	27	Data Lost While in Command Mode
	29	Invalid Escape Sequence
	30	Keyboard Lockout
	31	Printer Off

TO CLEAR RECEIVE BUFFER:
Hold Down "blank" Key and Press RESET.

Note: CMD/ERR light flashes rapidly.

SETTING FORMAT

FORM LENGTH **Press CMD FORM then**

Top of Form Only		CR
Form Length in Inches	NN or NN.5	then CR
Form Length in Lines	NNN LF or LF...LF	then CR
Roll Paper (0 Length)	0	then CR

MARGINS AND TABS		**To Set**	**To Clear**	
Left Margin	CMD	LEFT	CLEAR LEFT	then CR
Right Margin	CMD	RIGHT	CLEAR RIGHT	then CR
Top Margin	CMD	TOP	CLEAR TOP	then CR
Bottom Margin	CMD	BOT	CLEAR BOT	then CR
Horizontal Tab (1)	CMD	HORZ	CLEAR HORZ	then CR
Vertical Tab (1)	CMD	VERT	CLEAR VERT	then CR
Clear All	Press CMD	CLEAR	ALL	then CR

CHARACTER SPACING

10 Char. per Inch	CMD CHARS then	10 then CR
5 Char. per Inch (1)	CMD CHARS then	5 then CR
8 Char. per Inch (1)	CMD CHARS then	8 then CR
16 Char. per Inch (1)	CMD CHARS then	16 then CR

LINE SPACING

6 Lines per Inch	CMD LINES then	6 then CR
3 Lines per Inch (1)	CMD LINES then	3 then CR
4 Lines per Inch (1)	CMD LINES then	4 then CR
8 Lines per Inch (1)	CMD LINES then	8 then CR

ENHANCED PRINT

Select 5 or 10 cpi Only (2)	CMD ALTN	then CR
Reselect Standard Print	CMD CLEAR ALTN	then CR

(No.) See Included Options Label

Configuration:

For service, call:

Specify your "Included Options" and this identification number:

STATUS/ ERROR LIST	SETTING FORMAT	SETTING CONFIGURATION	

Quick Reference Chart

SETTING CONFIGURATION

Press CNFG for Configuration Mode, then Enter Code.
To Select Press CR. To Delete Press DEL.

Recall Default	9	Default Configuration (see below)
Communication Selection (one only)	13	Full Duplex (Default)
	14	SCA ON = Ready, OFF = Busy
	15	SCA ON = Busy, OFF = Ready
	16	Current Loop (3)
Transmission Speed (one only)	21	Bits per Second: 110
	22	200
	23	(Default Speed) 300
	24	600
	25	1200 (4)
	26	2400 (4)
	27	4800 (4)
	28	9600 (4)
	29	300/1200 (4)
Parity Selection (one only)	31	Odd, No Checking
	32	Even, No Checking (Default)
	35	Odd, Checked
	36	Even, Checked
	37	Mark (Parity Bit = 1), No Checking
	38	Space (Parity Bit = 0), No Checking
	39	Eight Data Bits, No Parity Bit (6)

(No.) See Included Options Label

Character Set Selection (one only)	41	US ASCII (Default)
	42	France
	43	United Kingdom
	44	Germany
	45	Sweden
	46	Denmark/Norway
	47	Spain
	48	Finland
Line Disconnects (not limited)	61	"Loss of Carrier" or "Wrong Number"
	62	"EOT" Received
	63	"DLE EOT" Received
	64	Paper-Out or Ribbon/Printhead Jam
	65	No Activity
Answerback Control (not limited)	70	Program ABM with up to 32 Characters
	71	Transmit ABM when Communication Established
	72	Print ABM for Configuration Report
Miscellaneous Codes (not limited)	81	Enable Remote Escape Sequence Execution (1)
	82	Print Transmitted Data
	83	Transmit DC1 when Ready, DC3 when Busy
	84	Do Both CR and LF on Receipt of LF
	85	Do Both CR and LF on Receipt of CR
	87	Print All Control Characters
	96	Transmit "Busy" when 840 has Fault
	97	Disable Paper-Out Detection
	98	Enable Single Mode for Katakana (6)

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E.4.4 Character Printing

The 840 RO printer contains a 9-by-7 (9-by-9 for the advanced version) dot-matrix printhead, capable of printing a full 96-character ASCII character set plus 33 control characters and a parity error symbol. The print speed varies according to the sequence of characters being printed. The printer can reach speeds up to 75 cps. Seven European character sets are available in the printer memory and can be programmed from the keypad. APL programming symbols and Katakana character sets are available as options.

E.4.5 Tone Indicator

The 840 tone indicator produces either a short tone (beep) or a long tone sound. The beep indicates normal operation of the 840 such as:

- Successful power-up self-test
- Right margin approaching
- Bell character received from the system
- Setting of margins, tabs, and so on, in command mode

The longer tone indicates unusual conditions or problems, such as:

- Unsuccessful attempt to set margins, or tabs, in command mode
- Error detected and the CMD ERR (command error) light begins to blink
- Power-up self-test error

E.4.6 Control Panel and Keypad

The printhead control panel and keypad controls the position of the printhead and paper when the printer is offline or in command mode. These keys are also used to program the printer. A description of the operation and function of the keypad is presented in the Terminal Operation paragraph in this appendix.

E.5 TERMINAL OPERATION

The following paragraphs describe the operation of the 840 RO terminal.

E.5.1 Off-Panel Controls

The following paragraphs describe functions controlled by knobs, switches, and keys that are not located on the control panel.

E.5.1.1 Power ON/OFF Switch. A rocker switch is provided on the rear of the terminal to turn the ac power on and off.

E.5.1.2 Friction Control Lever. A lever is provided on friction-feed printers to release friction when adjusting paper position.

E.5.1.3 Forms Thickness Adjustment. An adjustment knob located near the printhead is provided to compensate for forms thickness to a maximum of one original and three copies. Clockwise adjustment produces darker print; counterclockwise produces lighter print.

E.5.1.4 Paper-Out Switch. A mechanical sensor is actuated when approximately 38 millimeters (1.5 inches) of fan-fold paper or approximately 200 millimeters (8 inches) of roll paper remain in the printer. The audible alarm sounds and paper-out is indicated by a rapidly flashing error light. The terminal issues a break signal unless configured to disconnect or indicate busy (DC3).

Using single-sheet paper requires that the user enable configuration code 97. This disables paper-out detection.

Printing is inhibited at the end of the current print line after paper-out is detected. Any characters remaining in buffer memory are saved. To print the remaining characters, the user presses the RESET key. One additional line is printed each time RESET is pressed. If the user reloads the paper and then presses RESET, the rapidly flashing error light goes out, normal operation resumes, and all the characters remaining in the buffer are printed.

E.5.2 RO Operator Panel

The RO operator panel consists of two functional groups:

- Control panel
- Keypad

The following paragraphs discuss these groups.

E.5.2.1 RO Control Panel. The 840 RO control panel provides terminal controls and indicators for the user. The control panel keys are:

- ONLINE — Toggles between online and local operation as necessary.
- PAPER ADV, up arrow, and down arrow — Provides paper control.
- RESET — Provides an error condition reset capability.
- RESET and blank — Simultaneously pressing these keys clears the receive buffer.

The control panel lights are:

- LINE RDY — Indicates the status of line communications.
- CMD/ERR — Indicates the terminal status.

E.5.2.2 RO Keypad. The calculator-type control keypad is located under a cover on the front panel of the terminal. It has 35 keys that are used to control the following types of functions: paper movement and printhead positioning, form parameters, configuration codes and selection, answerback memory programming, and test and report initiation. The keypad is active only in the command mode or offline. The following paragraphs describe the keypad functions.

The CMD key places the terminal in command mode and enables the CHARs (characters), LINEs, and FORM (format) function keys. Command mode is discussed in detail in the Command Mode paragraph in this appendix.

The CNFG key places the terminal in the configuration function of the command mode. This allows entry of configuration changes and prints the configuration report.

The TEST key places the terminal in command mode and allows a test to be started.

The RPT key places the terminal in command mode and allows a report to be requested.

The CR key is used to enter the code selected in command mode or configuration mode.

Numeric keys and the decimal point (.) key can be used when the terminal is offline or in command mode, as entered with the CMD key only. They are used to enter the parameters after the CHARs, LINEs, and FORM keys are pressed.

In configuration mode, these keys are used to input configuration codes and, with the alpha keys located in the middle part of the keypad, are used to create ASCII characters for the answerback memory.

The two columns of four keys, in the middle of the keypad below the control keys, are active in the command mode. They are used to set or clear margins and tabs. Tabs are part of the DFC option.

The two columns of four keys are located in the middle of the keypad and below the control keys. These keys (except for the ALTN and DEL keys) are active in the command mode and when the terminal is offline. The following descriptions explain the functions of these keys.

Backspace (BS) Key

The BS key causes the printhead to move left one character space. It repeats if held down.

Space (SP) Key

The SP key causes the printhead to move right one character space. It repeats if held down.

Horizontal Tab (HT) Key

The HT key advances the printhead to the next horizontal tab stop (DFC option required). It advances the printhead to the left margin on the next line if the printhead is beyond the last tab stop.

Vertical Tab (VT) Key

The VT key advances the paper to the next vertical tab stop (DFC option required). It advances the paper to the first print line (top margin) of the next form if beyond the last tab stop.

Form Feed (FF) Key

The FF key advances fan-fold paper to top of form, left margin (form length set). It advances the last line printed past the tear bar for roll paper (no form length set).

E.6 COMMAND MODE

The command mode is used to perform the following functions:

- Configuration — See the System Configuration paragraph in this appendix
- Request reports — discussed in the Reports paragraph in this appendix
- Initiate tests — discussed in the Tests paragraph in this appendix
- Set and clear margins
- Set and clear tabs
- Set defaults
- Set form length
- Set spacing

The command mode is entered by pressing CMD. The following paragraphs define the procedures for performing the last five of these functions.

E.6.1 Set and Clear Margins

To set and clear margins, the following instructions apply.

- To set left margin at current printhead position, press the CMD, LEFT keys and then CR.
- To clear left margin, press the CMD, CLEAR, LEFT keys and then CR.
- To set right margin at current printhead position, press the CMD, RIGHT keys and then CR.
- To clear the right margin, press the CMD, CLEAR, RIGHT keys and then CR.
- To set top margin at current paper position, press the CMD, TOP keys and then CR.
- To clear top margin, press the CMD, CLEAR, TOP keys and then CR.
- To set bottom margin at current paper position, press the CMD, BOT keys and then CR.
- To clear bottom margin, press the CMD, CLEAR, BOT keys and then CR.

E.6.2 Set and Clear Tabs

Setting tabs is a DFC option. If the option is installed, the following instructions apply. (Options are listed on the Included Options Label located near the quick reference chart under the print-head cover.)

- To set a horizontal tab at current printhead position, press the CMD, HORIZ keys and then CR.
- To clear a horizontal tab from current printhead position, press the CMD, CLEAR, HORIZ keys and then CR.
- To set a vertical tab at current printhead position, press the CMD, VERT keys and then CR.
- To clear a vertical tab from current printhead position, press the CMD, CLEAR, VERT keys and then CR.

E.6.3 Set Defaults

The clear function returns the margins to the default settings and clears any previously set tabs. The default settings are as follows:

- Left margin = column 1
- Right margin = column 132 (220 for 16 2/3 characters-per-inch compressed printing)
- Top margin = line 1, top of form
- Bottom margin = last line of form

To clear all margins and tabs, press the CMD, CLEAR, ALL keys and then CR.

E.6.4 Set Form Length

To set the form length, the following instructions apply.

- To set the top of form at the present line, press the CMD, FORM keys and then CR.
- To set the form length in 0.5-inch increments, press the CMD, FORM keys, nn, and then CR. Where nn is the form length in inches (0.5 through 14 inches).
- To set the form length as number of lines from top of form, press the CMD, FORM keys, nnn, LF, and then CR. Where nnn is the length in number of lines (1 through 04 for 6 lpi; 1 through 112 for 8 lpi, leading zeros not required).
- To set the form length from top line of one page to top line of next page:
  - Align the top of the form.
  - Press the CMD, FORM keys; using the LF key advance the paper to the top of the next form, using the LF key, then press CR.
- To set the form length to roll paper mode (form length = 0), press the CMD, FORM keys, 0, and then CR.

E.6.5 Spacing (DFC Option Only)
If the option is installed, the following instructions apply.

- To set character spacing of M cpi, press the CMD, CHARS keys, M, and then CR. Where M = 5, 8, 10, or 16 (standard print).
- To set vertical pitch of N lpi, press the LINE key, N, and then CR. Where N = 3, 4, 6, or 8.

The standard configuration for spacing is 10 cpi and 6 lpi.

E.6.6 Enhanced Print
Enhanced characters are more fully formed and have greater contrast than standard characters. Enhanced printing can be done at five and 10 characters per inch only.

To set the enhanced print option, press CMD, ALTN (the blank key to the left of the DEL key on some models), then CR. Pressing CMD, CLEAR, ALTN, then CR, returned to the normal print mode.

NOTE

> The enhanced print option includes a nine needle print head; this is required for enhanced printing.

E.7 REPORTS AND TESTS

Four reports and two tests can be called from the command mode. The following paragraphs describe these reports and tests.

E.7.1 Reports
The four reports that are available from the RO terminal are as follows:

- Report 0 — Memory status report
- Report 1 — Form report
- Report 2 — Error report
- Report 3 — Configuration report

To generate an error and form report, press CMD, RPT, and then CR.

To generate any of the four reports, use the following key sequence, press CMD, RPT, N, and then CR. Where N is one of the report numbers.

E.7.1.1 Memory Status Report. Report 0 lists the status of system memory when memory options are present. The first (numeric) character of the memory status codes the expanded buffer: one (1) for 2K, two (2) for 4K, and zero (0) for no expansion. The remaining characters are the revision levels of the 840 system firmware. This information is useful to service personnel.

E.7.1.2 Form Report. Report 1 is a form report showing margins, form length, number of cpi, and number of lpi. Tab locations are not reported. If any errors exist, an error/status report is printed. The computer system can also request transmission of a form report if the 840 terminal has the DFC options. When requested, the form report prints out in the following format:

FORM: aaa; bbb; ccc; ddd; ee.e (or fff); gg; h

where:

aaa	represents the column number of the left margin.
bbb	represents the column number of the right margin.
ccc	represents the line number of the top margin.
ddd	represents the line number of the bottom margin.
ee.e	represents the form length in inches.
fff	represents the form length in lines.
gg	represents the number of cpi: 5 corresponds to 5 cpi. 8 corresponds to 8 1/3 cpi. 10 corresponds to 10 cpi. 16 corresponds to 16 cpi.
h	represents the number of lpi: 3 corresponds to 6 lpi (double-spaced). 4 corresponds to 8 lpi (double-spaced). 6 corresponds to 6 lpi. 8 corresponds to 8 lpi.

E.7.1.3 Error Report. Most errors can be cleared by pressing the RESET key. Report 2 provides error messages for many common problems that may occur in the 840 RO terminal. Table E-2 lists and explains the built-in error status codes.

Table E-2. Model 840 RO Error Status Codes

Error/Status Code	Explanation	Action Required
02 03 04 05	ROM expansion fault Battery failure UART fault RAM expansion fault	Press **RESET** or cycle power. If error repeats, call for service. Battery failure causes default configuration and no form length. Normal operation is possible by redefining the form and reconfiguring.
11*	Ribbon or printhead jam	*Ribbon Jam* — Remove ribbon cartridge and turn knob in the direction of the arrow. Be certain the ribbon is free to move; if not, install a new cartridge. Press **RESET**. *Other Jams* — Clear obstruction, which is usually paper. Press **RESET**.
12*	Paper-out	Load paper and then press **RESET**. To use single-sheet paper, select code 97.
21	Loss of carrier time-out	Not normally an 840 RO error. The external device is not sending a signal. Press **RESET**.
22	Wrong number time-out	Not normally an 840 RO error. Communication is not established with the external device. Press **RESET**.
23	Receive buffer overflow	Not always an 840 RO error. The external device transmitted when the 840 RO was not ready to receive. Check for proper configuration (code 14, 15, or 83 required?), and then press **RESET**. If error repeats, call for service.
24	Data (parity) error	Check parity selection (codes 31-39). Press **RESET**.
25	Transmit buffer overflow	Requests for reports or ABM transmissions come in faster than they can be completed. Increase communication rate or examine incoming control characters (code 87). Press **RESET**. If error repeats, call for service.
26	No activity time-out	Not an 840 RO error. Press **RESET**.
27	Data lost while in command mode	Not an 840 RO error. The external device transmitted when the 840 KSR was not ready to receive. Check for proper configuration (code 14, 15, or 83 required?). Press **RESET**. If error repeats, call for service.
29	Invalid escape sequence	Not an 840 RO error. It is caused by an incorrect sequence from the external computer. Press **RESET**.
30 31	Keyboard lockout Printer off	Not an error. "Keyboard lockout" and "printer off" are transmitted from the external device. To override either of these controls, press **RESET** twice. "Keyboard lockout" does not affect 840 RO operation.

* **CMD/ERR** light flashes rapidly.

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E.7.1.4 Configuration Report. Report 3 prints a system memory status line above the configuration report if no options are present. The configuration report lists the codes currently selected for terminal operation. The following example of a configuration report uses the default configuration for output. The default set, or initial configuration, of terminal characteristics is selected by enabling code 9 or 09. This predefined selection of one code from each of the required code sets would be reported as follows:

CNFG: 13; 23; 32; 41

where:

13	specifies communication method for a data set (modem)
23	specifies 300 baud transmission speed
32	specifies transmission of an EVEN parity, no parity check
41	specifies the character set as US ASCII

Configuration codes are listed on the code chart in Table E-1.

E.7.2 Tests

Two tests are available for the RO version of the 840 terminal. These tests are as follows:

- Test 1 — Offline barberpole test
- Test 2 — Online barberpole test

E.7.2.1 Offline Barberpole Test. Test 1 is the default test and the only test run by the user. The barberpole test can be run to verify that the terminal can print all characters in all columns. For this test the terminal must be offline and the margins must not be set greater than the paper width.

CAUTION

Ensure that the margins are set correctly. Printing off the paper can damage the printhead. If paper is not full width, obtain a form report to see where the margins are set.

To generate the offline barberpole test, press CMD, TEST, and then CR.

To generate a specific barberpole test, press CMD, TEST, N (N is one of the test numbers), and then CR.

E.7.2.2 Online Barberpole Test. Test 2 is not normally run by the user. The online barberpole test transmits a barberpole pattern and prints whatever is received.

Appendix F

Model 911 Video Display Terminal

F.1 GENERAL INFORMATION

The Model 911 Video Display Terminal (VDT) provides two-way communication between the user and the computer system. The 911 VDT cannot be operated unless it is properly connected to a Model 990 or Business System minicomputer with the applicable software. The VDT allows the user to enter data, view and edit files, and execute SCI procedures.

This appendix describes the operation of the Model 911 VDT, the terminal controls and indicators, the keyboard, and the data entry process, and describes how you can operate the VDT successfully. For more detailed information about any of the topics covered in this appendix, refer to the *Model 911 Video Display Terminal Installation and Operation* manual.

F.1.1 Controls and Indicators

The display unit has a control panel on the right side of the cabinet and data indicators on the rear. The following paragraphs describe the functions of each of these controls and indicators.

F.1.1.1 Control Panel. The control panel, located on the right side of the VDT housing, has an ON/OFF rocker switch and rotary controls for adjusting brightness and volume. Figure F-1 shows these controls. The ON/OFF switch turns the unit on and off. The BRIGHTNESS control sets the intensity of the characters displayed on the screen. The VOLUME control sets the level of the audible alarm. To increase brightness or volume, turn the control clockwise.

F.1.1.2 Data Indicators. A row of 10 light-emitting diode (LED) indicators is located in the center of the rear panel of the display unit. The rightmost indicator should always be lit if the computer interface cables are properly installed, the computer and VDT power are on, and the VDT controller is inserted into the computer chassis and working properly.

F.1.1.3 Keyboard. A separate keyboard connects to the display unit by a cable. The keyboard used in the United States and Europe provides the 128-character ASCII code set and additional eight-bit codes for special functions. The Japanese keyboard provides for generating the Katakana character set and the alphanumeric character set.

NOTE

> Since this appendix contains information on a specific terminal, generic key names are not used. The keys are referred to as they are labeled on the keyboard.

The 911 keyboard consists of a basic alphanumeric keyboard, a numeric key pad, a cursor control and edit key pad, and a row of function keys. The standard keyboard consists of 88 keys. Figure F-2 shows where each key is located.

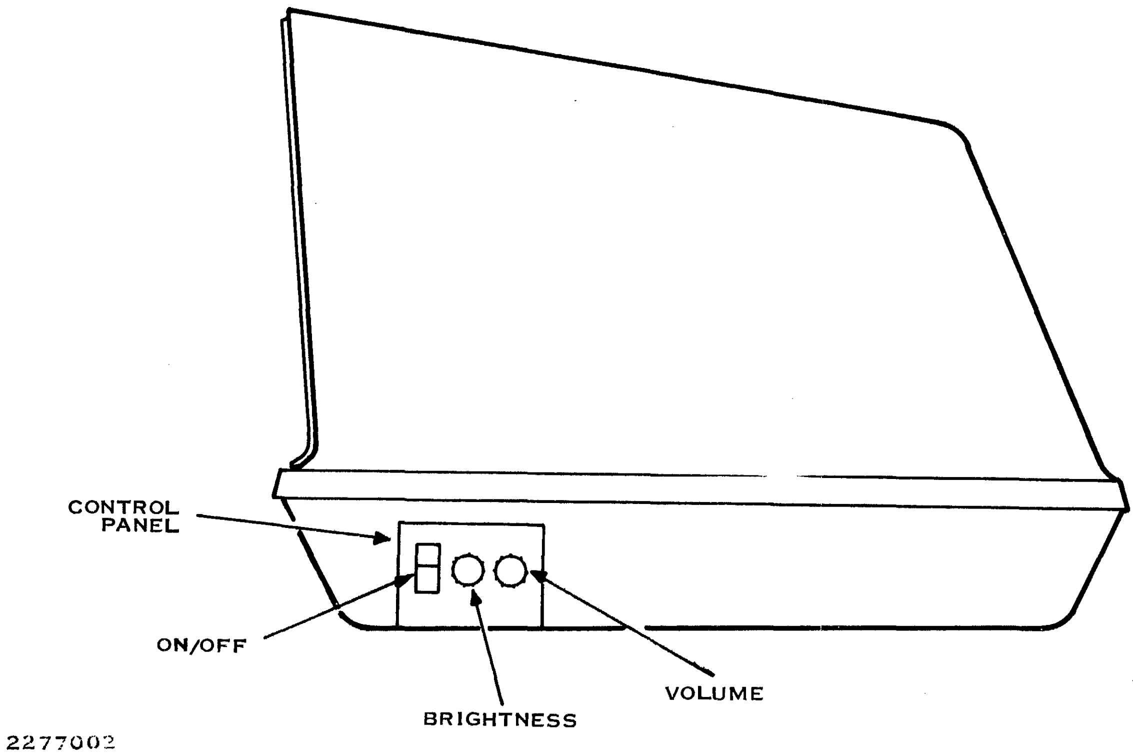

Figure F-1. Model 911 Display Unit Control Panel

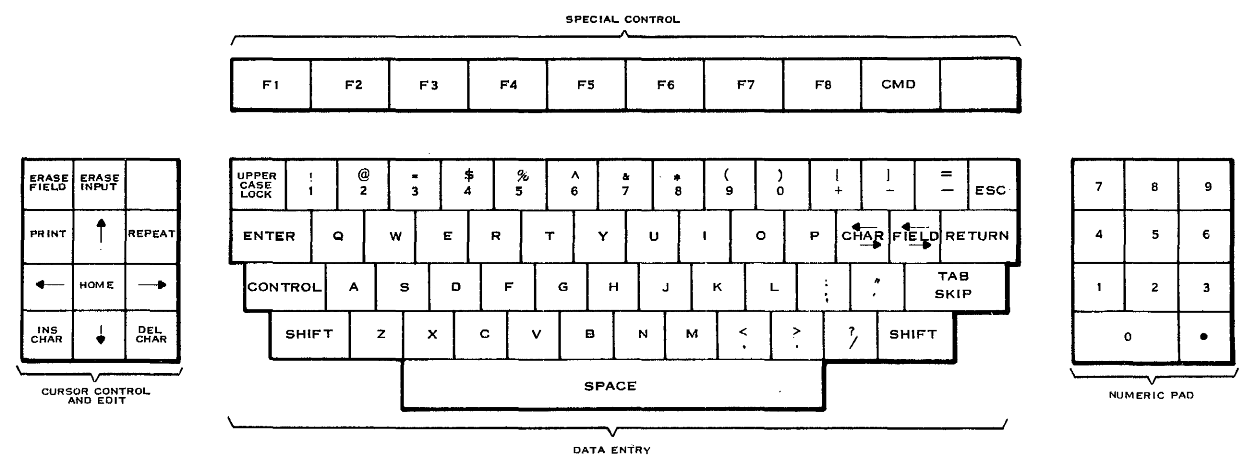

Figure F-2. Model 911 United States Keyboard

F.1.2 Entering Data

Pressing a key on the keyboard causes the computer to perform a function. The following paragraphs explain the usual functions of each key. However, actual functions can vary from site to site, since some sites use custom-tailored input/output programs to control their terminals. The user is responsible for learning any nonstandard functions used on site.

F.1.2.1 Cursor Control and Edit Keys. The cursor is a brightly lit marker on the display screen. It shows where the next character of input goes. The cursor control and edit keypad enable the user to move the cursor forward, backward, up, or down. They also allow the user to modify data already entered. These keys function as follows in the Text Editor and SCI:

ERASE FIELD Key
: Erases the contents of the line where the cursor is positioned.

ERASE INPUT Key
: Removes the line in which the cursor is positioned, moving up the following lines.

Unlabeled Gray Key
: Inserts a blank line above the line in which the cursor is positioned.

Up Arrow Key
: Moves the cursor up one line.

Left Arrow Key
: Moves the cursor one position to the left.

Right Arrow Key
: Moves the cursor one position to the right.

Down Arrow Key
: Moves the cursor down one line.

HOME Key
: Moves the cursor to the leftmost position of the top line of the screen.

INS CHAR (Insert Character) Key
: Inserts characters to the left of the cursor, moving the rest of the line to the right to make room for characters entered by the alphanumeric keys.

DEL CHAR (Delete Character) Key
: Deletes the character upon which the cursor is positioned.

PRINT Key
: Performs a function determined by the input/output program controlling the terminal. Typically, it is used to print a facsimile of the screen on a line printer.

REPEAT Key
: Repeats the function of other keys pressed as long as it is held down.

F.1.2.2 Numeric Keypad. The numeric keypad is arranged like a calculator keyboard. It provides a fast, efficient way to enter numerical data.

F.1.2.3 Keyboard Modes. The United States and European versions of the 911 keyboard have three mode keys (UPPERCASE LOCK, CONTROL, and SHIFT), which permit the user to select one of four codes for each alphanumeric key. Alone, these keys do not enter any data. The mode selection keys are used as follows:

UPPERCASE LOCK Key
The UPPERCASE LOCK key affects only the 26 alphabetic characters. The key locks in either the up or down position. Each time the key is pressed, it locks into the other position. While down (lock position), the alphabetic characters are entered in uppercase. When up (unlocked position), the alphabetic characters are entered in lowercase. The UPPERCASE LOCK key does not affect the numeric keys or the punctuation keys. For example, to type the @ symbol, the SHIFT key must be used regardless of the position of the UPPERCASE LOCK key.

CONTROL Key
The CONTROL key produces an entirely different set of characters than those indicated on the keys. Many of these characters cannot be printed. The CONTROL key must be held down while the character is entered.

SHIFT Key
The SHIFT key on a 911 works like the shift key on a typewriter. Pressing an alphanumeric key while holding down the SHIFT key enters the uppercase version of the letter or symbol shown on the keyboard.

The following is a summary of mode selection on the United States and European Keyboards:

Keyboard Mode	**Shift**	**Control**	**Uppercase Lock**
Lowercase	Up	Up	Up
Uppercase	Up	Up	Down
Control	Up or Down	Down	Up or Down
Shift	Down	Up	Up or Down

The locations of the characters produced in each of the keyboard modes are shown in Figure F-3 through Figure F-6. Diagrams of the keyboard modes for European and Japanese 911 keyboards are shown in the *Model 911 Video DisplayTerminal Installation and Operation* manual.

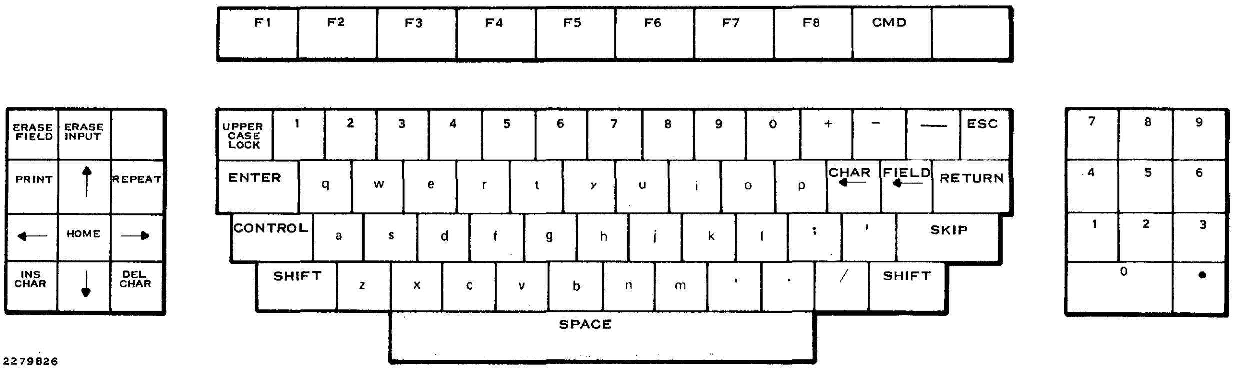

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Figure F-3. Model 911 United States Keyboard Showing Lowercase Mode Character Positions

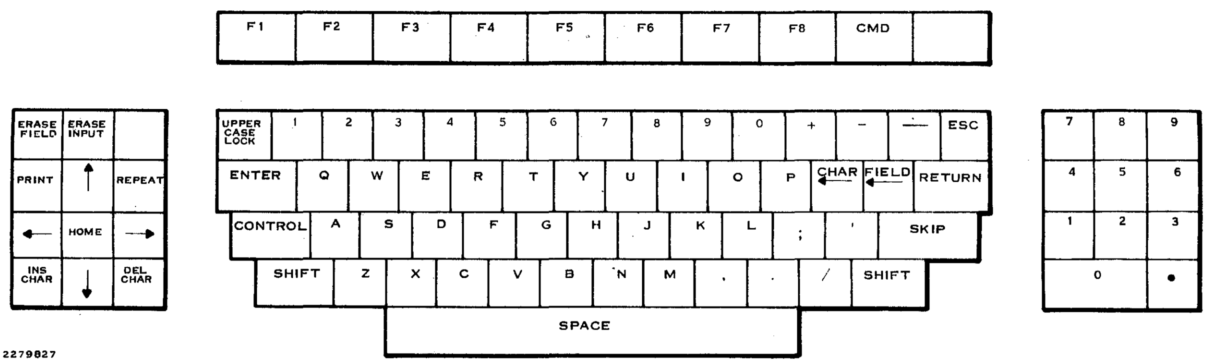

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Figure F-4. Model 911 United States Keyboard Showing Uppercase Mode Character Positions

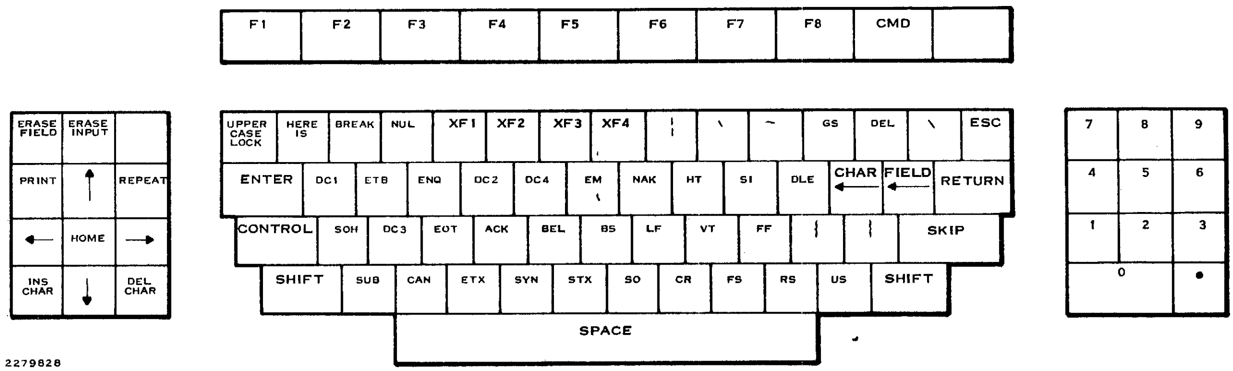

Figure F-5. Model 911 United States Keyboard Showing Control Mode Character Positions

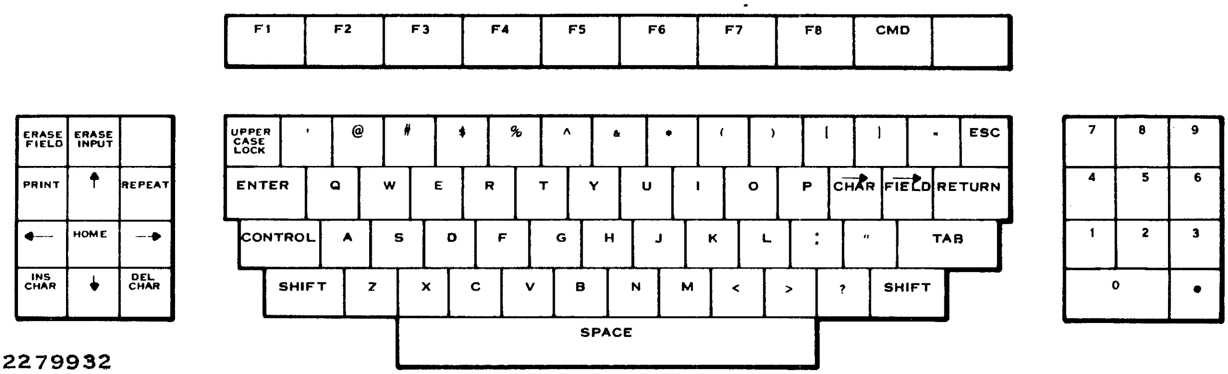

Figure F-6. Model 911 United States Keyboard Showing Shift Mode Character Positions

Appendix G

Model 931 Video Display Terminal

G.1 GENERAL INFORMATION

The 931 Video Display Terminal (931 VDT) shown in Figure G-1 is used for entry and display of alphanumeric data. The unit consists of two physical parts: an electronic-display module and a detachable keyboard. It is designed for use on the typical nonmetalic table or desk top. For more detailed information, refer to the *Model 931 Video Display Terminal General Description Manual.*

Data is entered on a typewriter-like keyboard that has an additional calculator-style numeric keypad, a cursor control cluster, a function key cluster, and several keys that control local functions of the terminal. The paragraph Keyboard in this appendix discusses the keyboard in more detail.

Data is displayed on a 12-inch diagonal cathode ray tube (CRT). The display consists of 24 data lines that are 80 characters long. A twenty-fifth line displays status information and messages from the host computer. The paragraph Video Display Unit in this appendix discusses the video display unit (VDU) in more detail.

The 931 VDT communicates via a serial synchronous data bus at rates of 300 to 19,200 baud on the primary EIA RS-232C or Optic Fiber communications port. An auxiliary communications port is provided for sending data to a printer. The data rate is independently selectable for rates between 300 and 9600 baud. The paragraph Communications in this appendix discusses communications in more detail.

The Programmer Configuration Mode paragraph in this appendix discusses how to configure the Comm and Aux ports.

The exterior surfaces of the 931 VDT should be cleaned using a clean soft cloth dampened with a mild nonabrasive household detergent.

WARNING

Never spray or pour liquids directly on any part of the 931 VDT; doing this can damage electronic components and poses a serious shock hazard. Always turn the power off, unplug the power cord, and disconnect the communications cable before cleaning.

Clean the CRT by gently wiping the screen with a soft clean cloth dampened with a glass cleaning fluid.

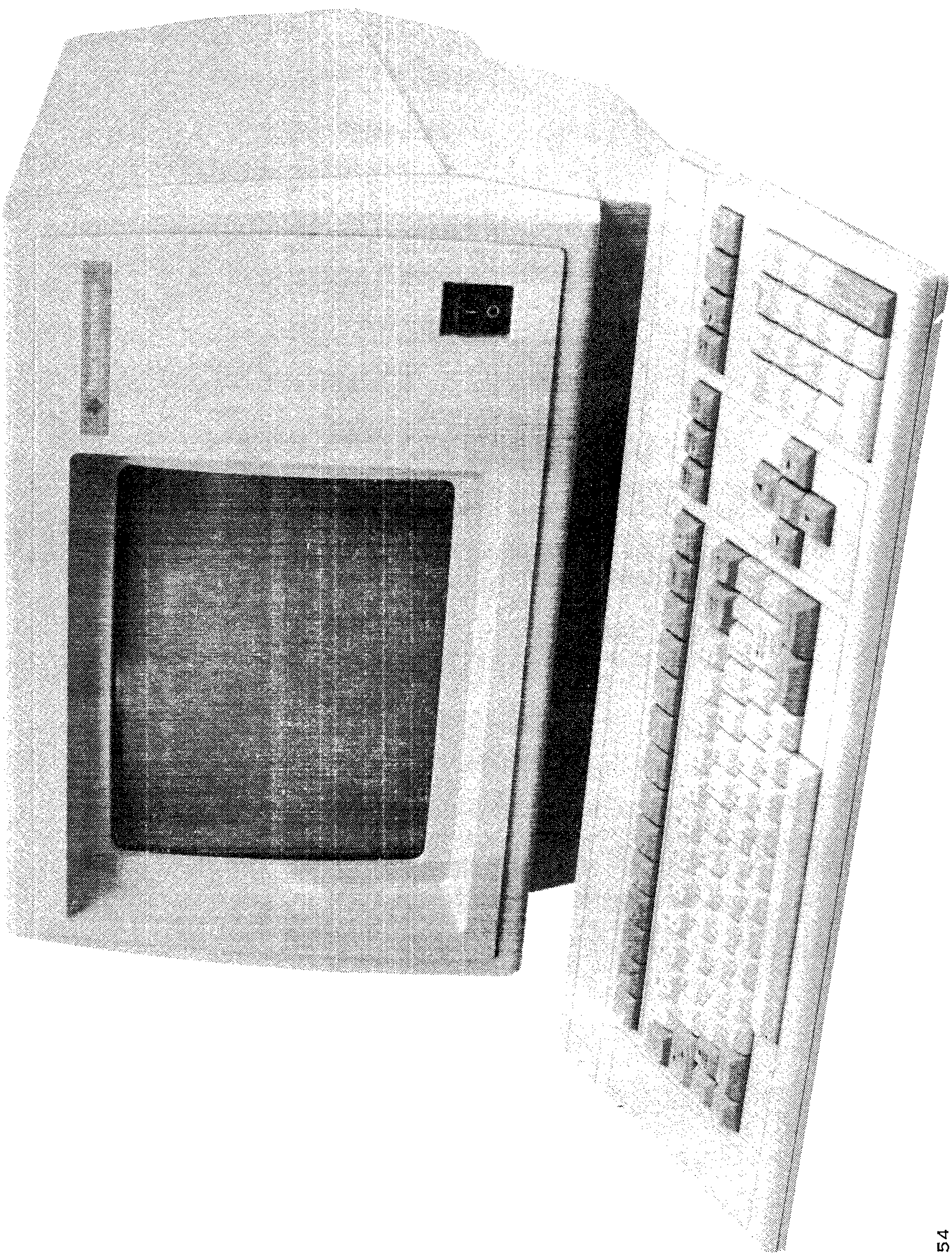

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Figure G-1. Model 931 Video Display Terminal

G.1.1 Keyboard

The keyboard (see Figure G-1) is a separate unit designed to allow the operator to adjust it to the most comfortable position. The keyboard has 103 keys mounted in a low-profile adjustable-tilt base and connected to the video display unit (VDU) by a 6-foot coiled cord.

The keys are arranged in five main groups: the alphanumeric keys, the cursor control keys, the numeric keypad, the editing keys, and the special function keys.

NOTE

> Since this appendix contains information on a specific terminal, generic key names are not used. The keys are refered to as they are labeled on the keyboard.

- Alphanumeric Keys — The largest group of keys on the keyboard, this group contains the letters, numbers, special characters, SHIFT, ESC, TAB, SKIP, BACK SPACE, CTRL, ALT, RETURN, space bar, and ENTER keys in typewriter-like layout.
- Cursor Control Keys — These are the five keys laid out as a cross immediately to the right of the alphanumeric keys. The cursor control group contains the HOME and up, down, left, and right arrow keys.
- Numeric Keypad — These are the 18 keys on the right side of the keyboard that are laid out in calculator-like fashion. This group contains numeric, period (.), comma (,), equal (=), plus (+), minus (−), TAB, SPACE, and RETURN keys.
- Editing Keys — These are the seven keys above the cursor control and numeric keys. The editing group contains ERASE FIELD, ERASE INPUT, DEL CHAR, INS CHAR, FIELD, blank gray, and PRINT keys.
- Special Function Keys — These are the 14 keys arranged in a row above the alphanumeric keys and labeled F1 through F12, CMD, and an orange block.

Usually the letters, numbers, punctuation, and special character keys enter the characters labeled on them, however the function of all the keys are dependent upon the specific applications program controlling the 931 VDT. (See Figure G-2.)

Alternate keyboards are available for Danish/Norwegian, French Data Processing, French Word Processing, German/Austrian, Spanish, Swedish/ Finnish, Switzerland, and United Kingdom.

G.1.2 Video Display Unit

Built-in self tests run when the 931 VDT is turned on to help detect problems. The results of the self tests are displayed on the status line of the screen. The Status Line paragraph in this manual discusses the status line in more detail.

Adjustments which can be made to the display and audible alarm by the operator are discussed the Adjusting the Display and Audible Alarm paragraph in this appendix.

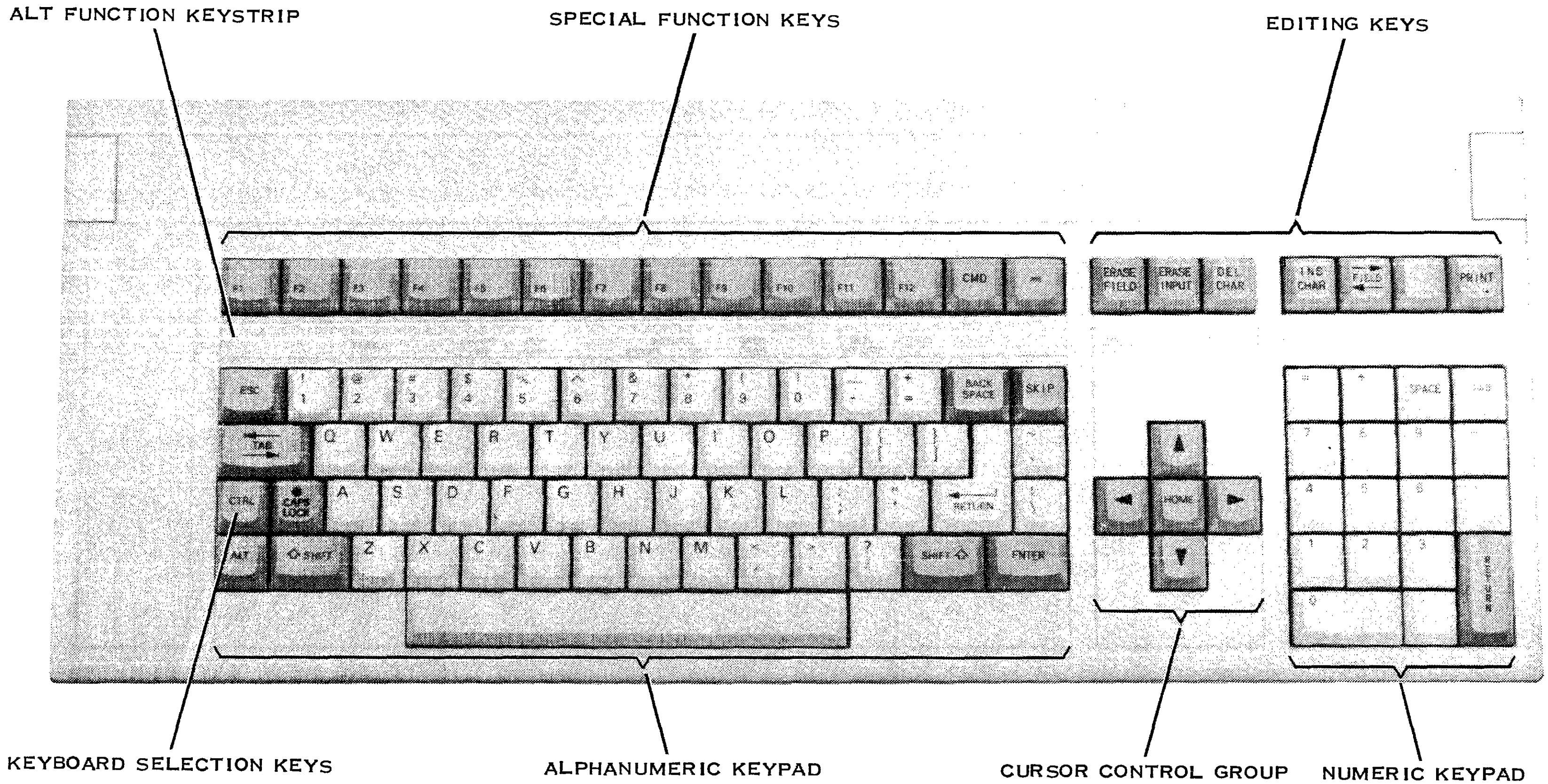

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Figure G-2. Model 931 Video Display Terminal Keyboard

G.1.2.1 Turning the 931 VDT On and Off. Turn the terminal on by pressing the upper half of the power switch located at the front lower-right of the VDU.

CAUTION

Turning on the terminal within five seconds after turning it off can damage the electronic components; to prevent this, wait at least five seconds after turning terminal off before turning it on again.

When the terminal is turned on, the following actions occur:

1. The warm-up requires 30 seconds.

2. The terminal automatically performs a self-test. The message SELF TEST should be displayed in the left bottom corner of the screen. If the self-test completes before the screen warms-up, The SELF TEST message may not be displayed.

3. After SELF TEST, the terminal presents a status line display. Either of the following self test results can occur:

   a. If the terminal fails the self-test, the words SELF TEST FAILED followed by one or more error messages is displayed. Refer to the *Model 931 Video Display Terminal General Description Manual* to determine what action you should take.

   b. When the self-test successfully completes, the 931 VDT is ready to receive input from the keyboard or the host computer. When the self-test status line is displayed, the terminal is ready for normal operation.

4. If no input is received within 15 minutes, the display goes blank automatically, but the display is stored in memory. Pressing a key or input from the host computer restores the display.

To turn off the Model 931, press the lower half of the power switch.

G.1.2.2 Adjusting the Display and Audible Alarm. The display has 16 levels of brightness, bright or dark background, and four levels of volume for the beep; all of these can be adjusted by the operator. Table G-1 lists each option, shows how to select it and describes the results.

Table G-1. Model 931 VDT Operator Adjustments

Selection	Action	Results
Status Line	Press ALT and SHIFT keys simultaneously, then 2.	Status line is blanked from view. The host computer can still display messages on the status line.
	Press ALT and SHIFT keys simultaneously, then 2.	Restores status line.
	Press ALT then 2.	Selects the alternate status line.
	Press ALT then 2 again.	Selects the primary status line.
Reverse Screen	Press ALT then 5.	Display changes to dark characters on a bright screen.
	Repeat	Display changes to bright characters on a dark screen.
Display Bright	Press ALT then 7.	Brightness increases one level. There are 16 levels of brightness. When the highest level of brightness is reached, there is no further response.
Display Dim	Press ALT then 8.	Brightness decreases one level. When the lowest level is reached, the characters disappear.
Bell Volume	Press ALT then the minus (–) key.	Volume of the audible alarm increases. There are four levels of loudness. When the highest level is reached, the sequence starts from the beginning.

Other options are available. Individual characters or groups of characters can be displayed at normal or high intensity, in normal or reverse image, underlined, steady or blinking. These options are selected when the installation is programmed. The keys used to implement these options are labelled by the programmer.

G.1.3 Status Line

The twenty-fifth (bottom) line of the screen displays status messages. This line can display either the primary or alternate status line. When the host computer sends a message to the terminal, the message remains on the screen until the host sends another message. The terminal operator can toggle between the primary and alternate status lines by pressing the ALT then the 2 key. See Table G-1.

G.1.3.1 The Primary Status Line. The primary status line consists of two parts — columns 1 through 40 display messages from the host computer; columns 41 through 80 display status messages from the terminal concerning communications with the host computer and printer. Table G-2 explains the messages displayed in the columns 41 through 80.

The status line on the screen indicates whether the 931 VDT is online or offline. If the terminal is offline the status line will display OFFLN; conversely, the status line will display ONLN when the terminal is online.

If a printer is connected to the 931 VDT through the Aux port, anything on the screen can be sent to the printer while the terminal is offline.

Before any data can be transmitted between the 931 VDT and the host computer, the terminal must be placed online; to do this, press the ALT and 4 keys simultaneously. The status line will change from OFFLN to ONLN. When the 931 VDT goes online, the terminal and host computer begin an exchange of messages that opens communications between them. The status line reflects the state of these exchanges. Five fields comprise the terminal status line. The following sequence summarizes the messages displayed in the terminal status line when communication begins:

1. When the terminal is placed Online, the message in Column 42-46 will change from OFFLN to ONLN.

2. From this point on, the system completes a set of protocol exchanges to establish an active communication channel between the terminal and the host.

3. These exchanges are reflected in the messages displayed in Columns 48 through 53 and 55 through 60.

4. DCD (Data Carrier Detect) is a signal sent to the terminal by the modem advising whether a data channel appointed for communication is receiving a valid signal from the host. When this happens, the message changes from 0 to 1.

5. DSR (Data Set Ready) in columns 55 through 60 advises the terminal whether the modem has a channel available for communication. It must change from 0 to 1 before a message can be received.

6. The remaining two message areas advise you whether the host and printer are ready for communication or whether operations are suspended due to interfering activity or error.

   a. Comm tells whether the host computer is ready.

   b. Aux tells whether the printer is ready.

No action is required unless communications cannot be established. If communications cannot be established, record the messages on the status line and call your representative.

Table G-2. Model 931 Terminal Status Line

Display Columns	Message Displayed	Meaning
42-46	OFFLN	Terminal is offline; data cannot be transmitted or received.
	ONLN	Terminal in online; data can be transmitted or received.
48-53	DCD(0)	Communications port data carrier detect signal is off.
	DCD(1)	Communications port data carrier detect signal in on.
55-60	DSR(0)	Communications port data set ready signal is off.
	DSR(1)	Communications port data set ready signal is on.
62-70	COMM:CONN	A communications link has been made with the host, but the carrier has not been established.
	COMM:DISC	A communications link is not established with the host.
	COMM:RDY	A communications link and carrier has been established with the host; data can be transmitted.
	COMM:BUSY	The host is busy; data will be held until COMM:RDY is displayed.
	COMM:RNG	Communications port ring signal is on; the terminal is offline and must be put online to answer.
72-80	AUX:OFF	The device at the Aux port is offline or not connected.
	AUX:RDY	The device at the Aux port is ready; data can be transmitted to it.
	AUX:BUSY	The device at the Aux port is busy; data transmission is halted.

G.1.3.2 The Alternate Status Line. Sometimes the host computer sends messages that are longer than 40 columns; when this happens the host computer selects the alternate status line. The entire 80 columns of the status line now can be used to display the message from the host computer.

G.1.4 Programmer Configuration Mode

The programmer configuration mode configures the Comm port (the port that the 931 uses to communicate with the host computer) and the Aux port (the port where a printer can be attached to the 931). Columns 62 through 80 of the status line display the configuration. The terminal configuration parameters for both ports are stored in nonvolatile memory.

The configurable parameters are accessed through the programmer configuration mode; this can be done Online or Offline. Host communications are suspended while the terminal is in the CONFIG mode when Online. Press the the ALT, SHIFT, and BACK SPACE keys simultaneously; the first menu of the programmer configuration appears on the status line beginning in column one as shown below:

```
[]
Config: Comm Aux Dsply Diag
```

This menu allows the programmer to select the set of parameters (Comm Port, Aux Port, Display Frequency) to be configured. The current configuration is highlighted and underlined.

- The TAB or Right Arrow key selects the next CONFIG display to the right of the current position.
- Pressing SHIFT and TAB or Left Arrow key selects the next CONFIG display to the left.
- The RETURN or Down Arrow key enters the highlighted and underlined selection, then displays the next set of choices.

Exit the configuration mode by pressing the ALT, SHIFT, and BACKSPACE keys simultaneously.

For DNOS, the 931 must be configured with the following parameters:

- Comm Parity must be ODD.
- Comm Protocol must be FDPX.
- Comm Speed must match the speed specified during system generation:
  - 19.2K max for CI403 or CI404
  - 9600 max for all others
- Comm port is INTERNAL for fiber optics and EIA for all other.

Certain 931 parameters are intented to handle third party communication devices. Unless otherwise instructed by Texas Instruments customer support, the following options should be selected:

- Comm Receive Parity Check should be ON.
- Comm Transmit Block Size should be 01H for all configurations.
- Comm Transmit Block Delay should be 00H for terminals using CI403 or CI404 interfaces, or 01H for all others.
- Comm Receive DC1/DC3 should be OFF.

If an attached printer is used the following parameters should be set:

- Aux Enable must be YES if an associated printer is attached to the 931. If no printer is attached, set Aux Enable to NO. None of the remaining attached printer parameters have any significance when Aux Enable is set to NO.
- Aux Offline Data Abort must be NO. If NO is not selected data will be lost when the associated printer runs out of paper or is placed offline.
- Aux Speed must match the printer's speed. Running the printer as fast as possible prevents tying up the 931's internal buffer. 4800 or 9600 baud is suggested.
- Aux Parity must be the same as the printer.
- Aux Protocol must be the same as the printer. Texas Instruments supported printers such as the 810 and 850 use FDPX-RC(RDY = ON).

G.2 TROUBLE SHOOTING

The 931 status line can help determine the status of the terminal and its connection to the computer. If the status line was disabled, it can be enabled by using the following sequence:

- Press the ALT and 2 keys simultaneously.
- Press the ALT, SHIFT, and 2 keys simultaneously.
- Press the ALT and 2 keys simultaneously.

The status line should reappear. If the 931 is connected directly to the Business System using the standard cables, the cursor should be displayed and the status line should display the following:

```
Onln DCD(1) DSR(1) Comm: Rdy
```

If the status line displays something different, the trouble may be in the cable or computer. If the status line displays Offln, press the ALT and 4 keys simultaneously to put the terminal online.

If the terminal stops working for an unknown reason, and the cable, computer, comm parameters, and status line are all correct, take the terminal offline for about five seconds by pressing the ALT and 4 keys simultaneously. Then use the same key sequence to put the 931 back online; this causes the device service routine to reinitialize the DNOS software and the 931 hardware configurations.

If none of these work, turn off the 931 for 30 seconds and then turn it back on.

If the 931 still does not work, refer to section 7 in the *The Model 931 Video Display Terminal General Description Manual.* The type of reset described there is a drastic action that requires a complete reconfiguration of the 931.

Appendix H

Model 940 Video Display Terminal

H.1 GENERAL INFORMATION

The Model 940 Video Display Terminal (VDT) (Figure H-1) provides two-way communication between the user and the computer system. It has capabilities for extensive editing, formatted data entry, and sufficient flexibility to select terminal features and to create formats at the terminal. The 940 allows the user to enter data, view and edit files, and execute SCI procedures.

This appendix describes the 940 and gives an overview of terminal operation. For more detailed information about any of the topics covered, refer to the *Model 940 Electronic Video Terminal Installation and Operation* manual, part number 2250368-9701.

H.2 TERMINAL DESCRIPTION

The 940 consists of two major components, the video display unit and the keyboard. The following paragraphs describe these components as they are used with the 990 computer operating under DNOS.

Some 940 functions and operations are available only with TIFORM, and others only with SCI. Refer to the *Model 940 System Manual*, part number 2213826-9701, for details.

H.2.1 Video Display Unit

The video display unit houses the display screen and the control components. The following paragraphs describe the characteristics of the display screen, the display areas, the character images, and the cursor. The keys on the separate keyboard activate the control components. The use of these keys is described later.

H.2.1.1 Display Screen. The display is a 12-inch (diagonal) screen that is capable of representing all 128 ASCII characters. The terminal displays the 95 ASCII graphic characters, representing standard alphanumeric and special characters, as they are entered from the keyboard or received from the computer system. User-selectable parameters control the display screen characteristics.

The user can select the following display characteristics:

- Underline or no underline
- Normal or high intensity
- Normal or reverse image
- Nondisplay (blank) or display

- Normal or double-wide character width
- Normal or double-high character height
- Normal or double-wide and double-high characters

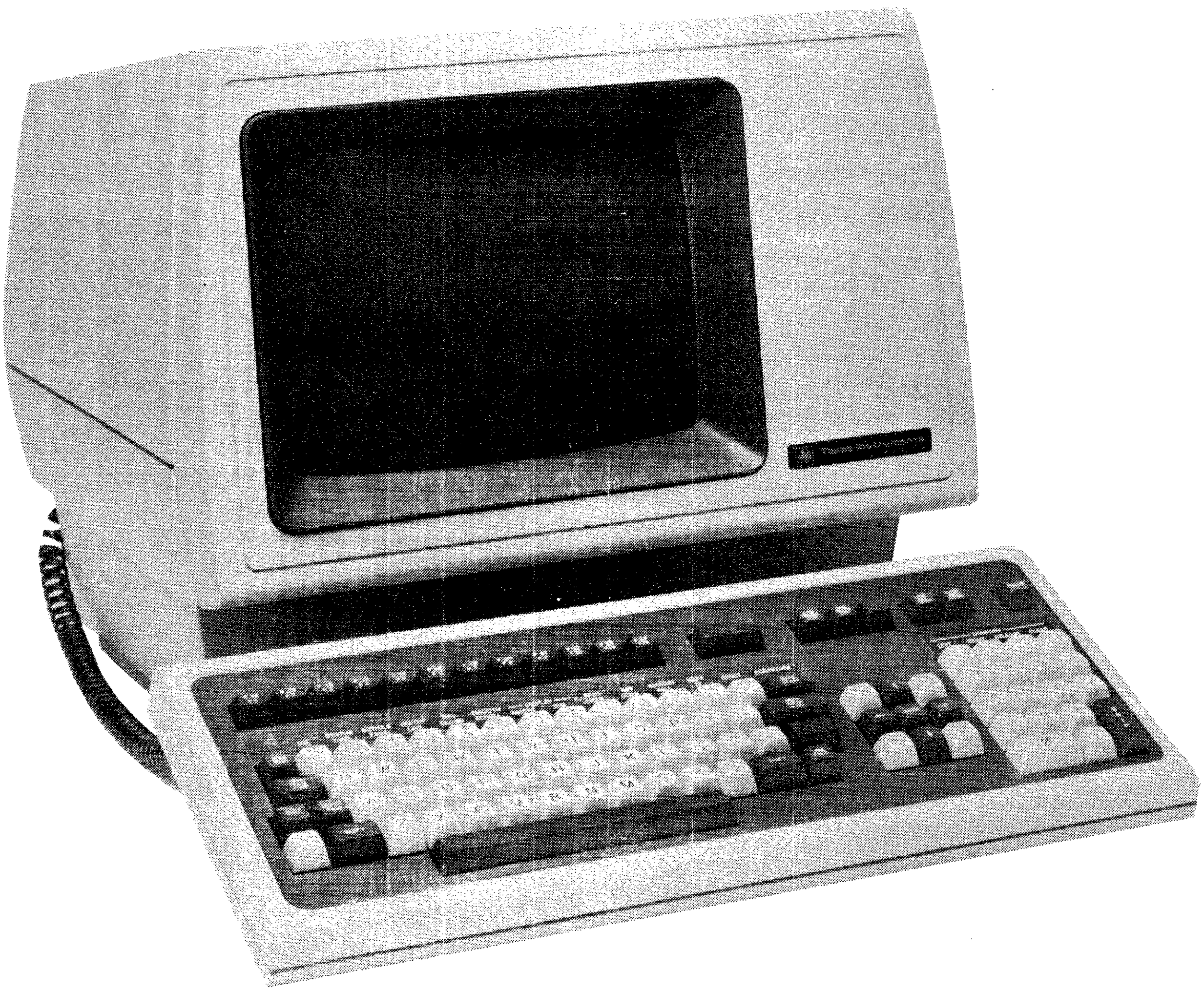

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Figure H-1. Model 940 VDT

User action controls the entire display screen in the following ways:

- Reverse background — The user can select reversal of the display background. This reversal illuminates the background and darkens the characters.

- Brightness — The user controls the screen brightness via the 940 keyboard. (Thirty-two brightness settings are available.) Internal circuits control the resolution and focus.

- Scrolling — The user controls up or down scrolling. When the user scrolls up, new lines roll on at the bottom of the screen and old lines roll off at the top. Scrolling down reverses this action. Scrolling can be selected as smooth or discrete. In smooth scrolling, the data lines roll up or down without interruption at a rate of approximately six lines per second. Discrete scrolling rolls the lines up or down one line at a time.

H.2.1.2 Display Areas. The display on the terminal screen is divided into two primary areas: the main display and the status line.

The main display occupies lines 1 through 24 on the screen, displaying 80 characters per line.

As an additional feature, the display can be programmed to go blank if no activity occurs for approximately 15 minutes. An entry from the keyboard or transmission of a character to the 940 causes the display to show the previous screen contents with no delay for CRT warmup. By pressing any character key, the user can determine the on or off status of a terminal with a blank display. This *wake-up* character is not accepted as data.

Line 25 is reserved for displaying 940 configuration status. See the paragraph Status Line in this appendix for instructions on using the status line display area.

H.2.1.3 Character Images. The characteristics of character images displayed on the screen depend on the character set chosen. The image cell (area) for a single character is a 9-by-11 dot matrix, with a 7-by-10 dot matrix used for the character itself. The standard 940 displays uppercase and true lowercase characters (including descenders), numerals 0 through 9, true underlining through the cell, and common special characters. For international applications, special character sets are available. Internally, the 940 supports a configuration of three different character sets. The primary (standard) set provides for the standard 128 ASCII characters as discussed previously. Special Character Set 1 (SC1) includes characters for displaying superscripts and subscripts. Special Character Set 2 (SC2) provides characters for line-drawing capability. SC1 and SC2 are optional character sets. During power-up, the terminal defaults to the primary character set. Selection of the character set can be made from the keyboard, or by command transmitted by special applications.

H.2.1.4 Cursor. The cursor is a unique, nondestructive, illuminated block occupying a full character cell. When occupying the same screen position as the cursor, a character is presented in block-reverse form (as a silhouette). The cursor appears at the position where the next character entered from the keyboard will be displayed.

H.2.2 Keyboard

The 940 keyboard is a separate unit, connected to the display unit by a cable. This feature allows the user flexibility in positioning it for workstation convenience. Its keys are in stepped rows for quick and accurate placement of hands and fingers, which also reduces fatigue. The keyboard is similar to a typewriter in location and function of alphabetic, numeric, special characters, and control keys.

NOTE

> Since this appendix contains information on a specific terminal, generic key names are not be used. The keys are referred to as they are labeled on the keyboard.

Functionally, the keys are grouped under the following general headings:

- Alphanumeric input
- User configuration
- Positioning
- Editing
- General-purpose function
- Special-purpose function

Refer to Figure H-2 for the location of these groups on the keyboard.

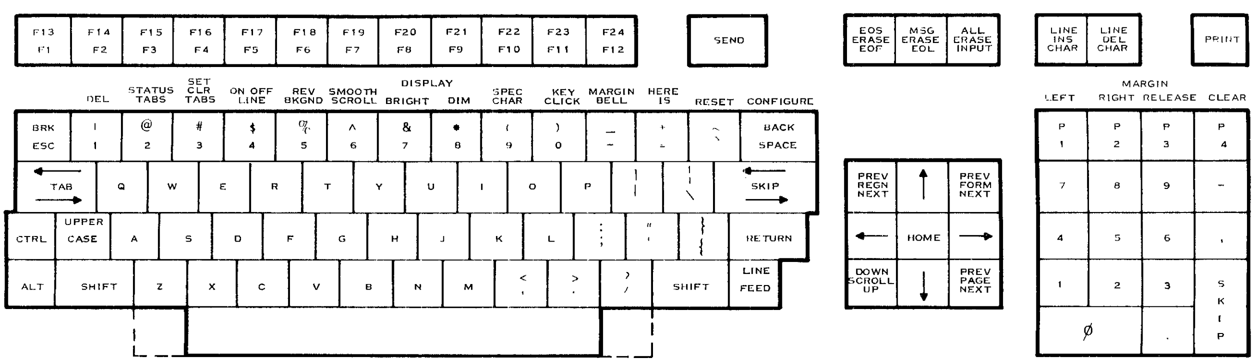

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Figure H-2. Model 940 Keyboard

H.2.2.1 Alphanumeric Input Keys. The alphanumeric input keys consist of the standard entry keys used in normal data input. Additionally, they are used with the other keys to accomplish a desired function or configuration. The function of the standard alphanumeric input keys is changed when they are used in combination with the other groups of keys.

H.2.2.2 User Configuration Keys. User configuration is the process of selecting parameters that determine the functional operation of the terminal. These selections are made using the numeric keys with the SHIFT and ALT keys. The available functions are listed on the label strip above the alphanumeric keyboard. User-selectable parameters and configuration keys are described in the Configuration paragraph in this appendix.

H.2.2.3 Positioning Keys. Positioning keys move the cursor, and also affect the display in some cases. These keys operate in both unformatted and formatted applications. The positioning keys are as follows:

- BACK SPACE
- (cursor) RETURN
- Up arrow (↑)
- Down arrow (↓)
- Right arrow (→)
- Left arrow (←)
- HOME (positions cursor in column 1, line 1)
- TAB forward
- TAB backward

H.2.2.4 Editing Keys. The editing keys are located on the right side, top row of the keyboard. The keys are as follows:

- INS CHAR (insert character)
- INS LINE (insert line)
- DEL CHAR (delete character)
- DEL LINE (delete line)
- ERASE INPUT
- ERASE EOL (erase end-of-line)
- ERASE EOF (erase end-of-field)

- PRINT
- SKIP forward (above RETURN key)
- SKIP backward (above RETURN key)

H.2.2.5 General-Purpose Function Keys. General-purpose function keys are located on the left side, top row of the keyboard, and are labeled F1/F12 through F13/F24. Unshifted, these keys activate functions F1 through F12. Shifted, they initiate functions F13 through F24. The functions of these keys are software controlled.

H.2.2.6 Special-Purpose Function Keys. The special-purpose function keys are as follows:

- SEND
- CTRL (control)
- ALT (alternate)
- RETURN
- SHIFT
- UPPER CASE lock
- Repeating action keys (called *Typamatic*)
- Two-key rollover

For a detailed discussion of the keyboard and its use, refer to the *Model 940 VDT Installation and Operation* manual, part number 2250368-9701.

H.3 TERMINAL OPERATION

The 940 VDT operates online or offline. Online, the terminal is connected directly (or via communications) to a computer and can exchange data with the computer system. Offline, the terminal can be connected to communications or the computer, but it cannot transmit or receive data. When offline, the 940 operates like a typewriter. Two types of operation can be performed on the 940: configuration and data entry. Configuration includes selection of status line and character set.

H.3.1 Configuration

Configuration is the process of selecting features that determine the response of the terminal. The user selects such things as KEYCLICK or MARGIN BELL (on or off), or terminal ON/OFF LINE. Table H-1 lists the parameters that are available for selection. Use the label strip above the alphanumeric input keys for reference. The selections on the label strip can be made online or offline.

Table H-1. Model 940 User-Selectable Parameters

Parameter Label	Hold	Press	Function
STATUS TABS	ALT	2	Toggles the terminal between displaying status or displaying the current tabs and margins on line 25 of the display.
STATUS TABS	SHIFT and ALT	2	Toggles between blanking and displaying the status line. The line remains blank except when a message is received. Messages remain displayed until ERASE MSG is pressed.
ON/OFF LINE	ALT	4	Toggles between taking the terminal offline or placing it online to communicate with the computer system.
REV BKGND	ALT	5	Toggles between a dark screen background with illuminated characters or an illuminated screen background with dark characters.
SMOOTH SCROLL	ALT	6	Toggles between discrete or smooth scrolling when the 940 is instructed to scroll.
DISPLAY BRIGHT	ALT	7	Increases the intensity of the CRT display from dim to bright in incremental steps each time 7 is pressed. At the end of the range, it remains at highest intensity.
DISPLAY DIM	ALT	8	Decreases the intensity of the CRT display from bright to dim in incremental steps each time 8 is pressed. At the end of the range, it remains at lowest intensity.
SPEC CHAR	ALT	9	Toggles between use of primary and special character sets.
KEY CLICK	ALT	0	Toggles between the 940 sounding or not sounding a key click when a key is pressed.
MARGIN BELL	ALT	hyphen	Toggles between sounding or not sounding the audible alert as the cursor passes the eighth column preceding the right margin. Check this margin bell selection by moving the cursor to the right through the eighth column preceding the right margin.
CONFIGURE	ALT	BACK SPACE	Toggles into or out of the user configuration mode.

H.3.2.2 Configuration Display. To enter the configuration display mode, the terminal must be offline. To activate the user configuration display, press and hold ALT while pressing BACK SPACE. The configuration display allows selection of parameters, configuration status, and diagnostics.

Cycle between the configuration groups by pressing RETURN. The user can exit from the configuration groups at any time by pressing and holding ALT and pressing BACK SPACE at the same time.

The keys P1 through P4 (located on the top row of the numeric keypad) allow selection of user-programmable character strings. The user can load these keys with character strings so that pressing any one of them displays its contents as if the string had been entered character-by-character. This data is not destroyed if the terminal is turned off or loses power. The user can load a combined maximum of 120 characters for the four keys.

Selecting one of the four programmable (P) keys by pressing it, causes the screen to display that character string for viewing or change. When in the display and change mode for the P keys, the selected P key number appears on the left of the status line; the current character string is displayed within brackets. Characters can be changed by moving the cursor to the character position and keying in the new character. Characters can be deleted only by positioning the cursor over them and pressing the DEL CHAR key. The INS CHAR key functions in a similar manner.

H.3.2.3 Blank Display. To switch between display of the status line and a blank status line, press and hold SHIFT and ALT while pressing 2. The line remains blank until switched back to the status line.

H.3.3 Character Set

The special character sets described earlier are keyboard selectable. The primary character set is the default at power-up. To select special character sets, press SHIFT and P1 for SC1, or press SHIFT and P2 for SC2. To switch between the primary character set and the selected special set, hold ALT while pressing 9. Refer to the *Model 940 VDT Installation and Operation* manual for further discussion of special character sets.

H.3.4 Data Entry

Data entry is the process of entering and displaying data, and is dependent on communications usage.

The 940 communications capabilities require a minimum of user intervention. Most communications parameters are selected by the programming staff and are based upon the computer system used. Operation can be either offline or online.

H.3.4.1 Offline Operation. Offline, the terminal may be connected to the communications line but cannot transmit or receive data. While offline, the 940 operates similar to a typewriter. The user can make hard copy by selectively using a printer attached to the AUX1 auxiliary port connector.

H.3.4.2 Online Operation. Online, the terminal is connected to the communications line or to the computer system by direct cabling and can transmit or receive data. Online use is governed by the operational configuration of the 940.

H.4 OPERATIONAL CONFIGURATION

To set the internal configuration of the 940 to run under DNOS, use the following procedure.

1. If the terminal is not already offline, place it offline as follows:
   Press and hold ALT, and simultaneously press 4 (ON/OFF LINE).

2. Enter the configuration mode as follows:
   Press and hold ALT and SHIFT, and simultaneously press BACK SPACE (CONFIGURE).

3. Display the configuration parameters set as follows:
   Press the F5 key (RESET CONFIGURATION).

4. Press RETURN to view these parameters. They cycle through a circular set one step each time RETURN is pressed. Press TAB to move the cursor to the next parameter.

5. Set the HOST parameters (by entering the new values) to the values specified during system generation, for example:
   SPEED = 4800, PARITY = ODD.

6. Exit the configuration mode as follows:
   Press and hold ALT and SHIFT, and simultaneously press BACK SPACE (CONFIGURE).

7. Place the terminal back online as follows:
   Press and hold ALT, and simultaneously press 4 (ON/OFF LINE).

8. Begin log-on procedures as follows:

   a. Press and hold SHIFT, and simultaneously press PREV FORM NEXT.

   b. Press and hold SHIFT, and simultaneously press 1.

9. Perform log-on using locally assigned user identification and passcode (if any).

Appendix I

Models CD1400/32 and CD1400/96 Disk Drives

I.1 GENERAL INFORMATION

The CD1400/32 and CD1400/96 drives are moving-head disk drives with one removable unit and one fixed unit. The removable unit consists of one platter; the fixed unit consists of either one platter (CD1400/32) or three platters (CD1400/96). The CD1400/32 has a capacity of 32 million bytes —16 million bytes on each platter. The CD1400/96 has 96 million bytes of storage—16 million on the removable platter and 80 million on the fixed platter. Each disk surface has 821 tracks with 64 sectors per track and 256 bytes per sector. Single track seek time is 6 milliseconds, average seek time is 30 milliseconds, and maximum seek time is 55 milliseconds for each disk. The average latency time for both drives is 8.33 milliseconds. The transfer rate is 1,210,000 bytes per second.

This appendix describes normal operating procedures for the Model CD1400 Disk System, including the following:

- Power-up, stop, and power-down
- Cartridge handling, installation, and replacement
- Fault operation

For additional information, refer to the *Model CD1400 Disk System Installation and Operation Manual.*

The TILINE disk controller requires no operator intervention after installation. On-board controls and indicators are intended only for installation and maintenance use. The controller should be serviced only by qualified personnel. Before operating, read and observe all of the following listed precautions.

CAUTION

To prevent damage, the following precautions must be observed when operating the disk drive:

1. **Do not remove ac power from the disk drive or switch the MAIN AC BREAKER circuit breaker to OFF until the platters have stopped rotating. Failure to observe this precaution results in unfiltered air being sucked in by the rotating platters.**

2. **A removable cartridge must be kept in the unit at all times whether operating or not. If a removable cartridge is not in place, the cover does not seal out atmospheric contaminants.**

3. **Keep the access door closed at all times to prevent entry of atmospheric contaminants.**

4. **If a pinging or scratching sound (caused by head-to-disk contact) is heard and persists, stop the unit by following the stop and power-down procedures found in this appendix, then call maintenance personnel. If a head crash is suspected, do not place another cartridge into the drive until the system can be checked; otherwise, further damage could result to both the disk and the disk drive.**

5. **If the disk drive is cabinet-mounted on slides, never extend the drive unless all other cabinet mounted equipment is fully retracted. Never set any test equipment or other objects on top of an extended drive. Never lean on an extended drive. If these precautions are not followed, the entire cabinet may tip over.**

6. **If the disk drive is pedestal-mounted, do not place heavy test equipment or other heavy objects on top of the pedestal. Do not sit on the pedestal. Never stack disk drives.**

7. **Always carefully follow disk handling, installation, and removal procedures as described in this appendix.**

8. **Use only Texas Instruments approved disk cartridges.**

9. **Never attempt to override any interlocks in the system.**

I.2 CONTROLS AND INDICATORS

All operator controls and indicators are located on the front panel except for the MAIN AC BREAKER circuit breaker, which is located on the rear panel. Figure I-1 shows locations of these controls and indicators. Table I-1 describes their functions.

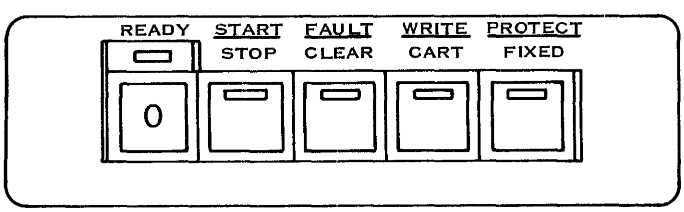

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Figure I-1. Model CD1400 Controls and Indicators

Table I-1. Model CD1400 Controls and Indicators

Control or Indicator	Function
START/STOP	
Alternate action switch:	When depressed (in), starts spindle motor and initiates the first seek mode, provided the following conditions are met: 1. The drive MAIN AC BREAKER circuit breaker is ON. 2. The disk cartridge loading door is closed and latched with a cartridge in place. 3. The drive FAULT light is off. When not depressed (out), removes power from spindle motor and halts all drive operations.
Indicator:	Lights when the START/STOP switch has been energized.
READY indicator:	Lights when unit is up to speed, heads are loaded, and no fault exists requiring manual intervention. The READY indicator blinks throughout the spindle start and stop procedure.
FAULT	
Switch:	When pressed, clears certain drive fault conditions.
Indicator:	Lights to indicate a fault condition. If pressing the FAULT switch clears the fault, the light goes out.
WRITE PROTECT FIXED	
Switch:	Alternate action switch. When actuated, the write driver for the fixed volumes is disabled, preventing data from being written on any fixed volumes.
Indicator:	Lights to indicate that the WRITE PROTECT FIXED switch is depressed.
WRITE PROTECT CART	
Switch:	Alternate action switch. When depressed, the write driver for the removable cartridge is disabled, preventing data from being written on the removable cartridge.
Indicator:	Lights to indicate that the WRITE PROTECT CART switch is actuated.
MAIN AC BREAKER ON/OFF	
Circuit breaker:	Applies primary ac power to disk drive. Trips on overload.

I.3 REMOVABLE DISK CARTRIDGES

The following paragraphs discuss removable disk cartridge purchase, handling, installation, and removal procedures.

CAUTION

Procedures in the following paragraphs must be carefully followed to prevent damage to the disk drive or cartridge as well as to protect data written on the cartridge.

I.3.1 Disk Cartridge Purchase

The disk cartridge used in the CD1400 disk system must meet the following quality criteria. Texas Instruments approved disk cartridges must be used in the system since standard disk cartridges sometimes do not meet these critical specifications.

1. Tracks 0 and 1 must be error free to ensure reliable operating system performance.
2. To ensure reliable error correction, unmapped track errors cannot exceed seven bits in length.
3. An error map must be included in order for software to deallocate bad track areas.
4. Surface finish must be superior in order to minimize the possibility of head crashing.

I.3.2 Disk Cartridge Handling Procedures

The cartridge consists of a platter, and top and bottom dustcovers. The platter is contained within these plastic dustcovers for protection from contaminants that can cause damage. The top dustcover is permanently attached to the platter and is installed with the platter into the drive unit. The bottom dustcover is removed prior to inserting the cartridge into the disk drive. After detaching, set the bottom dustcover upside down to prevent dust from collecting inside the cover.

The bottom dustcover should always be on the cartridge when not installed in the drive unit to protect the cartridge from damage and contaminants.

Cartridges can be stored flat or on the edge, but stacking should be avoided. Do not lay objects on top of cartridges.

Never touch the recording surface on the cartridge. Always lift the cartridge by the handle on the top dustcover.

I.3.3 Disk Cartridge Installation

The disk cartridge must be stored in the same environment as the disk drive for at least 60 minutes prior to installation. Refer to Figure I-2 while performing the following cartridge installation procedure.

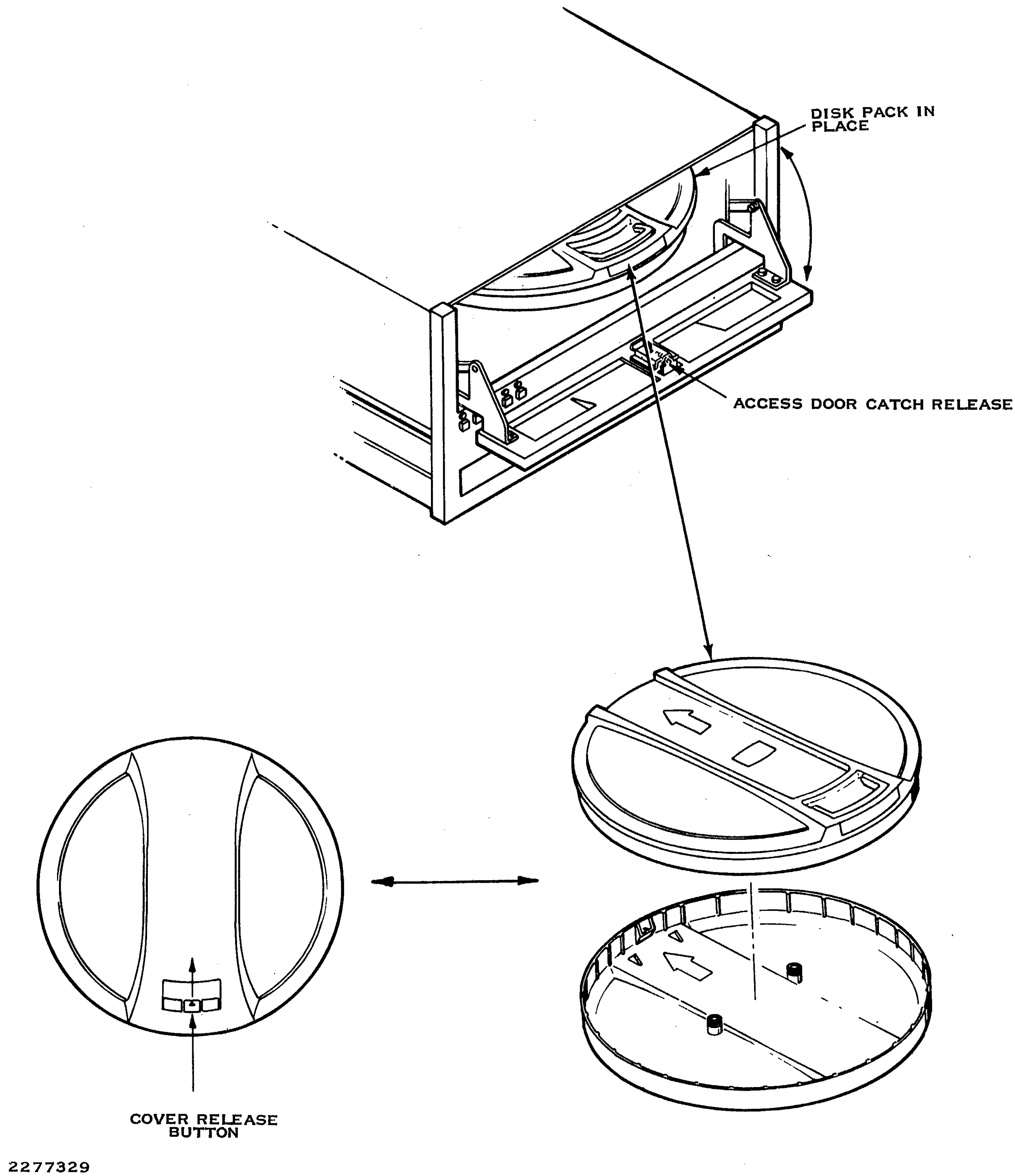

Figure I-2. Model CD1400 Cartridge Installation and Removal

1. Release latch under lip of access door recess and pull down cartridge access door.

NOTE

Power must be on, the START/STOP switch out, and READY and FAULT lamps must be off to release the lock on the cartridge door.

2. To separate the bottom dustcover from the cartridge, push the cover release button toward the center of the cartridge.
3. Disengage the bottom dustcover from the cartridge and set the bottom dustcover upside down to prevent dust from collecting in the cover.
4. Slide the cartridge into the receiver track, ensuring that the head opening is toward the rear of the disk drive. Align the small metal prongs on the top of the disk with the runners inside the drive and insert the disk along the runners.
5. Push the handle down, then push the cartridge fully to the rear.
6. Close the cartridge access door and press the door closed until latched. The cartridge slides into place on the spindle and automatically engages as the access door is latched.
7. Engage the START/STOP switch (switch in) to apply power to the spindle motor.

NOTE

If the spindle motor does not rotate, the cartridge access door may not be completely closed, the cartridge may not be properly seated on the spindle chuck, or the cartridge receiver/base may not be fully seated on the lower chassis.

I.3.4 Disk Cartridge Removal

The following procedure describes cartridge removal under normal conditions. If for any reason the door cannot be opened, check that power is on, the START/STOP switch is out, and the READY and FAULT lamps are off. If these conditions are met and the door cannot be opened, refer the problem to a qualified service technician. Do not attempt to force the door or defeat interlocks. Do not attempt to remove the cartridge during a power failure. Refer to Figure I-1 and Figure I-2 during the following procedure:

1. Disengage the START/STOP switch (switch out).
2. Wait until the READY indicator ceases blinking and goes out.

3. Pull down the cartridge access door.

4. Pull the cartridge out of the receiver with sufficient force to overcome the detent action.

5. Place the bottom dustcover on the cartridge and fold over the top handle.

NOTE

> Swing out the handle to carry the cartridge but do not push the cover release button while transporting.

6. Install another cartridge as described in the preceding procedure. Always keep a cartridge in the receiver to ensure that the cover remains sealed and contaminants do not enter the drive unit.

I.4 OPERATING PROCEDURES

The following paragraphs detail disk drive normal operation, including power-up, write-protect, stop, and power-down procedures.

I.4.1 Power-Up Procedure for Online Operation

Since the disk drive draws a high amount of current upon start-up, disk drives in multiple drive systems should be powered up one at a time to prevent circuit breakers from tripping due to start-up overload. Under normal conditions, the disk controller supervises application of power and start-up of the disk drive. To allow the controller to perform this power application sequencing, ensure that the MAIN AC BREAKER circuit breakers are ON on all disk drives and the front panel START/STOP switches are in the depressed position prior to applying power to the CPU. When power is applied to the CPU, the controller automatically sequences power to all drives in the system. If the disk drive(s) in single or multiple drive installations are not powered up and the CPU is powered up and online, perform the following procedure to power up the drive(s):

1. Ensure that the START/STOP switch is in the STOP position (switch out and indicator unlit).

2. Set the MAIN AC BREAKER circuit breaker on the rear panel to ON.

3. Install the cartridge into the disk drive using the disk cartridge installation procedures previously explained.

4. Depress the START/STOP switch, and verify that the indicator is lit.

5. Verify that the READY indicator ceases blinking and remains constantly lit. This occurs after the disk drive is up to speed and the heads are loaded (approximately 60 seconds).

6. Verify that the FAULT indicator is not lit.

7. Repeat this procedure for all drives in the system, one at a time.

I.4.2 Write-Protect Procedure

To ensure that data is not inadvertently written on either a fixed platter or the removable platter, the write-protect feature can be activated. Actuate the WRITE PROTECT FIXED switch to protect the fixed media in the disk drive. Press the WRITE PROTECT CART switch to protect the cartridge platter. Verify that the indicator is lit on the switch. The selected platter is now write-protected. To remove write protection, deactivate the appropriate switch and verify that the indicator is out.

I.4.3 Stop Procedure

The disk drive can be stopped whether or not a disk function is being performed. If a disk function is being performed, the operation stops, and the carriage retracts. To stop the disk drive, press the START/STOP switch. The READY indicator blinks until the platters cease rotating. The cartridge may now be removed using cartridge removal procedures.

I.4.4 Power-Down Procedure

Application and removal of power is generally accomplished by the CPU as described in the power-up procedures. The powering down of a single drive is usually done by maintenance personnel. To remove power from a disk drive, stop the unit as described, ensure that the spindle has stopped rotating (READY light out) and set the MAIN AC BREAKER circuit breaker on the rear panel to OFF.

I.5 FAULT OPERATION

If the FAULT indicator lights during operation or power-up, proceed as follows:

1. Press the FAULT switch. If the lamp goes out, normal operation can be resumed. If the FAULT lamp does not go out, proceed to step 2.

2. Press the START/STOP switch to the STOP position and allow the spindle to stop rotating (READY light out).

3. Press the START/STOP switch to the START position. If the FAULT light goes out, normal operation can resume. If the FAULT light remains lit, proceed to step 4.

4. Power down equipment in accordance with the power-down procedure.

5. Power up equipment in accordance with the power-up procedure. If the FAULT light remains lit, refer the problem to qualified maintenance personnel. Do not attempt to operate the disk drive.

Appendix J

Model DS10 Disk Drive

J.1 GENERAL INFORMATION

This appendix describes the operation of the Model DS10 disk drive. It includes information on controls and indicators, procedures for installing and unloading disk volumes, and common operational errors. For a more detailed account of this disk drive, refer to the *Model 990 Computer Model DS10 Cartridge Disk System Installation and Operation Manual.*

The Model DS10 Cartridge Disk System (Figure J-1) consists of a disk controller and one or two Model DS10 Cartridge Disk Drives. The disk drive has one fixed and one removable platter. A total storage of 10 million bytes is recorded on one 5-megabyte fixed platter and one 5-megabyte removable 5440-type disk cartridge.

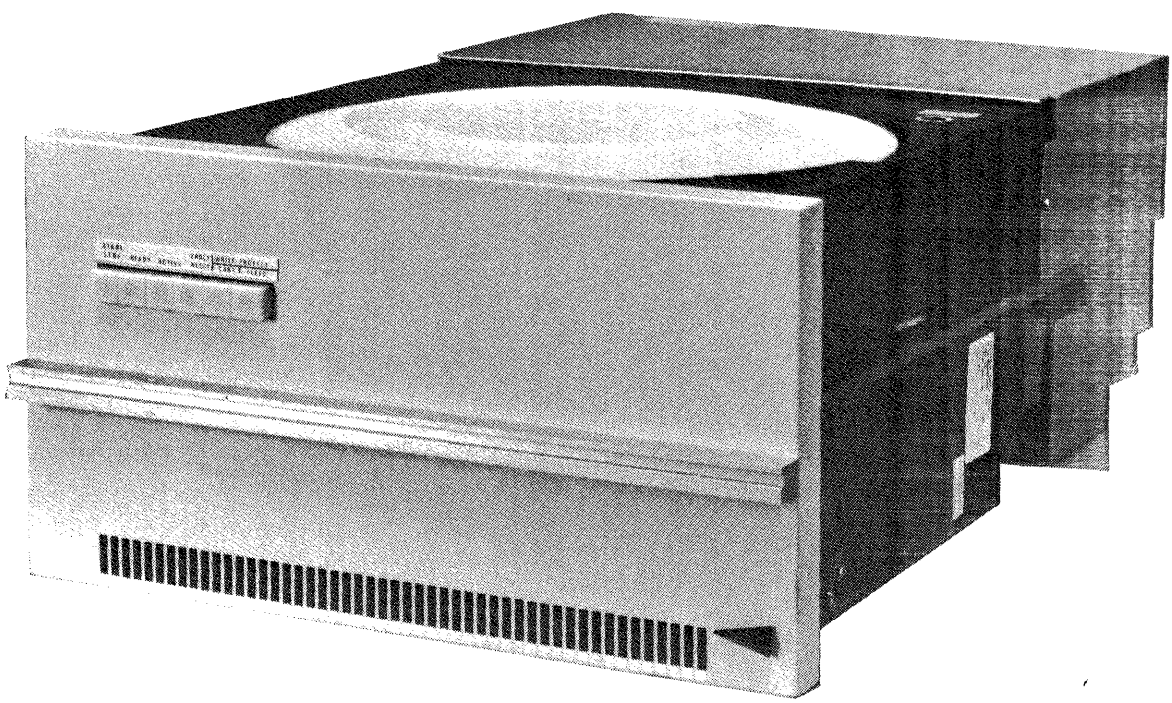

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Figure J-1. Model DS10 Disk Drive

The Model DS10 Disk System operates under the following environmental conditions:

Temperature:	10 to 40 degrees C (50 to 104 degrees F) with a maximum gradient of 6.7 degrees C (12 degrees F) per hour
Humidity:	10% to 90% relative with no condensation
Altitude:	– 305 to 3048 m (– 1000 to 10,000 ft.)

J.1.1 Controls and Indicators

Figure J-2 shows the locations of the controls and indicators on the front of the Model DS10 Disk Drive. In addition, two circuit breaker controls (not shown) are located on the back of the disk drive. The paragraphs that follow describe the operation of these controls and indicators.

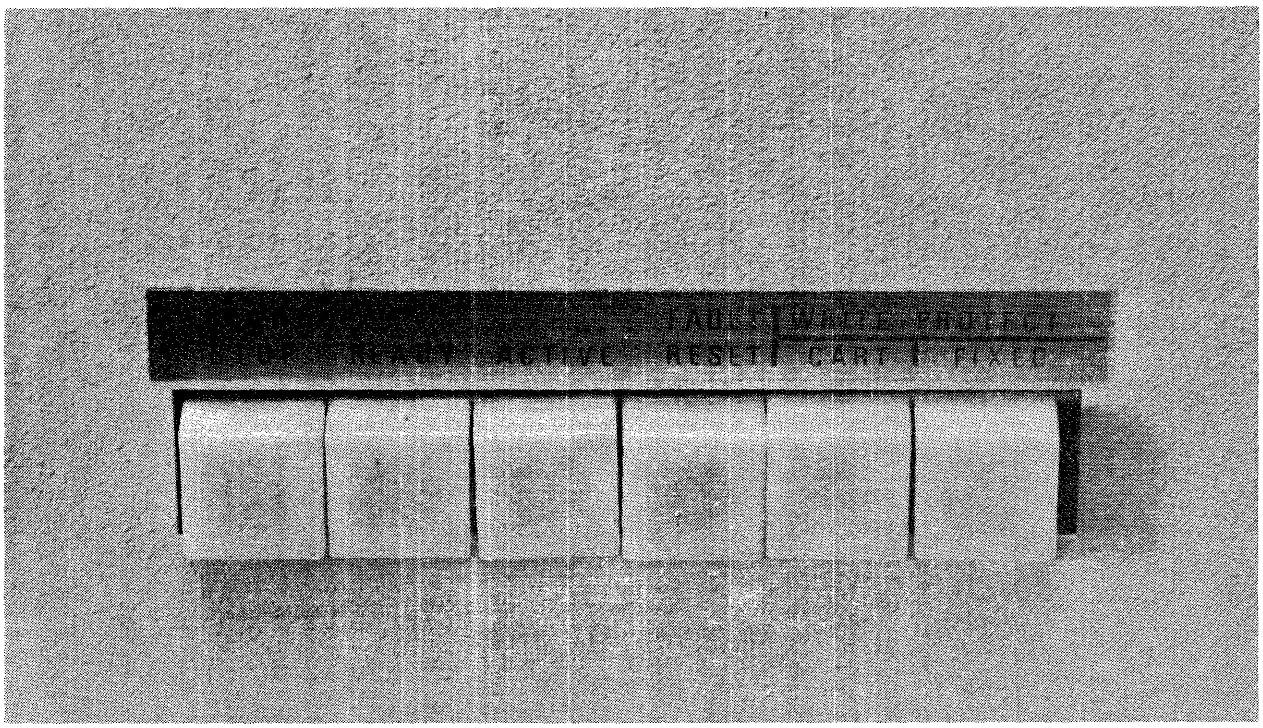

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Figure J-2. Model DS10 Disk Drive Controls and Indicators

J.1.1.1 START/STOP Indicator/Switch. The START/STOP indicator/switch is a lighted pushbutton switch. If the indicator is not lit and is operational, pressing the switch starts the spindle motor and initiates the first seek mode under the following conditions:

- The circuit breakers are closed.
- The disk cartridge dust cover is properly installed.
- The cartridge hold-down arms are properly positioned.

While the spindle motor is running, the START/STOP indicator stays lit. Pressing START/STOP while the indicator is lit stops the motor. The indicator remains lit until the disk rotation has stopped.

The first seek mode is automatic and requires about 65 seconds. The disk drive can be reset at any time after initiation of the start sequence. If a potentially damaging fault occurs during the first seek mode, the heads retract and the disk drive stops.

J.1.1.2 READY Indicator. The READY indicator is lit when the spindle motor reaches operating speed, the heads are loaded, and the disk drive is ready for use. The READY indicator is not lit during any fault, emergency retraction, or stop operation.

J.1.1.3 ACTIVE Indicator. The ACTIVE indicator lights while the disk drive is actively engaged in an operation.

J.1.1.4 FAULT Indicator/Switch. The FAULT indicator/switch lights when any fault occurs except ac power failure. If a momentary ac power drop occurs, the heads retract and the disk drive stops. The disk drive restarts when ac power returns to normal.

If a momentary, nondamaging fault occurs, pressing the FAULT switch clears the fault logic and turns off the indicator. The FAULT switch cannot be used to clear a persistent fault.

J.1.1.5 WRITE PROTECT CART Indicator/Switch. This indicator/switch protects the removable disk from write and erase operations. To write protect a removable disk, the user presses the WRITE PROTECT CART indicator/switch.

J.1.1.6 WRITE PROTECT FIXED Indicator/Switch. This indicator/switch protects the fixed disk from write and erase operations. To write protect the fixed disk, the user presses the WRITE PROTECT FIXED indicator/switch, which will light to indicate write protection is in effect.

J.1.1.7 BRUSH Indicator. The brush indicator (Figure J-3) resembles a slotted-head screw. The position of the slot indicates whether the brushes that clean the disk are retracted. If the brushes are retracted, the slot lines up with the two black marks on either side of the hole. If the brushes do not retract when they are supposed to, a coin or screwdriver can be used to turn the brush indicator to retract the brushes. This should be done before attempting to remove the disk.

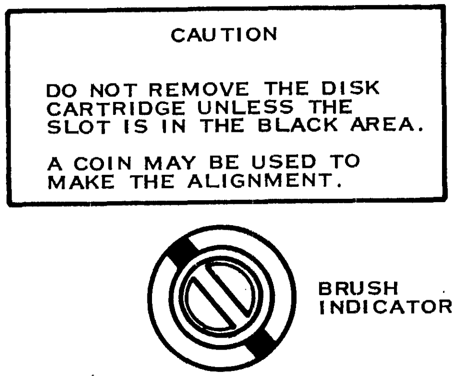

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Figure J-3. Model DS10 Brush Indicator

J.1.2 Loading DS10 Disk Cartridges

Before loading or removing a disk cartridge from the disk drive, the user should be sure the spindle is not rotating and that the BRUSH indicator on top of the disk drive lines up with the black area as shown in Figure J-3. A coin or screwdriver may be used to make the alignment.

Perform the following steps to load a disk cartridge (refer to Figure J-4):

1. Open the disk drive. Raise the cartridge access door if the unit is mounted in a cabinet, or pull the disk drive out of the rack if it is mounted in a rack. To release the lock on the hold-down arms, the power must be on and the START/STOP light must be off.

2. Pull back the hold-down arms.

3. Take the dustcover off the disk.

   Two types of disk cartridges are available. One type has a dustcover lock that opens when the slide button is pushed toward the center. The other type opens when the slide button is moved to the left.

   Set the disk upright on a firm surface. Push the disk cartridge cover release button left or toward the center, depending upon the type of cartridge you have. At the same time, lift the cartridge handle to separate the dustcover from the disk. Set the dustcover aside.

4. Put the cartridge in the disk drive.

CAUTION

Load the disk carefully. Ensure that the read/write heads are fully retracted and that the brushes are completely out of the disk area.

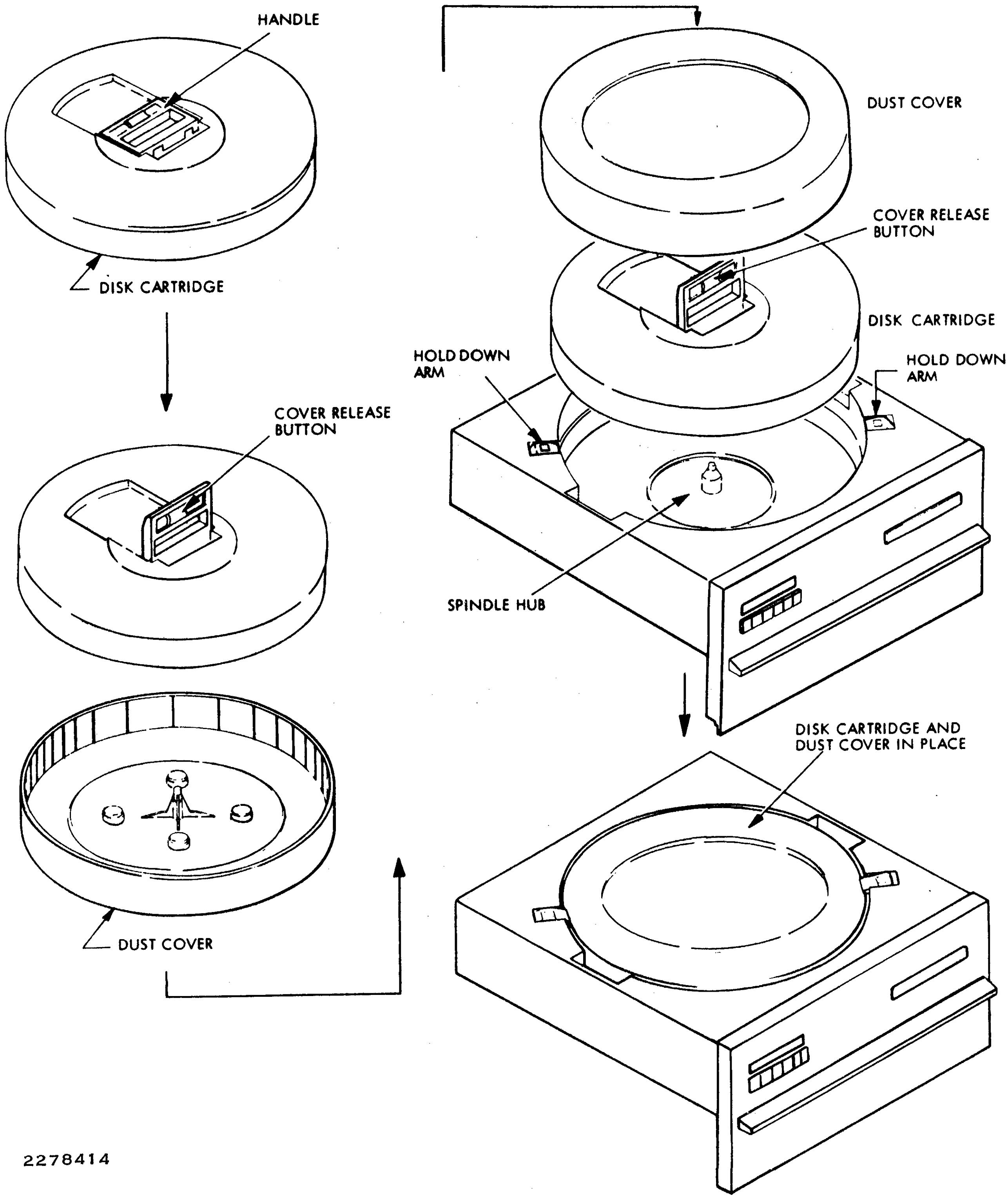

Figure J-4. Model DS10 Disk Cartridge Installation

Position the head opening of the disk toward the rear of the disk drive and place the disk onto the spindle hub. Rotate the cartridge until the cartridge seats over the spindle.

5. Fold the handle down.

6. Place the dustcover open-end down over the cartridge.

7. Position the hold-down arms over the cartridge and dustcover.

8. Close the cartridge access door (cabinet mount) or push the disk drive into the rack (rackmount).

9. Push the START/STOP switch. Wait for the READY indicator light to come on.

10. Verify that the FAULT indicator switch remains off. If the FAULT indicator lights, perform the fault operating procedures described in the next paragraph.

11. If you plan to write to the disk, make sure that the disk is not write-protected. See the descriptions of the WRITE PROTECT CART and WRITE PROTECT FIXED indicator switches.

12. When all indicators show normal, the disk can be used as described in the section on using disk volumes.

J.1.2.1 Fault Operating Procedures. If the FAULT indicator lights during normal operation or power application, proceed as follows:

1. Press the FAULT switch. If the FAULT indicator goes off, normal operation can be continued. If the FAULT indicator remains lit, proceed to step 2.

2. Press the START/STOP switch and allow the spindle to stop rotating. Wait until the START/STOP indicator goes off.

3. Press the START/STOP switch and observe the FAULT indicator. If the FAULT indicator goes off, normal operation can be resumed. If the FAULT indicator remains lit, proceed to step 4.

4. Perform the stop and power removal procedure described in the Stopping the Drive and Removing Power paragraph in this appendix.

5. Call your service representative.

J.1.2.2 Stopping the Drive and Removing Power. To stop the disk drive and remove power, perform the following steps:

1. Press the START/STOP switch and verify that the following occurs:

   a. The READY indicator goes off.

   b. The START indicator goes off.

   c. The spindle stops.

   d. The hold-down arms unlock and can be retracted.

2. Remove the disk cartridge as described in the next paragraph.

3. Set the ac circuit breaker (labeled MAIN) on the rear of the drive to OFF. This should only be performed by maintenance personnel.

J.1.3 Removing DS10 Disk Cartridges from the Disk Drive

This paragraph describes how to remove a disk cartridge under normal conditions and how to remove a disk cartridge after power failure or in an emergency.

J.1.3.1 Removal Under Normal Conditions. To remove a disk cartridge under normal conditions, perform the following steps:

1. Unload the volume using the procedure given in the Unloading a Disk Volume paragraph in the section Using Disk Volumes.

2. Stop the disk by pressing the START/STOP switch and waiting for the START/STOP indicator to turn off. If the START/STOP indicator is still lit after 2 1/2 minutes and the brushes are not fully retracted, contact your customer service representative.

3. Raise the cartridge access door (cabinet mount), or pull the disk drive out of the rack (rackmount).

4. Pull back the hold-down arms. The arms will not move until the cartridge has stopped spinning. Figures J-4 and J-5 show the hold-down arms.

5. Remove the dustcover.

6. Remove the cartridge from the disk drive.

   Push the cover release button to the left or to the center, as necessary. Lift the cartridge handle and then take out the cartridge, lifting it up and out by the handle.

7. Place the cartridge inside the dustcover and fold down the handle until you hear a snap. This indicates that the cartridge and dustcover are locked together.

8. Close the cartridge access door (cabinet mount) or push the disk drive back into the rack (rackmount).

J.1.3.2 Removal After Power Failure or in an Emergency. To remove a disk cartridge after power failure or in an emergency, perform the following steps:

1. Press the START/STOP indicator/switch.

2. Wait aproximately three minutes for the cartridge to stop spinning.

3. Raise the cartridge access cover (cabinet mount) or pull the disk unit out of the rack (rackmount).

4. Ensure that the brush indicator is properly aligned.

5. Release the cartridge locks by inserting a flat-head screwdriver or a similar object into the hole on the top of the cartridge lock as shown in Figure J-5. Press the solenoid plunger into the solenoid and tilt the cartridge lock.

6. Pull back the hold-down arms.

7. Remove the dustcover.

8. Remove the cartridge from the disk drive. Push the cover release button to the left or to the center, as necessary. Lift the cartridge handle and then take out the cartridge, lifting it up and out of the disk drive.

9. Place the cartridge inside the dustcover and fold down the handle until a snap is heard, indicating that the cartridge and dustcover are locked together.

10. Close the cartridge access door (cabinet mount) or push the disk drive back into the rack (rackmount).

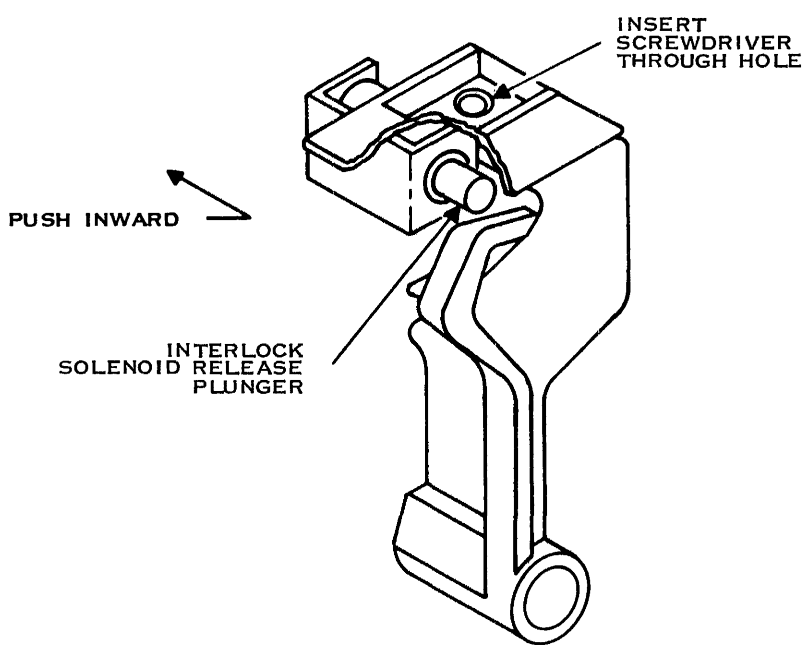

Figure J-5. Model DS10 Hold-down Arm

J.1.4 Common Operator Errors

The following is a list of symptoms of common problems that may occur and possible ways of overcoming each problem.

Symptom	Possible Actions
Cannot access the disk	• Disk may not have come up to speed. Make sure the READY indicator is lit. • Make sure that both disks are physically in the drive. • Make sure that no accesses are made to the non-removable platter while the removable platter is being removed or loaded. • Make sure that the disk is installed with the Install Volume (IV) or Initialize New Volume (INV) command before attempting to access it.
Cannot write to the disk	Make sure that the disk is not write protected.
Disk does not begin to spin after START/STOP switch is set to START	Make sure that the cover is properly seated between the cartridge locks that hold it down.
Cannot remove disk from drive	Make sure that the power is on. The disk cannot be removed when the power is off because the cartridge locks are electrically operated. To remove the disk, turn the power on. If the power cannot be turned on, follow the steps described in the Removal After Power Failure or in an Emergency paragraph in this appendix.

Appendix K

Models DS50, DS80, DS200, and DS300 Disk Drives

K.1 GENERAL INFORMATION

This appendix describes the operation of the DS50 and DS80, and the DS200 and DS300 disk drive systems. It includes information on controls and indicators, procedures for installing and unloading disk volumes, and common operational precautions. For more information concerning these disk drives, refer to the following manuals:

- *Model DS50 Cartridge Disk System Installation and Operation.*
- *Model DS80 Disk System Installation and Operation.*
- *Model DS200 Disk System Installation and Operation.*
- *Model DS300 Disk System Installation and Operation.*

K.2 DS50 AND DS80 DISK DRIVES

The Model DS50 Disk Drive is a moving-head disk unit for the five-platter disk packs. (One platter is protective. Writing to the other four is permitted.) The DS50 provides 815 cylinders or 4075 tracks, each track containing 38 sectors with 288 bytes per sector. This totals 44.60 million bytes of storage.

The DS80 Disk System is a random-access mass storage device that provides 63 megabytes of formatted online data storage. The system features a removable disk pack, and allows up to four disk drives per controller to be connected to the Model 990 or Business Systems minicomputer TILINE data bus.

The following paragraphs describe the controls, indicators, and operating procedures for the DS50 and DS80 disk drives.

K.2.1 Controls and Indicators

All operator controls and indicators are located on the front panel, except for the power circuit breaker which is located on the rear panel.

K.2.1.1 START/STOP Switch. The START/STOP toggle switch is the rightmost control on the front panel. When in the START position, this switch energizes the spindle motor and initiates the first seek mode, provided the following conditions are met:

- Drive power switch is ON
- Disk pack is loaded and the lid is closed and latched
- Drive DEVICE CHECK light is off

When in the STOP position, this switch removes power from the spindle motor and halts all drive operations.

K.2.1.2 Ready Indicator. The ready indicator is the unlabeled green indicator found next to the START/STOP switch. This indicator lights, indicating the drive is ready for operation, when the following conditions are met:

- The unit is up to speed.
- The heads are loaded.
- No fault exists requiring manual intervention.

The indicator light blinks throughout the spindle start and stop procedures.

K.2.1.3 DEVICE CHECK Indicator. The DEVICE CHECK indicator, located to the left of the ready indicator, lights when a fault condition occurs. The indicator is reset if the fault condition is cleared or if drive power is recycled.

K.2.1.4 READ ONLY READ/WRITE Switch. The READ ONLY READ/WRITE toggle switch is the leftmost control on the front panel. When in the READ ONLY position, this switch disables the drive write circuits, preventing data from being written on any platters. When in the READ/WRITE position, this switch enables both read and write operations.

K.2.1.5 Power Circuit Breaker. This control, labeled PWR ON/OFF, is located on the rear panel of the drive. This switch applies primary ac power to the disk drive.

K.2.2 Powering Up the Disk Drive

Since the disk drive draws a high amount of current upon start-up, disk drives in multiple drive systems should be powered up one at a time to prevent circuit breakers from tripping due to start-up overload. Under normal conditions, the disk controller supervises application of power and start-up of the disk drive. To allow the controller to perform this power application sequencing, ensure that the PWR ON/OFF circuit breakers are set to ON prior to applying power to the CPU. When power is applied to the CPU, the controller automatically sequences power to all drives in the system. If the disk drive(s) in a single or multiple drive installation is not powered up and the CPU is powered up and online, perform the following procedure to power up the drive(s):

1. Ensure that the START/STOP switch is set to STOP.
2. Set the PWR ON/OFF circuit breaker on the rear panel to ON.

3. Install a disk pack in the disk drive using the installation procedures detailed in the Disk Pack Installation paragraph in this appendix.

4. Set the START/STOP switch to START.

5. Verify that the green ready indicator stops blinking and remains constantly lit. This occurs after the disk drive is up to speed and the heads are loaded (approximately 20 seconds).

6. Verify that the DEVICE CHECK indicator is not lit.

7. Repeat this procedure for each drive in the system.

K.2.2.1 Write-Protect Feature. To ensure that data is not inadvertently written on a disk pack, activate the write-protect feature. To protect the media in the disk drive, set the READ ONLY READ/WRITE switch to READ ONLY. Then, to disable the write-protect feature, set the switch to READ/WRITE.

K.2.2.2 Stop Operation. The disk drive can be stopped even if a disk function is being performed. If a disk function is in progress, the operation stops and the heads retract. To stop the disk drive, set the START/STOP switch to STOP. The ready indicator blinks until the platters stop rotating. The disk pack can now be removed, if desired, using disk pack removal procedures.

K.2.2.3 System Power-Down. Application and removal of power is generally accomplished by the CPU, as described in the power-up procedures. Power-down of a single drive is usually accomplished only by maintenance personnel. If removing power from a disk drive is necessary, stop the unit as previously described, ensure that the spindle has stopped rotating (ready indicator not lit), and set the PWR ON/OFF circuit breaker on the rear panel to OFF.

K.2.3 Disk Pack Installation

To install a disk pack, perform the following procedure:

1. Set the disk drive START/STOP switch to STOP and wait for the green light (ready indicator) to stop blinking and remain off.

2. Unlatch and open the drive cover. The cover latch is located above the front panel, centered beneath the front edge overhang.

3. Check the interior of the compartment. It should be clean and the heads should be completely retracted. If not, notify maintenance personnel.

4. Remove the lower cover from the disk pack by pressing the two plastic release clamps together, and carefully lower the top cover with the disk pack onto the disk drive spindle.

5. Press down the top cover handle to engage the spindle-locking mechanism. Then, rotate the handle clockwise to lock the disk pack to the spindle and to disengage the top cover.

6. Carefully lift the top cover and remove it from the disk drive; close the disk drive cover. Ensure that the disk drive cover latch is locked.

7. If the installed disk is a permanent record, set the READ ONLY READ/WRITE switch to READ ONLY to protect the disk pack from inadvertent overwriting. If data is to be recorded on the disk pack, set the switch to READ/WRITE.

8. Replace the bottom cover on the canister to minimize dust accumulation inside the case.

9. Set the disk drive START/STOP switch to START.

K.2.4 Clearing Device Check Errors

If the DEVICE CHECK indicator lights during operation or power-up, proceed as follows:

1. Set the START/STOP switch to STOP and wait for the green light to stop blinking and remain off.

2. Set the START/STOP switch to START. If the DEVICE CHECK indicator lights again after recycling power, an equipment malfunction is indicated. Refer the problem to maintenance personnel. Do not attempt to operate the disk drive.

K.2.5 Disk Pack Removal

To remove a disk pack from the disk drive, perform the following procedure:

1. Set the disk drive START/STOP switch to STOP and wait for the green light to stop blinking and remain off.

2. Unlatch the disk drive cover and open it.

3. Separate the top and bottom covers of the disk pack canister and lower the top cover by the handle over the disk pack.

4. Press down the top cover handle to engage the spindle-locking mechanism. Then, rotate the handle counterclockwise to unlock the disk pack from the spindle and to reengage the top cover onto the disk pack.

5. Carefully lift the top cover and disk pack from the disk drive and close the disk drive cover.

6. Replace the bottom cover on the disk pack canister and return the pack to storage.

K.2.6 Handling Disk Packs

The disk pack consists of a stack of five separate platters mounted on a spindle hub. The top and bottom platters are protective platters and are not used for recording. Of the middle three platters, five surfaces are used for recording data, and one surface contains prerecorded servo information. The disk pack is enclosed in a rigid plastic canister to protect the disk surfaces from damage and contaminants. Observe the following precautions when handling disk packs:

- Always use the canister handle to transport the disk pack. The handle locks onto the spindle hub and supports the disk pack at its center, which keeps damaging stresses from the platters and hardware.
- Always attach the bottom cover while holding the pack by the handle with the pack parallel to the ground.
- To eliminate damaging or contaminating the disk platters, never set the disk pack on any surface without having the bottom cover in place.
- Never stack disk packs.
- Never disturb the lead weights that are attached to the spindle hub. Tampering with these weights can seriously affect dynamic balance.
- Never attempt to stop the disk pack from rotating on the drive. The spin-down time is drive-controlled to minimize wear to the drive spindle bearings and to prevent large torques from being transmitted to disk pack components.

K.3 DS200 AND DS300 DISK DRIVES

The Model DS200 Disk System consists of a disk controller, one to four stand-alone disk drive units, and the interconnecting cables that link the disk drives to the controller. Data storage is provided by removable high-density disk packs. Each pack contains ten plastic-enclosed recording disks with a total storage capacity of 169.5 million bytes of data.

The Texas Instruments Model DS300 Disk System is a random-access mass storage device that provides 240 megabytes of formatted online data storage. The system features a removable disk pack, and allows up to four disk drives to be connected to the Model 990 or Business Systems minicomputer TILINE data bus.

The following paragraphs describe the controls and indicators, the procedures for powering up the drive, and provide instructions for loading, using, and unloading disk packs.

K.3.1 Controls and Indicators

Routine operator controls and indicators are located on the disk drive front panel. The power circuit breaker is located on the power distribution panel at the bottom rear of the drive chassis. The INTERFACE/DEGATE switch is located on the interface input/output (I/O) board inside the drive chassis.

K.3.1.1 START/STOP Switch. The START/STOP toggle switch is the rightmost control on the front panel. When in the START position, this switch energizes the spindle motor and initiates the first seek mode, provided the following conditions are met:

- The drive power switch is ON.
- The disk pack is loaded and the air shroud lid is closed and latched.
- The drive DEVICE CHECK light is off.
- The INTERFACE/DEGATE switch is set to INTERFACE.

When in the STOP position, this switch removes power from the spindle motor and halts all drive operations.

K.3.1.2 Ready Indicator. The ready indicator is the unlabeled green indicator found next to the START/STOP switch. This indicator lights, indicating the drive is ready for operation, when the following conditions are met:

- The unit is up to speed.
- The heads are loaded.
- No fault exists requiring manual intervention.

The indicator light blinks throughout the spindle start and stop procedures.

K.3.1.3 DEVICE CHECK Indicator. The DEVICE CHECK indicator, located to the left of the ready indicator, lights when a fault condition occurs. The indicator is reset if the fault condition is cleared or if drive power is recycled.

K.3.1.4 READ ONLY READ/WRITE Switch. The READ ONLY READ/WRITE toggle switch is the leftmost control on the front panel. When in the READ ONLY position, this switch disables the drive write circuits, preventing data from being written on any platters. When in the READ/WRITE position, this switch enables both read and write operations.

K.3.1.5 Power Circuit Breaker. This control, labeled CB1 ON/OFF, is located on the ac distribution box on the power distribution panel at the bottom rear of the drive chassis. This circuit breaker is accessible after removing the disk drive rear panel and swinging out the swing panel. Remove the rear panel by lifting the panel straight up and out of the retaining trough, and pulling the top of the panel out and away from the magnetic catch. Open the swing-out panel by pulling the spring-loaded latches to the left while pulling the door out and to the left. This switch applies primary ac power to the disk drive.

K.3.1.6 INTERFACE/DEGATE Switch. The INTERFACE/DEGATE switch is located on the interface I/O board within the disk drive chassis. This switch disconnects the disk drive from the controller for certain maintenance operations. The INTERFACE position enables normal, online operation, permitting the disk drive to be powered up and selected by the controller. The DEGATE position disconnects the disk drive from the controller and enables inputs from the T2000A/B exerciser for maintenance operations. For normal operation, verify that the switch is in the INTERFACE position.

K.3.2 Powering Up the Disk Drive

Since the disk drive draws a high amount of current upon start-up, disk drives in multiple drive systems should be powered up one at a time to prevent circuit breakers from tripping due to start-up overload. Under normal conditions, the disk controller supervises application of power and start-up of the disk drive. To allow the controller to perform this power application sequencing, ensure that the CB1 ON/OFF circuit breakers are set to ON on all disk drives and the front panel START/STOP switches are set to START prior to applying power to the CPU. When power is applied to the CPU, the controller automatically sequences power to all drives in the system. If the disk drive(s) in a single or multiple drive installation is not powered up and the CPU is powered up and online, perform the following procedure to power up the drive(s):

1. Ensure that the START/STOP switch is set to STOP.

2. Set the CB1 ON/OFF circuit breaker on the ac distribution box to ON.

3. Install a disk pack in the disk drive using the installation procedures detailed in the Disk Pack Installation paragraph in this appendix.

4. Set the START/STOP switch to START.

5. Verify that the green ready indicator stops blinking and remains constantly lit. This occurs after the disk drive is up to speed and the heads are loaded (approximately 20 seconds).

6. Verify that the DEVICE CHECK indicator is not lit.

7. Repeat this procedure one at a time for all drives in the system.

K.3.2.1 Write-Protect Feature. To ensure that data is not inadvertently written on a disk pack, activate the write-protect feature. To protect the media in the disk drive, set the READ ONLY READ/WRITE switch to READ ONLY. Then, to disable the write-protect feature, set the switch to READ/WRITE.

Note that the status of this switch is checked by the controller when the drive is idle; the drive does not have to be deselected to change write-protect status. If this switch is changed during an operation, the write-protect status is not changed until the operation has been completed and the drive becomes idle. This feature prevents interrupting a disk write operation.

K.3.2.2 Stop Operation. The disk drive can be stopped even if a disk function is being performed. If a disk function is in progress, the operation stops and the heads retract. To stop the disk drive, set the START/STOP switch to STOP. The ready indicator blinks until the platters stop rotating. The disk pack can then be removed, if desired, using disk pack removal procedures.

K.3.2.3 System Power-Down. Application and removal of power is generally accomplished by the CPU, as described in the power-up procedures. Power-down of a single drive is usually accomplished only by maintenance personnel. If removing power from a disk drive is necessary, stop the unit as previously described, ensure that the spindle has stopped rotating (ready indicator not lit), and set the CB1 ON/OFF circuit breaker on the ac distribution box to OFF.

K.3.3 Disk Pack Installation

To install a disk pack, perform the following procedure:

1. Set the disk drive START/STOP switch to STOP and wait for the green light (ready indicator) to stop blinking and remain off.
2. Unlatch and open the disk drive cover. The cover latch is located above the front panel, centered beneath the front edge overhang.
3. Check the interior of the compartment. The interior should be clean and the heads and brushes should be completely retracted. If not, call maintenance personnel.
4. Remove the lower cover from the disk pack by pressing the two plastic release clamps together, and carefully lower the top cover with the disk pack onto the disk drive spindle.
5. Press down the top cover handle to engage the spindle-locking mechanism. Then, rotate the handle clockwise to lock the disk pack to the spindle and to disengage the top cover.
6. Carefully lift the top cover and remove it from the disk drive; close the disk drive cover. Ensure that the disk drive cover latch is locked.
7. If the installed disk is a permanent record, set the READ ONLY READ/WRITE switch to READ ONLY to protect the disk pack from inadvertent overwriting. If data is to be recorded on the disk pack, set the switch to READ/WRITE.
8. Replace the bottom cover on the canister to minimize dust accumulation inside the case.
9. Set the disk drive START/STOP switch to START.

K.3.4 Clearing Device Check Errors

If the DEVICE CHECK indicator lights during operation or power-up, proceed as follows:

1. Set the START/STOP switch to STOP and wait for the green light to stop blinking and remain off.
2. Set the START/STOP switch to START. If the DEVICE CHECK indicator lights again after recycling power, an equipment malfunction is indicated. Refer the problem to maintenance personnel. Do not attempt to operate the disk drive.

K.3.5 Disk Pack Removal

To remove a disk pack from the disk drive, perform the following procedure:

1. Set the disk drive START/STOP switch to STOP and wait for the green light to stop blinking and remain off.
2. Unlatch the disk drive cover and open it.

3. Separate the top and bottom covers of the disk pack canister and lower the top cover by the handle over the disk pack.

4. Press down the top cover handle to engage the spindle-locking mechanism. Then, rotate the handle counterclockwise to unlock the disk pack from the spindle and to reengage the top cover onto the disk pack.

5. Carefully lift the top cover and disk pack from the disk drive and close the disk drive cover.

6. Replace the bottom cover on the disk pack canister and return the pack to storage.

K.3.6 Handling Disk Packs

The disk pack consists of a stack of 12 separate platters mounted on a spindle hub. The top and bottom platters are protective platters and are not used for recording. Of the middle 10 platters, 19 surfaces are used for recording data, and one surface contains prerecorded servo information. The disk pack is enclosed in a rigid plastic canister to protect the disk surfaces from damage and contaminants. Observe the following precautions when handling disk packs:

- Always use the canister handle to transport the disk pack. The handle locks onto the spindle hub and supports the disk pack at its center, which keeps damaging stresses from the platters and hardware.

- Always attach the bottom cover while holding the pack by the handle with the pack parallel to the ground.

- To eliminate damaging or contaminating the disk platters, never set the disk pack on any surface without having the bottom cover in place.

- Never stack disk packs.

- Never disturb the lead weights that are attached to the spindle hub. Tampering with these weights can seriously affect dynamic balance.

- Never attempt to stop the disk pack from rotating on the drive. The spin-down time is drive-controlled to minimize wear to the drive spindle bearings and to prevent large torques from being transmitted to disk pack components.

K.4 COMMON PRECAUTIONS

For all of these disk drives, several precautions should be followed concerning the operation and storage of the disk packs themselves.

When operating the disk drive, observe the following precautions:

- Keep the disk pack cover closed at all times to prevent entry of atmospheric contaminants.

- If a pinging or scratching sound (caused by head-to-disk contact) is heard and persists, stop the unit by following the stop and power-down procedures covered earlier; then call maintenance personnel. If a head crash is suspected, do not place another disk pack into the drive until the system can be checked. Otherwise, further damage can result to the disk pack and the disk drive.

- Never use a disk pack suspected of damage in another disk drive. Head crashes can result.

- Never place heavy test equipment or other heavy objects on top of the disk drive.

- Never stack disk packs.

- Always carefully follow disk pack handling, installation, and removal procedures described earlier in this appendix. Observe the storage requirements that follow.

- Use only Texas Instruments-supplied disk packs to ensure data integrity and maintain system performance.

- Never attempt to override any interlocks in the system.

When storing disk packs, observe the following precautions:

1. Store the disk packs in the following environment:

   a. Temperature: – 40 to 60 degrees Celsius (– 40 to 150 degrees Fahrenheit).

   b. Humidity: 8 to 80 percent, excluding all conditions that can cause condensation.

2. If a disk pack has been subjected to temperatures outside the operating range of the disk drive (13 to 40 degrees Celsius; 55 to 104 degrees Fahrenheit), store the disk pack in the operating environment for at least 24 hours before use. During this conditioning period, the disk packs should be removed from their shipping containers, but not from their protective canister.

3. For long-term storage, replace disk packs in their shipping containers. Do not stack shipping containers more than three high.

CAUTION

Always store disk packs in their canisters (and shipping containers if stored for long periods of time) on a flat surface and in a horizontal position. Never stack disk packs, unless packed in their shipping containers.

Appendix L

Model FD1000 Flexible Diskette System

L.1 GENERAL INFORMATION

This appendix describes how to operate the Model FD1000 flexible diskette drive unit. For more detailed information, refer to the *Model FD1000 Flexible Disk System Installation and Operation* manual.

The Model FD1000 Flexible Diskette System, shown in Figure L-1, supports both single-sided, single-density diskettes and double-sided, double-density diskettes. When used with DNOS, single-sided, single-density diskettes can only be used to hold IBM formatted files.

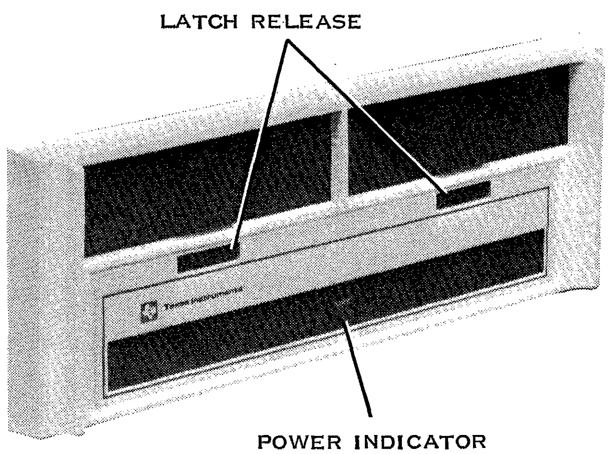

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Figure L-1. Model FD1000 Flexible Diskette System

L.2 CONTROLS AND INDICATORS

The only operator control is the door latch, which opens the diskette unit so that a diskette may be inserted or removed. The only indicator is the POWER INDICATOR which lights when power to the diskette drive is on. These two items are shown in Figure L-1.

L.3 WRITE-PROTECT FEATURE

A diskette is write-protected by means of the notch (or hole) in the jacket (covered by the write-protect tab in Figure L-2). An optical sensor in the drive detects the presence of the notch. The diskette cannot be recorded or formatted unless the light beam is blocked; therefore, a tab or tape is placed over the notch to allow data to be recorded or altered. Write protection is again provided by removing the tab or tape.

L.4 LOADING AND REMOVING A DISKETTE

A diskette is inserted (and removed) through an access door at the front of the drive unit. The access door handle is a flange which is immediately above the door opening. The door release is a rectangular button that is centered below the door opening.

The diskette may be installed with the power off or on. To load a diskette, proceed as follows:

1. Press the latch release so that the access door pops open.
2. Remove the diskette from the envelope and hold the diskette with the label up, as shown in Figure L-3.
3. Insert the diskette into the slot. The read/write access slot should be inserted first. The eject spring offers a slight resistance just as the diskette is completely inserted. The eject spring latches when the diskette is fully inserted.
4. When the eject spring latches, press downward on the door handle. A door lock within the drive locks the door during any drive operation.

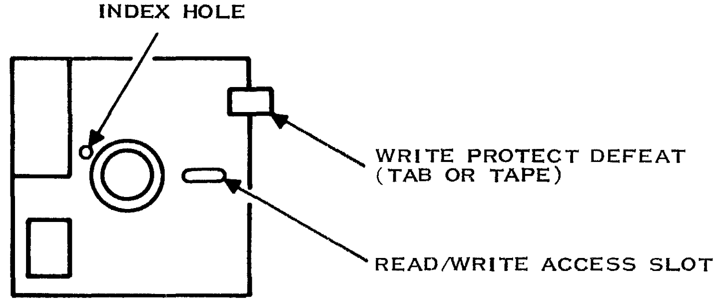

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Figure L-2. Model FD1000 Diskette Write Protection

To remove a diskette, proceed as follows:

1. Press the latch release.

2. If the diskette is not currently in use, the access door pops open and the diskette is ejected.

L.5 FORMATTING DISKETTES

All diskettes must be formatted before the first attempt to store data. Formatting checks the recording surfaces and records sector identifiers on the diskette. Double-sided, double-density diskettes may be formatted by using the Initialize New Volume (INV) command. This command is explained in in the section Using Disk Volumes in the paragraph Initializing New Volumes.

The formatting operation destroys any data that is currently on the diskette. Therefore, a diskette should not be reformatted unless the previous contents are expendable.

Single-sided diskettes must be initialized before use under DNOS. The DNOS IBM Conversion Utility (IBMUTL) program provides a means of transferring standard IBM-formatted data sets to DNOS files. For detailed information on the use of this program, refer to the *DNOS System Command Interpreter (SCI) Reference Manual.*

NOTE:

WRITE PROTECT TAB IS VISIBLE AT UPPER LEFT CORNER OF DISKETTE. MANUFACTURER'S LABEL IS ON THE RIGHT, FACING UP, ADJACENT TO THE OPERATOR'S HAND.

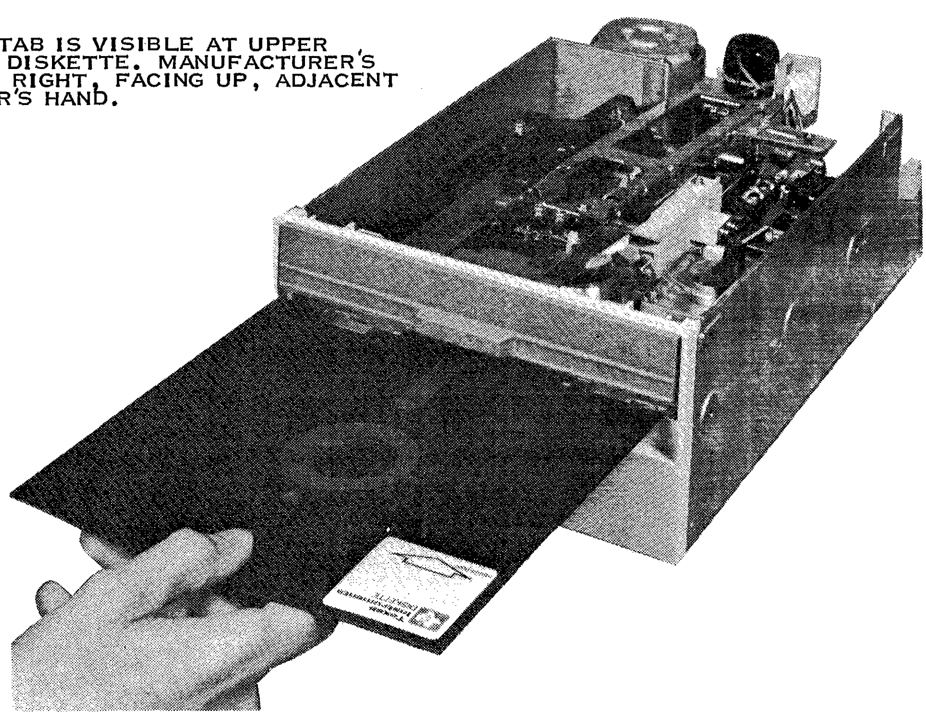

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Figure L-3. Model FD1000 Orientation of the Diskette for Installation

L.6 DISKETTE CARE AND HANDLING

To maintain serviceability, handle and care for the diskette as you would other flexible magnetic recording media, such as tape or cassettes. Take the following precautions:

1. Keep the diskette away from magnetic fields or ferromagnetic materials that may have been magnetized. Magnetic fields distort the data recorded on a diskette.

2. Avoid X-ray machines. The X-rays themselves do not harm the diskette, but most X-ray machines generate powerful magnetic fields.

3. Always return the diskette into its storage envelope when it is not installed in the drive. Replace storage envelopes and labels that have become cracked or worn.

4. Do not write on the plastic jacket or labels with a lead pencil or ball-point pen. Use a felt tip pen. Do not try to erase written information from the diskette jacket, since the erasure dust may contaminate the diskette surface.

5. Do not fold, bend, or file the diskette in any way that will cause it to be distorted or pressed under heavy objects.

6. Do not expose the diskette to heat, direct sunlight, or moisture.

7. Keep the diskette away from sticky, oily, dirty, or abrasive substances.

8. Do not touch or attempt to clean the recording surface of the diskette.

9. Do not attempt to load or use a diskette that has been creased or warped or that is contaminated with abrasive, sticky, or oily substances. Warped or contaminated diskettes may damage the read/write heads.

10. Do not leave diskettes in the drive when powering down the drive.

Data may possibly be recovered from a diskette whose jacket has been soiled, but only if the contaminant can be wiped off without contacting the recording surface of the diskette. After data recovery, the contaminated diskette should be discarded.

If a diskette has been exposed to extreme temperature (beyond 10 to 50 degrees Celsius or 50 to 125 degrees Fahrenheit), but is otherwise clean and dry, it may be serviceable after five minutes at room temperature. However, prolonged exposure to such extremes may warp the jacket or damage the media.

Appendix M

Model WD500 Disk Unit

M.1 GENERAL INFORMATION

This appendix describes how to operate the WD500 Disk Unit. For more detailed information, refer to the *WD500 Mass Storage System* manual.

The Model WD500 Disk Unit shown in Figure M-1 consists of one flexible diskette and one or two Winchester hard disk drives, all contained in one unit. The diskettes can be used for backup storage while the hard disks are used for primary storage. The host computer can be any computer with a TILINE * peripheral interface bus capability.

The front part of the drive holds the flexible disk drive where the diskettes are inserted. The disk unit uses 20-centimeter (8-inch) double-sided, double-density diskettes. The flexible disk drive can also accept single-sided single-density diskettes.

The Winchester drive contains one or two 13-centimeter (5 1/4-inch) Winchester hard disks, permanently mounted (fixed) inside the unit. A Winchester disk holds more data and takes less time for the computer to access than a diskette. Since you cannot insert or remove the fixed disks, you have to use diskettes for some operations. The computer can copy data from a Winchester disk to a diskette or from a diskette to a Winchester disk.

M.1.1 Controls and Indicators

All operator controls and indicators are located on the front panel except for the ac power switch which is located on the rear panel. Eight indicator LEDs and one or two rocker-type switches provide an operator interface for indicating subsystem status and for controlling Winchester disk write-protects. The right-hand switch (WP 2) and LED will not be installed on single Winchester disk subsystems. Figure M-2 shows the locations of these controls and indicators. The six LEDs on the left side of the front panel are used as status indicators to display running status or error conditions. The meaning of the LEDs is modified by LED 6. If LED 6 is off, LEDs 1 through 5 indicate chassis status. If LED 6 is lit or blinking, the remaining LEDs indicate an error code. Only a reset issued by the host or a chassis power-down will clear the error indication.

* TILINE is a trademark of Texas Instruments Incorporated.

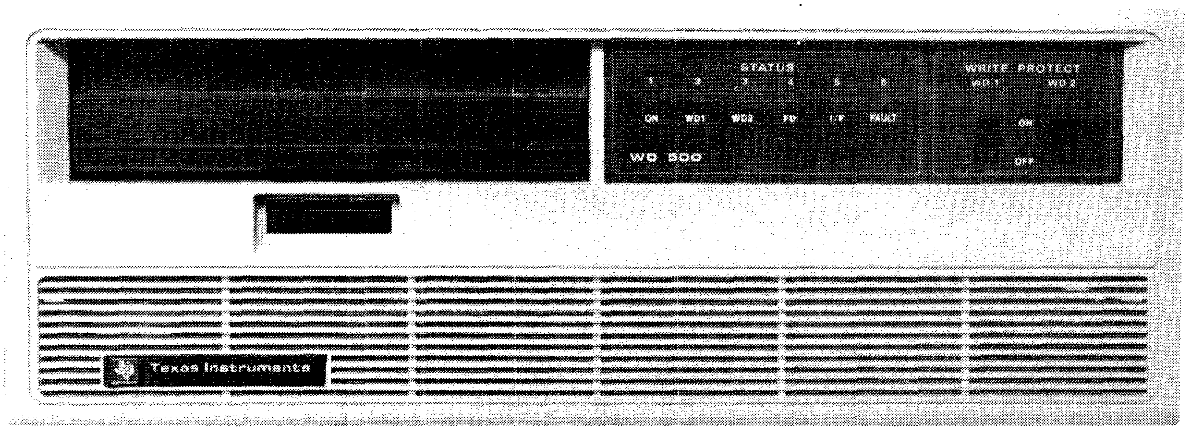

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Figure M-1. Model WD500 Disk Unit

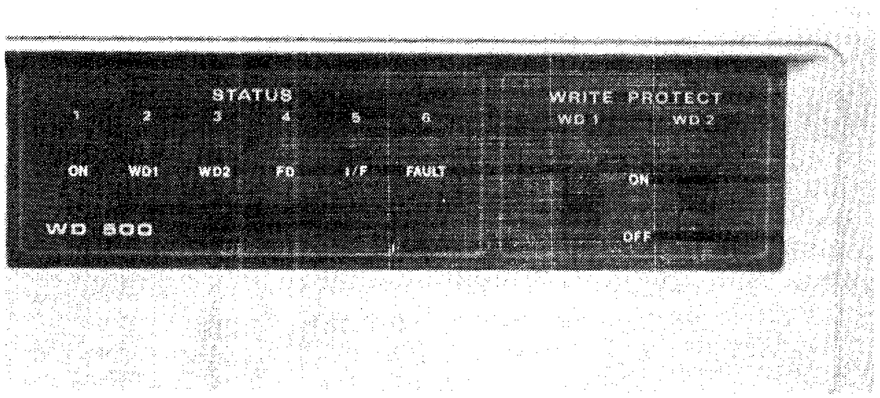

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Figure M-2. Model WD500 Controls and Indicators

Table M-1 lists the definition of each LED.

On power up, the following sequence of events occurs:

1. LEDs 2 through 6 light.

2. The formatter test begins. If the formatter test cannot start, LEDs 2 through 5 remain on and LED 6 blinks continuously; self testing stops.

3. If the formatter self test successfully completes, LED 6 goes off. If the formatter self test is unsuccessful, LEDs 2 thru 6 remain on.

4. LED 1 turns on.

5. The self tests for the subsystems begin. The self tests run sequentially, beginning with subsystem identified by LED 1 through the subsystem identified by LED 5.

6. As each self test completes successfully, the corresponding LED turns off.

NOTE

LED 5 identifies the peripheral bus interface (PBI); this LED will remain lit until the host computer replies to the interrupt sent by the WD500. If the host computer is not turned on, LED 5 may remain lit.

7. When self testing completes, LEDs 2 through 6 will turn off if all self tests completed successfully. If any subsystem failed the self test, the LED for that subsystem and LED 6 will remain on. For example, if the flexible disk failed the self test, LEDs 4 and 6 will remain lighted.

Table M-1. Model WD500 Front Panel LED Definitions

LED	Status Indication (LED 6 Off)	Fault Indication (LED 6 On)
1	Ac power good—requires up to 30 sec to turn on after ac power up.	If off, denotes power supply failure or drives powered down.
2	Winchester disk 1 accessing	Winchester disk 1 subassembly fault
3	Winchester disk 2 accessing	Winchester disk 2 subassembly fault
4	Flexible disk accessing	Flexible disk subassembly fault
5	Set on for 10 – 20 msec during PBI loopback test	PBI loopback test fault
6	None	If on, denotes fault detected in chassis. LEDs 2 – 5 indicate subassembly with fault. If 2 – 5 are all on, formatter is faulty. If blinking, self-test is unable to begin execution.
WP 1	Winchester disk 1 write-protected	None
WP 2	Winchester disk 2 write-protected	None

M.1.2 Write-Protect Feature

The WD500 provides write protection for both the Winchester disks and the diskette. Even when the diskette and disks are write protected, the data on them can be read. The WD500 uses different methods for write protecting the Winchester disks and the diskette.

M.1.2.1 Winchester. The front of the unit has a write-protect light and switch for each Winchester disk. When the write-protect light is on, the Winchester disk is write protected; when the light is off, data can be written to the disk.

M.1.2.2 Diskette. Every diskette has a write-protect notch on the edge inserted into the diskette drive. Figure M-3 shows the diskette methods.

When this notch is covered by an opaque adhesive tab, data can be written to the diskette. Uncovering the notch write protects the diskette.

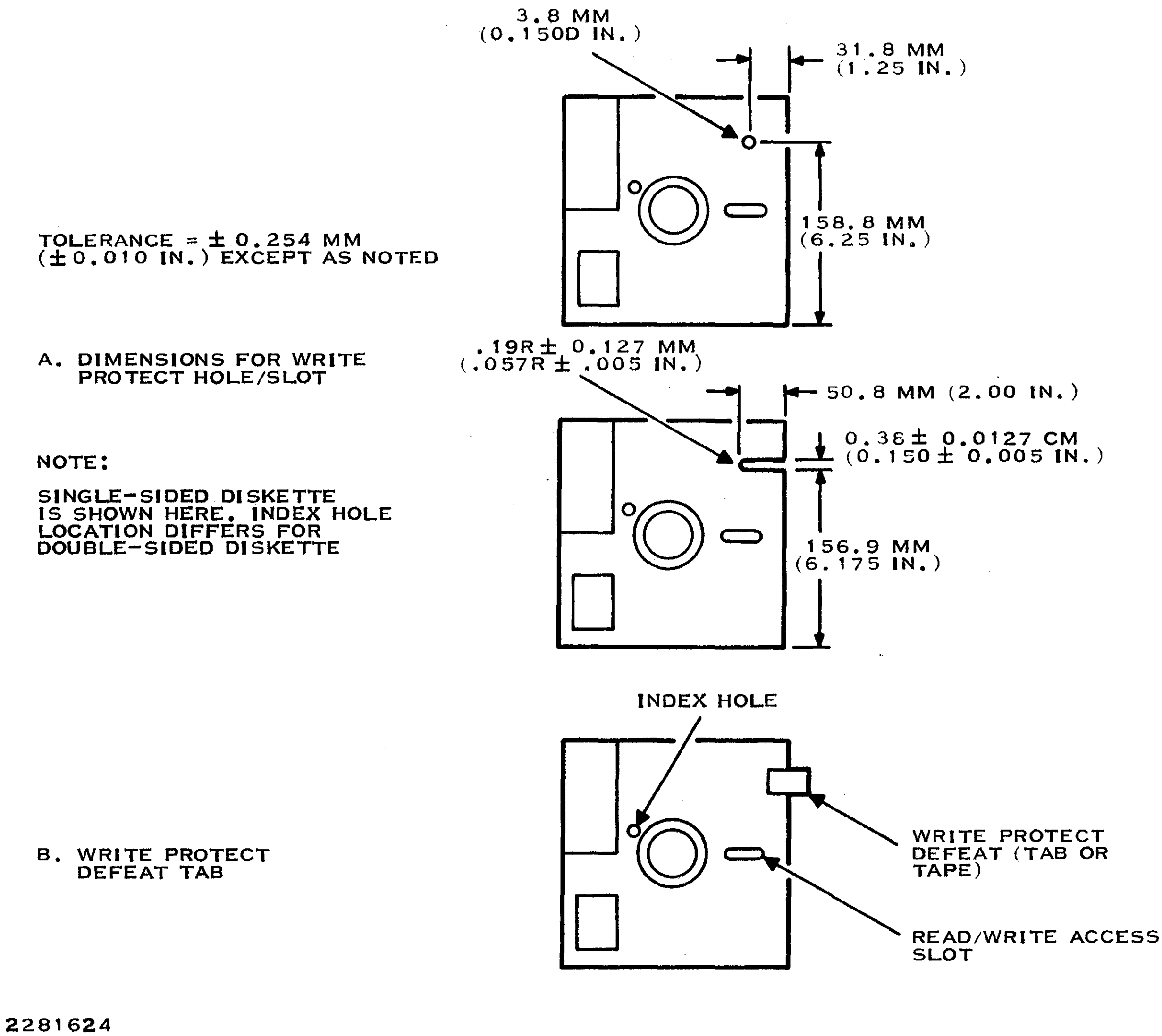

Figure M-3. Model WD500 Diskette Write-Protect Methods

M.1.3 Diskette Care and Handling

Diskettes can be easily damaged. Handling care for the diskette is similar to other flexible recording media, such as tape.

The following precautions apply:

- Keep the diskette away from magnetic fields or magnetic materials. Magnetic fields will distort the recorded data.
- Avoid X-ray machines. The X-rays themselves will not harm the diskette, but most X-ray machines generate powerful magnetic fields.

- Always return the diskette to its storage envelope when it is not installed in the drive. Replace storage envelopes and labels that may have become cracked or worn.
- Do not write on the plastic jacket or labels with a lead pencil or ball-point pen. Do not try to erase written information from the diskette jacket since the erasure dust may contaminate the diskette surface.
- Do not fold, bend, or file the diskette in any way that will cause it to be distorted or pressed under heavy objects.
- Do not expose the diskette to heat, direct sunlight, or moisture.
- Keep the diskette away from sticky, oily, or abrasive substances.
- Do not touch or attempt to clean the recording surface of the diskette.
- Do not attempt to load or use a diskette that has been physically creased or warped or is contaminated with abrasive, sticky, or oily substances. Warped or contaminated diskettes can damage the read/write heads.

NOTE

Data may possibly be recovered from a diskette whose jacket has been soiled, but only if the contaminant can be wiped off without contacting the recording surface of the diskette. After data recovery, the abused diskette should be discarded.

Prolonged exposure to extreme temperatures (outside a range of 10 to 50 degrees Celsius or 50 to 125 degrees Fahrenheit) can damage the diskette or warp the jacket so badly the diskette can no longer be used. If a diskette has been exposed to extreme temperature, but is otherwise clean and dry, it may be serviceable. Allow the diskette approximately five minutes to reach room temperature before using it.

M.1.4 Diskette Loading Procedure

The flexible-disk drive unit is mounted horizontally in the subsystem chassis. Diskettes are inserted and removed through an access door at the front of the drive unit. The access door handle is a flange located immediately above the door opening. The door release is a rectangular button centered below the door opening.

The diskette can be installed with drive power off, or with power on and the drive spindle rotating. To load a diskette, depress the latch release so that the access door pops open. Remove the diskette from the envelope and orient the diskette as shown in Figure M-4, with the manufacturer's label facing up and to the right. Insert the diskette into the slot while maintaining this orientation. The read/write access slot is inserted first into the slot. The eject spring will offer slight resistance for the last 38 millimeters (1.5 inches) or so of disk travel. The eject spring latches when the diskette is fully inserted. When the eject spring latches, press downward on the door handle, clamping the diskette into position on the spindle.

A door lock solenoid within the drive locks the door during, and up to one second after, any drive operation.

M.1.5 Diskette Removal

To remove a diskette, depress the latch release. If a disk is not currently in use, the access door pops open, and the diskette is ejected.

M.1.6 Formatting Disks

If the Winchester disks requires formatting, use the Initialize Disk Surface (IDS) command.

All diskettes must be formatted before the first attempt to store data. Formatting checks the recording surfaces and records sector identifiers on the diskette. Double-sided double-density diskettes can be formatted using the IDS command.

Diskettes that have been formatted can be initialized or reinitialized using the Initial New Volume (INV) command.

These commands are explained in in the section Using Disk Volumes under the paragraphs Initializing the Disk Surface and Initializing New Volumes.

The formatting operation destroys any data currently on the disk. Therefore a diskette should not be reformatted unless the contents are expendable.

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Figure M-4. Model WD500 Diskette Installation

M.1.7 Operating Procedures

The following paragraphs discuss normal disk drive operation including power-up and power-down procedures.

M.1.7.1 Power Up for Online Operation. Follow these steps to power up to the WD500 subsystem:

1. Verify that the female connector of the three-wire ac power cord is installed in the three-prong recessed male connector at the rear of the subsystem chassis.

2. Verify that the male connector on the power cord is installed in a supply socket that provides ac power of the specified voltage and frequency.

3. Set the ac power switch at the rear of the chassis to the ON (1) position.

NOTE

Power-up/down cycling will not damage diskettes installed in the drive units, or the media installed in the Winchester drive.

M.1.7.2 Power Down. Set the ac power switch to OFF (0). The access doors of the flexible drive units should be closed when unused to prevent dust accumulation.

Appendix N

Model WD800 Disk System

N.1 GENERAL INFORMATION

The Model WD800 Disk System provides a random-access mass-storage system for any Texas Instruments computer with a TILINE data bus. The WD800 uses Winchester technology for the primary storage device, with an optional magnetic tape cartridge that provides a removable backup storage medium. Up to eight Winchester disk drives can be connected to the computer without the cartridge tape backup. If one or two tape cartridge backup devices are connected to the controller in the computer system, then a maximum of four Winchester disk drives can be connected.

The Model WD800 Disk System includes the following features:

- Single circuit board 990 TILINE peripheral bus interface
- Microprocessor-based controller logic
- Error checking and correction capability
- Cartridge tape removable medium
- 0.8 megabyte-per-second Winchester disk bit burst transfer rate

N.2 OPERATIONAL ENVIRONMENT

The following specifications (media limited) apply for the operational environment of the WD800:

Ambient temperature:	10 to 43 degrees Celsius (50 to 110 degrees Fahrenheit) with a temperature gradient less than 10 degrees Celsius (18 degrees Fahrenheit) per hour
Relative humidity:	20 to 80 percent without condensation
Altitude:	0 to 3000 meters (0 to 9843 feet)

N.3 CONTROLS AND INDICATORS

The operator controls the functioning of the WD800 by using the following three controls: an ac power-on (PWR) switch, a TEST STATUS/TAPE UNLOAD switch, and a DISK WRITE PROTECT switch.

N.3.1 PWR Switch

The PWR switch is located on the rear panel of the WD800 cabinet, as shown in Figure N-1. If the equipment is installed properly, the WD800 attempts to initialize when the PWR switch is turned on.

N.3.2 TEST STATUS/TAPE UNLOAD Switch

The TEST STATUS/TAPE UNLOAD switch is located on the front panel near the tape cartridge aperture, as shown in Figure N-2. This control is a three-position, spring-loaded, center-return switch.

When the switch is up, it is in the TEST STATUS position. The center position is IDLE, and down is the TAPE UNLOAD position. After the switch is positioned either up or down, it automatically returns to IDLE when released.

The TAPE UNLOAD position is used to unload the tape cartridge and to display the unit select address for the storage system. When a cartridge tape is installed, momentarily toggling the switch down causes the storage system to advance the tape within the cartridge to the unload point. While tape activity is in progress (reads, writes, and other operations driven by the computer system), the storage system ignores the TAPE UNLOAD position.

The TEST STATUS position is used to cycle through the detected self-test fault status indicators and to set the unit select address. After this switch position is selected, the four status indicators display a four-bit diagnostic code, which is used to trace a possible subassembly fault.

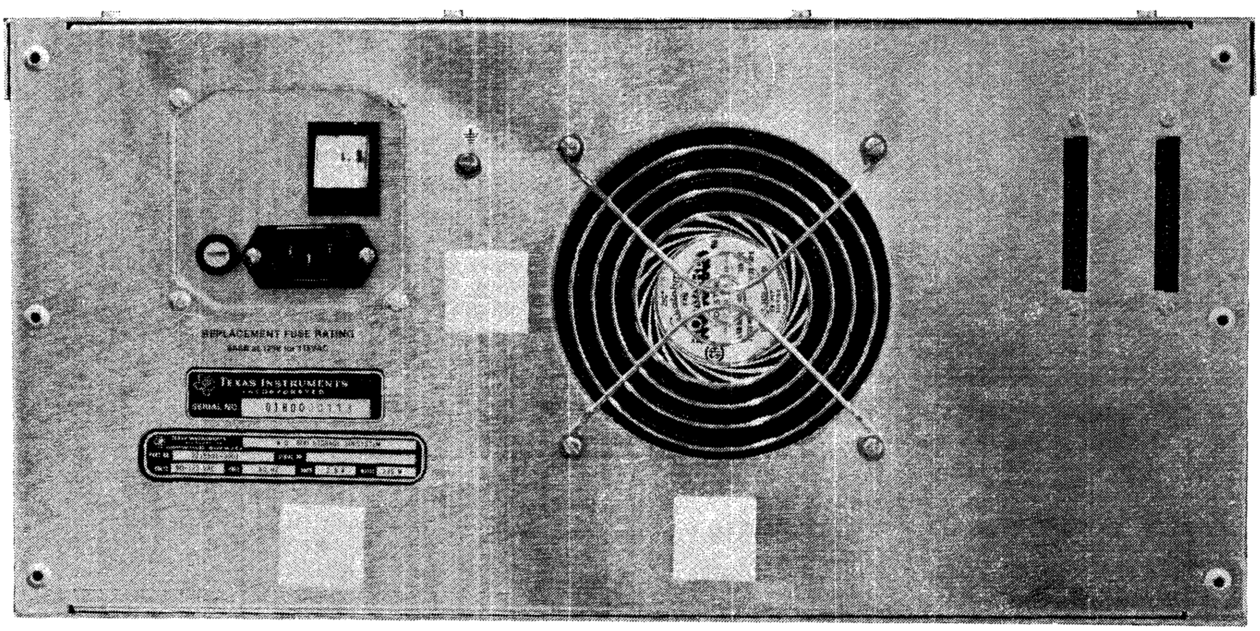

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Figure N-1. Model WD800 Rear Panel

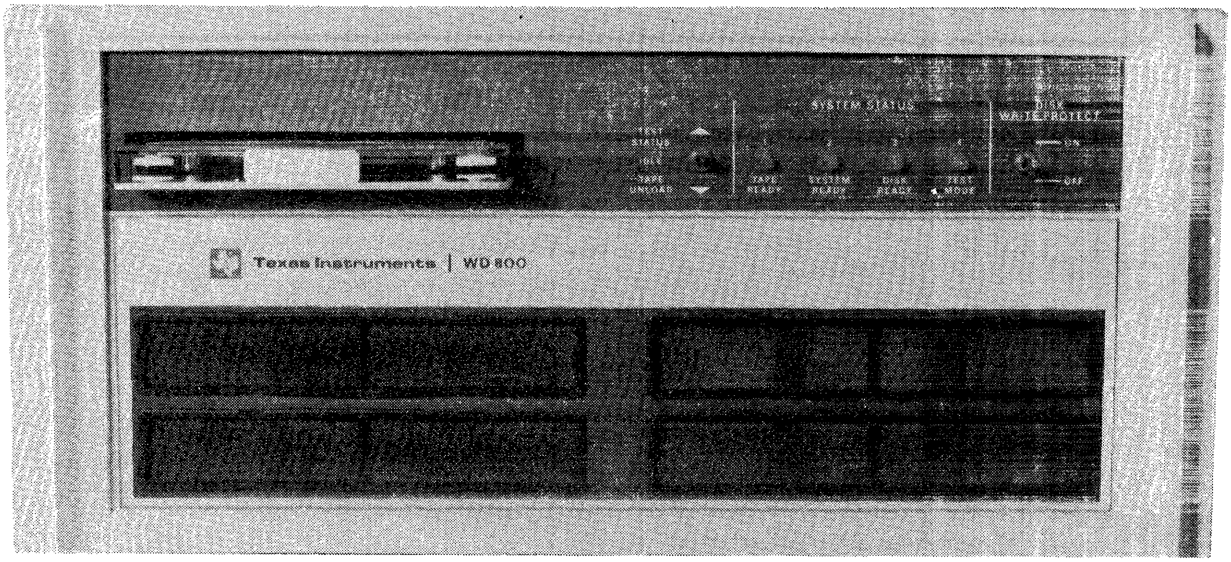

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Figure N-2. Model WD800 Front Panel

The system displays the no-error code by illuminating all four indicators. Thus, to display all possible storage system detected faults, toggle the switch to the TEST STATUS position until the no-error code appears.

N.3.3 DISK WRITE PROTECT Switch

The DISK WRITE PROTECT switch is located on the front panel, as shown in Figure N-2, and is a two-position switch. The system provides disk write protection when the switch is in the up (ON) position.

N.3.4 Indicators

Four three-function indicators are located on the front panel of the WD800. These four lights indicate tape status, storage system status, disk status, and test mode. The indicators perform the following three main functions:

- Display of storage system operational status (primary function)
- Display of detected subassembly faults
- Display of unit select address

The primary function is active when the other two are inactive. Toggling up the TEST STATUS/ TAPE UNLOAD switch activates the second function.

N.3.4.1 TAPE READY Indicator. The TAPE READY indicator shows the status of the tape subsystem as determined by the formatter subsystem. The three states of the indicator are as follows:

State	Description
ON	Indicates the tape subsystem is powered-up, successfully initialized, and has a tape cartridge installed and ready for operation.
Blinking	Indicates the tape subsystem is powered-up and either the formatter has detected a tape subsystem fault (if a cartridge is not installed) or the formatter is loading or unloading the tape (if a tape cartridge is installed). This process takes a maximum of two minutes.
Off	Indicates the tape subsystem has successfully performed power-up initialization and either does not have a tape cartridge installed or the tape cartridge installed has been advanced to the unload point and can be removed. The tape cartridge can be set to the unload point by a command from the computer system or by momentarily positioning the TEST STATUS/TAPE UNLOAD switch down. Other possible causes for this indicator being off include, but are not limited to: no power; formatter failure; missing or blown fuse; tape cartridge self-test failure (automatically takes the tape offline); or the optional tape system is not installed.

N.3.4.2 SYSTEM READY Indicator. The SYSTEM READY indicator shows the status of the formatter and interface as determined by the formatter subsystem. The three states of the indicator are as follows:

State	Description
On	Indicates the storage system is powered-up, has successfully initialized, and has reported proper initialization status to the controller.
Blinking	Indicates the storage system is powered-up, and either is performing initialization, detects a formatter fault, or has not been selected by the controller to report proper initialization status.
Off	Indicates the storage system is not operational. Possible causes include, but are not limited to: no power, formatter failure, or missing or blown fuse.

N.3.4.3 DISK READY Indicator. The DISK READY indicator shows the status of the disk subsystem. The three states of the indicator are as follows:

State	Description
On	Indicates power is on and the disk subsystem is successfully initialized.
Blinking	Indicates that power is on and the disk self-test is in progress, or that disk activity is going on (active reading or writing of data causes an irregular blink).
Off	Indicates the disk subsystem is not operational. Possible causes include, but are not limited to: initialization is occurring, no power, formatter failure, or missing or blown fuse.

N.3.4.4 TEST MODE Indicator. The TEST MODE indicator shows when the formatter is performing self-tests. The three states of the indicator are as follows:

State	Description
On	Indicates power is on and the formatter is performing self-tests. The TEST MODE indicator will not blink or turn off if the formatter fails the self-test.
Blinking	Indicates power is on and the formatter has passed its self-test. It is performing tests in either the disk or tape subsystem of formatter/controller interface.
Off	Indicates the formatter has successfully passed the formatter self-test and is not currently performing other tests.

N.3.5 Test Status Indicators

The test status indicators display diagnostic error codes that are described in Table N-1. These codes are displayed while the TEST STATUS/TAPE UNLOAD switch is in the TEST STATUS position.

Table N-1. Model WD800 Diagnostic Error Codes

Test Status Indicators 1	2	3	4	Possible Subassembly Faults
Off	Off	Off	Off	Power Supply (No power)
Off	Off	Off	On	Servo PWB
Off	Off	On	Off	Read/Write PWB
Off	Off	On	On	High Speed Digital Control PWB
Off	On	Off	Off	Processor PWB
Off	On	Off	On	Spare PWB
Off	On	On	Off	Tape Control PWB
Off	On	On	On	Tape Encode/Decode PWB
On	Off	Off	Off	Sealed Disk Assembly
On	Off	Off	On	Actuator Locked
On	Off	On	Off	Formatter Cable not Cconnected
On	Off	On	On	Tape Cartridge Drive Assembly
On	On	Off	Off	Spare
On	On	Off	On	Spare
On	On	On	Off	Spare
On	On	On	On	No Error

In addition to indicating errors as noted in Table N-1, the test status indicators also display the unit select address when the TEST STATUS/TAPE UNLOAD switch is toggled down momentarily (TAPE UNLOAD position). Table N-2 shows the codes for unit select addresses.

Table N-2. Model WD800 Unit Select Addresses

Test Status Indicators 1	2	3	4	Unit Select Address
On	Off	Off	Off	Unit 1 — Hex 8
Off	On	Off	Off	Unit 2 — Hex 4
Off	Off	On	Off	Unit 3 — Hex 2
Off	Off	Off	On	Unit 4 — Hex 1

N.4 SYSTEM START-UP AND USAGE

The WD800 requires minimal user intervention during both start-up and operation. Start-up consists of the following two operations:

- Turn on power
- Check operational status indicators

The following sequence of events occurs during standard operation and should be monitored on the front panel status indicators:

1. The TEST MODE indicator turns on when the ac PWR switch is turned on.
2. The SYSTEM READY indicator blinks while the formatter performs self-tests. The formatter checks itself. Then, it checks the disk subsystem, the tape subsystem, and the formatter/controller interface. If a tape cartridge is installed, the formatter performs a tensioning operation and a media test simultaneously with the formatter/controller interface test.
3. The initial formatter diagnostics check for a fully functional processor PWB. If the self-test fails, all other testing is suspended, the SYSTEM READY indicator continues to blink, and the TEST MODE indicator remains on. All other indicators should be off.
4. If the self-test diagnostics progress to the disk subsystem, the DISK READY indicator turns on if the system passes the tests or blinks if the system fails. The system will not perform diagnostics for disk writing if the DISK WRITE PROTECT switch is on. The system notes all disk subassemblies that do not pass self-tests. The TEST STATUS display indicates which components have failed.

CAUTION

Ensure that the tape cartridge (if installed) and disk is write protected to prevent loss of data during diagnostics. Self-tests for write operations to tape can be done on a scratch cartridge if desired.

5. If the diagnostics progress to the optional tape subsystem, the formatter will first test the storage system to see if the tape subsystem is installed. If the tape system is not installed, the TAPE READY indicator turns off. If the tape system is installed, the TAPE READY indicator turns off if the tape system passes initial tests or blinks if the system fails. The system notes which subassemblies fail self-tests and displays the appropriate error code when in the TEST STATUS mode. If a tape cartridge is installed, no tape action occurs at this point in the diagnostics.
6. Next, the formatter initializes the formatter/controller interface and waits for the controller to select the devices controlled by the formatter. After this initialization procedure, the SYSTEM READY indicator turns on and the TEST MODE indicator turns off.

7. Simultaneously with the formatter/controller interface test, the WD800 performs self-tests on the tape cartridge. If a tape cartridge is installed and the tape subsystem passes the self-tests, the tape subsystem readys the tape within the cartridge. While this procedure occurs, the TAPE READY indicator blinks.

8. While the self-test diagnostics perform the tape media diagnostics, the TEST MODE indicator turns on.

9. If the tape passes the tests, the TAPE READY indicator turns on and the TEST MODE indicator turns off. If the system fails the tests, the TEST MODE indicator will not turn off.

N.5 DISK OPERATION

The disk subsystem requires no user interaction. The DISK READY indicator on the front panel shows the status of the disk subsystem. When the indicator is on, the disk subsystem is initialized and ready for operation.

N.6 TAPE OPERATION

The following paragraphs describe tape cartridge handling and tape subsystem operation.

N.6.1 Handling Media

The tape cartridge eliminates the need to physically handle the media. The rugged cartridge encloses the supply and take-up reels. One access opening in the cartridge allows the drive motor capstan to contact the tape belt-drive capstan mounted inside the cartridge. A pivot-action door provides media access for the transport heads. This door opens automatically when the cartridge is inserted.

Use the following precautions to avoid damage to the tape cartridge:

- Keep the cartridge away from magnetic fields or materials. Magnetic fields distort recorded data.

- Avoid X-ray machines. The X-rays themselves will not hurt the tape, but most X-ray machines generate powerful magnetic fields.

- Do not expose the cartridge to excessive heat, direct sunlight, or moisture.

- Keep the cartridge away from sticky, oily, or abrasive substances.

N.6.2 Tape Write-Protect Feature

A slotted plug on the upper left corner of the cartridge can be turned in either of two directions for write-protected or unprotected operation. Turn the arrow to SAFE for write protection.

N.6.3 Cartridge Insertion

To insert the cartridge, orient it so that the clear plastic is up and the access door opens toward the cartridge slot. (Right side up, the cartridge will fit only in one direction.) Guide the cartridge into the front panel slot until it latches in place. The front panel TAPE READY indicator tells when the user can safely insert, use, or remove the cartridge.

When the TAPE READY indicator is off, the user can safely insert or remove a cartridge. Once a cartridge is inserted, it goes through an initial tensioning and positioning operation. Then the system runs a media test operation. The TAPE READY indicator blinks during this test. This indicator stops blinking and remains lit once the system properly tensions and positions the tape. The TAPE READY indicator remains on while the tape is in use until the user (or the computer system) initiates an unload sequence.

NOTE

If the TAPE READY indicator blinks when no cartridge is installed in the transport, insertion of a cartridge in the transport is unsafe. In this case, the formatter has detected a fault in the tape subsystem and tape operation is inhibited. Likewise, if the TAPE READY indicator blinks for more than two minutes when a cartridge is installed, a fault has occurred and tape operation is inhibited.

N.6.4 Cartridge Unloading and Removal

When the user (or the computer system) initiates an unload sequence, the system positions the tape inside the cartridge to a safe position (end-of-media). This helps protect the tape from contamination or other physical damage during tape removal and storage. When the unload sequence completes, the TAPE READY indicator turns off, indicating that removal of the cartridge and insertion of another is safe.

Once a cartridge completes an unload sequence, it remains in the not ready state even though physically installed in the transport. Only removing and inserting a cartridge will start another tape load operation.

The system ignores the TEST STATUS/TAPE UNLOAD switch if the TAPE UNLOAD switch is selected while tape activity (reads, writes, and other operations driven by the computer system) is in process.

N.7 PREVENTIVE MAINTENANCE

The lifetime of the subsystem depends on the cleanliness of the air that enters the WD800 subsystem chassis. Keep the chassis and the general area clean and dust free.

CAUTION

Do not use strong solvents to clean the front panel of the chassis. Use a mild detergent and water on a damp cloth.

Cooling air for the disk drive and electronic modules passes through snap-in filters in the front panel. These filters require periodic preventive maintenance as follows:

Operation	Interval
Remove and vacuum air filters.	Every 6 weeks
Discard old filters and replace with new filters, part number 2265041-0001.	Every 6 months

The filters snap into and out of the front panel cutouts, as shown in Figure N-2.

Preventive maintenance procedures for qualified service personnel are listed in the field service manual. These procedures should be performed every 5000 hours of operation.

Appendix O

Model MT979A Magnetic Tape Drive

O.1 GENERAL INFORMATION

This appendix describes how to operate the Model 979A Magnetic Tape Drive shown in Figure O-1. For more detailed information, refer to the *Model 979A Magnetic Tape System Installation and Operation* manual and the *Model 979A Tape Transport Installation and Operation* manual.

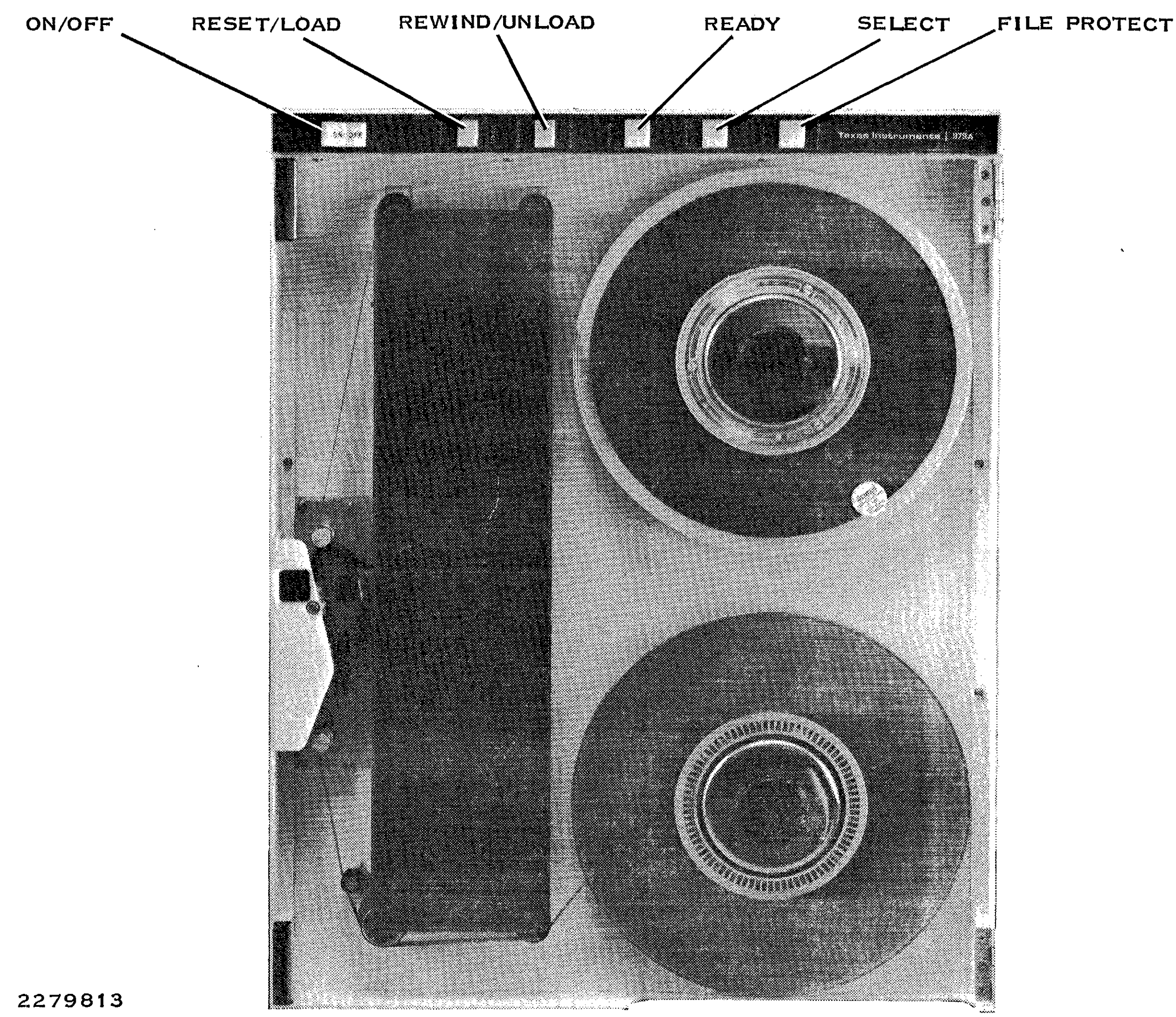

Figure O-1. Model 979A Tape Transport

O.2 CONTROLS AND INDICATORS

The controls and indicators for the Model 979A Magnetic Tape Transport are located at the top of the tape drive unit as shown in Figure O-1. These consist of the ON/OFF switch, the RESET/LOAD switch, the REWIND/UNLOAD switch, the READY indicator, the SELECT indicator, and the FILE PROTECT indicator. The functions of these controls and indicators are as follows:

Control/Indicator	Function
ON/OFF	The ac power to the tape transport is controlled by this switch.
RESET/LOAD	The RESET switch stops tape motion, takes the transport out of the remote mode, and enables local control. After tape reels are mounted and the tape is threaded, the LOAD switch initiates the automatic loading action. Tape is pulled into the vacuum column, and the transport drive automatically searches and positions the tape at the beginning of tape (BOT) marker. If the BOT marker is positioned too near the BOT sensor to permit sufficient tape to load the lower vacuum loop, BOT sensing precedes vacuum column sensing and the tape drive electronics lock out further tape motion. To recover, press the RESET switch, move the tape forward so that the BOT marker is on the take-up reel side of the BOT sensor, and reinitiate the LOAD sequence. Provided the tape is loaded, the LOAD switch reestablishes the remote mode after it has been terminated by RESET. While the transport is in the unload mode, the RESET/LOAD switch does not stop the unload operation after the BOT marker has been sensed.
REWIND/UNLOAD	The REWIND position of the switch causes the unit to rewind the tape on the drive. The UNLOAD position unloads the tape.
READY	The READY lamp indicates that the tape transport is in the remote mode and not rewinding.
SELECT	The SELECT lamp indicates that the particular transport is selected by the control unit.
FILE PROTECT	The FILE PROTECT lamp indicates that the transport is inhibited from writing because the write enable ring is not on the file reel.

O.3 LOADING A TAPE

Always use high quality certified tapes produced by reputable manufacturers. Unnecessary data losses and service calls can often be traced to the use of worn or low quality tapes.

Tape loading and threading for the 979A tape transport is performed in the following manner:

1. Turn the power ON/OFF switch to ON. If the power is turned off, wait five seconds before reapplying power to establish the proper reset operation.

2. If a fixed reel is not present, install a take-up reel on the lower hub, seating it firmly against the hub lip and locking it into place.

   When loading the tape, pull up on the handle on the hub, mount the tape reel, then depress the handle.

   When unloading the tape, pull up on the handle and remove the tape reel.

3. If file protection is required, verify that the write enable ring is not on the file reel before installing the reel. Place the file reel onto the upper hub, seating it firmly against the hub lip and locking it into place.

NOTE

> If data is to be written on the tape, the write enable ring must be installed on the file reel. The ring is placed in the groove on the backside of the reel just around the hub opening. When the reel is installed, the ring should engage the write enable sensor pin.

4. Thread the tape from the file reel over the turnaround rollers, heads, and capstan and onto the take-up reel so that clockwise rotation winds the tape onto the take-up reel. See Figure O-2. The cross-talk shield is spring-loaded against the heads and should be swung away from the heads while the tape is threaded through the opening. Wrap three to five turns of tape around the take-up reel. (Note that the tape should be pulled without slack across the vacuum column turnaround rollers during the threading operation.)

   When the tape is first loaded, it must be pulled free of slack so that the tape lies straight across the turnabout roller and capstan guides of the vacuum column.

   To ensure that sufficient tape is provided to establish the lower-loop in the vacuum chamber, verify that the Beginning of Tape (BOT) marker does not fall between the upper guide roller and the BOT sensor. The BOT marker is a metal tab on the tape that marks the beginning of usable tape. BOT sensing prior to lower loop vacuum column sensing locks out the tape drive electronics.

5. Close the drive door to muffle the noise of the drive.

6. Press the RESET/LOAD switch to RESET and to LOAD. After a brief delay to pull vacuum, tape loops form in the vacuum column, the tape is wound on the take-up reel, and the transport drive positions the tape at the BOT marker. If the BOT marker is placed beyond the BOT sensor during threading, forward search ceases after 11 seconds, and reverse search for the BOT marker begins automatically.

NOTE:
TAPE SHOULD BE PULLED SLACK-FREE ACROSS THE VACUUM COLUMN TURNAROUND ROLLERS DURING THREADING OPERATION.

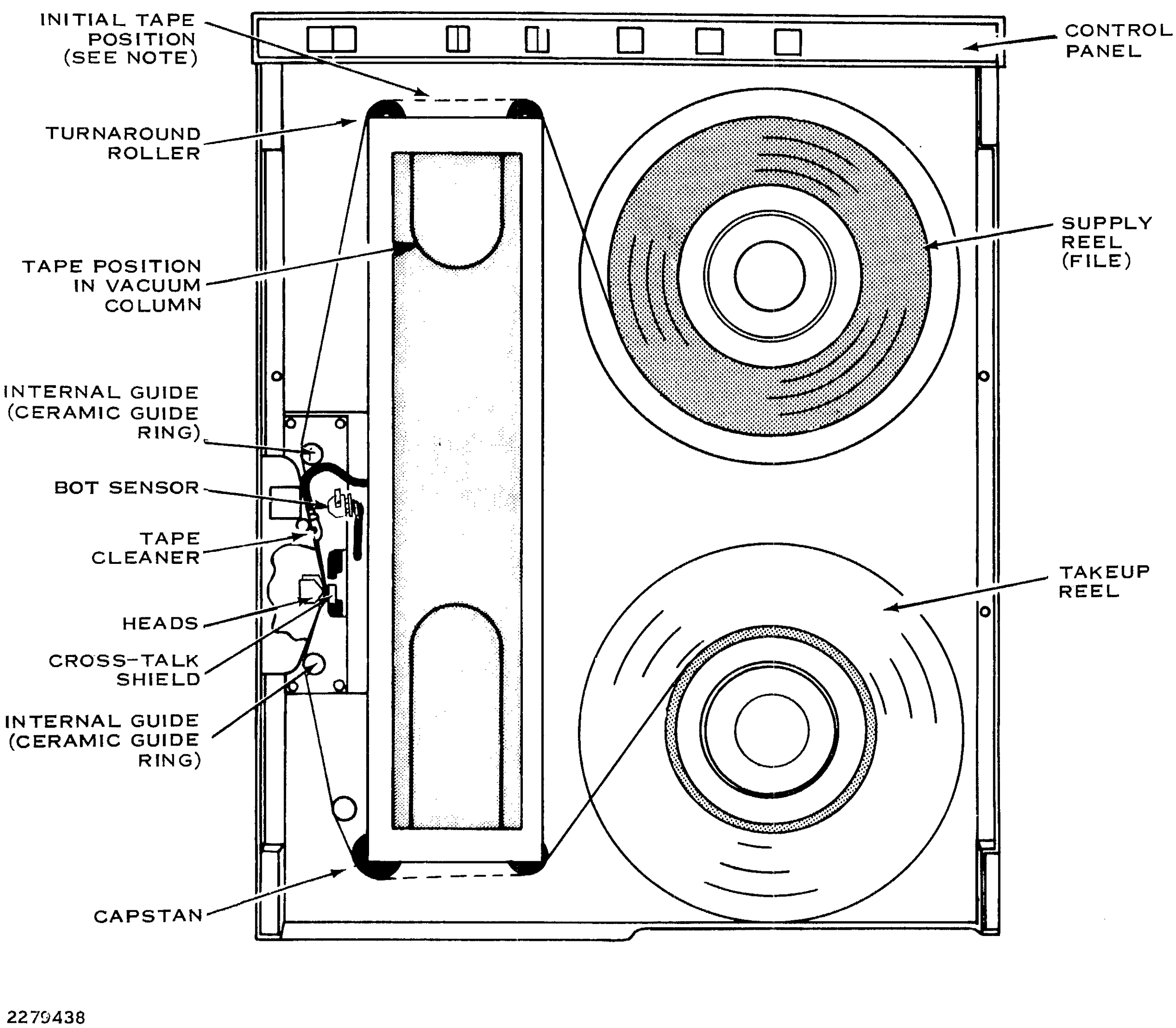

Figure O-2. Model 979A Transport Threading Diagram

O.4 RELOADING DURING A MIDREEL OPERATION

If power is removed or vacuum is lost during the tape midreel operation, a midreel reloading sequence is required. Thread the tape around the guides, heads, and capstan as shown in Figure O-2 and wind all slack tape (from the vacuum column) onto the supply reel. Push RESET, then LOAD, and wait for the automatic loading to start. When the tape starts the forward search, push RESET and the tape motion will stop. The transport is now ready for local mode operation. For remote mode, press LOAD.

O.5 REWINDING AND UNLOADING OPERATIONS

The rewind and unload operations may be remotely controlled for any transport in a single or multiple unit installation. When the transport is in the remote mode (ready status true) and selected, a low level on the remote rewind interface line initializes the rewind sequence. The ready line is high and the rewind status line is low during the rewind sequence. At completion, both these status lines switch to opposite states.

The interface cables have five select and five rewind status lines for individual remote control of each transport in a multiple unit configuration. All other control interface lines are common to all transports. A given transport can rewind (and show rewind status) without maintaining select status so the controller can select another transport and still monitor rewind status of the given transport.

The rewind operation performs fast tape rewind (at approximately 150 inches per second) until BOT sensing. This initiates tape reversal to position the tape at the BOT marker as in the load operation described earlier. A 732-meter (2400 feet) reel of tape rewinds in less than 200 seconds.

When the transport is in the remote mode, a low level on the remote unload line initiates the unload sequence. The ready line is high during unload. The unload sequence performs fast tape rewind until the BOT is sensed. The tape is then slowly wound onto the supply reel until the take-up reel is empty.

The only recovery from the unload sequence after the BOT sensing is manual rethreading and manual initiation of the load sequence. Prior to detecting the BOT, the unload sequence can be terminated by pressing the RESET switch.

The local REWIND/UNLOAD switch has control only when the transport is in the local mode, which is established by pressing the RESET switch.

Appendix P

Model MT1600 Magnetic Tape System

P.1 GENERAL INFORMATION

The Model MT1600 Magnetic Tape System provides serial-access mass data storage for the Texas Instruments Model 990 Computers. The tape recording/reproducing system is based on the compact, reliable Model MT1600 Tape Transport and the new, versatile MT1600 controller. The system components comply with international regulatory agency requirements for safety, electronic radiation, and design practice. For further information, refer to the *Model 990 Computer Model MT1600 Magnetic Tape System Installation and Operation* manual.

P.1.1 Controls and Indicators

The switches on the controller board are not considered operating controls, since they are set up during installation and not changed unless the software or hardware configuration changes.

The controls and indicators for the MT1600 are shown in Figure P-1 and described in Table P-1.

Table P-1. Model MT1600 Transport Controls and Indicators

Switch/Indicator	Function
POWER	An alternate-action rocker switch that controls ac power to the tape transport. The 0 position is off and the 1 position is on.
Unlabeled	This indicator lights up when the ac power in on.
LOAD	A momentary-action pushbutton switch with an indicator. Pressing the LOAD switch causes the following sequence of events: 1. Slack is taken up on the tension arms. 2. A forward search for the Beginning of Tape (BOT) marker is started. The BOT marker is a metal tab that marks the beginning of usable tape. 3. After passage of the BOT, or after eight seconds, the tape direction is reversd until the BOT marker is again sensed. Tape then stops on the load marker. 4. The transport goes into load mode, and the load indicator illuminates.

Table P-1. Model MT1600 Transport Controls and Indicators (Continued)

Switch/Indicator	Function
ONLINE	Momentary-action pushbutton switch/indicator. When illuminated, indicates that the machine is online and ready for commands; all other manual controls are inhibited except RESET and POWER.
RWD	A momentary-action switch that is disabled unless the tape transport is offline. Pressing RWD causes the tape to rewind onto the file reel at high speed. A 732-meter (2400-foot) tape rewinds in 200 seconds maximum. Upon sensing the BOT marker, the tape changes to the forward direction until the BOT marker is again passed. The tape then moves in the reverse direction until stopped by the BOT marker. This procedure ensures stopping with the BOT marker in the same relative location as in the load sequence. Pressing the rewind switch while the tape is a load point and the machine is offline causes the transport to unload.
1600 CPI	This switch has no on-line function. It may be used by the customer representive to adjust the MT 1600.
FILE PROT	A solenoid senses the presence of a plastic write ring on the reel. The transport is inhibited from writing if the write ring is not installed.
FWD	This switch has no on-line function; it may be used by the customer representative to adjust the MT 1600. On offline operations this switch will move the tape forward at 37.5 inches per second.
RESET	A momentary-action switch with indicator that does the following: • Takes the MT1600 offline • Stops rewind • Stops forward motion • Provides an interrupt to the processor • Indicates a malfunction when conducting internal diagnostics

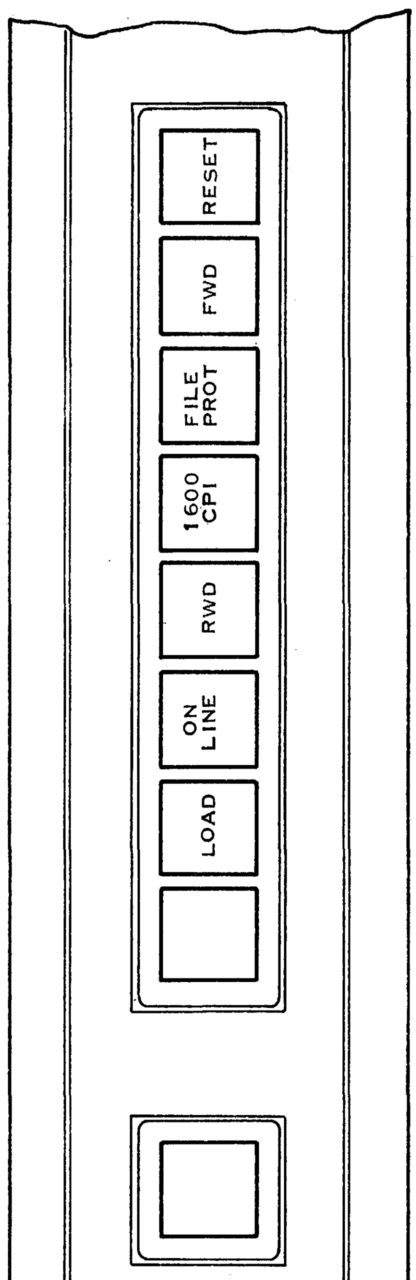

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Figure P-1. Model MT1600 Magnetic Tape Transport Control Panel

P.1.2 Loading a Tape

To load a reel of tape on the MT1600 tape transport proceed as follows:

NOTE

Use high-quality certified tape produced by reputable manufacturers. Field experience has shown that unnecessary data losses and service calls can often be traced to the use of worn-out or low-quality tapes.

1. Press the power switch ON.

2. Insert a plastic write ring on the reel if data is to be written on the tape.

3. Install the file reel on the lower reel hub by pulling the hub cap out, mounting the tape reel on the hub, and pushing the hub cap in.

4. Thread the tape from the file reel to the takeup reel as shown in Figure P-2. Wind three to five turns around the takeup reel.

NOTE

When the tape is first loaded, tape must be tight across the top and bottom rollers of the tension arms.

5. Close the transport door. The transport will not operate until the door latches.

6. Press the LOAD switch. Tape will be wound on the takeup reel, and positioned at the BOT marker.

The MT1600 tape transport is now ready for use.

P.1.3 Reloading During Midreel Operations

Tape can be loaded in the middle of a reel by winding slack tape on the takeup reel and positioning it as shown in Figure P-2. Push RESET and LOAD and wait for automatic loading to start. When the transport starts to move the tape forward in search of the BOT marker, push RESET and tape motion will stop. The transport is now ready to operate in the local mode. Push ONLINE for system operation.

P.1.4 Rewinding and Unloading Operations

Rewinding and unloading a tape is accomplished with the rewind (RWD) switch. The RWD switch is a momentary-action switch that is disabled when the tape drive is online. Pressing RWD will cause the tape to rewind a high speed until the BOT marker is sensed. The drive then positions the BOT marker in the same relative position as in the load sequence.

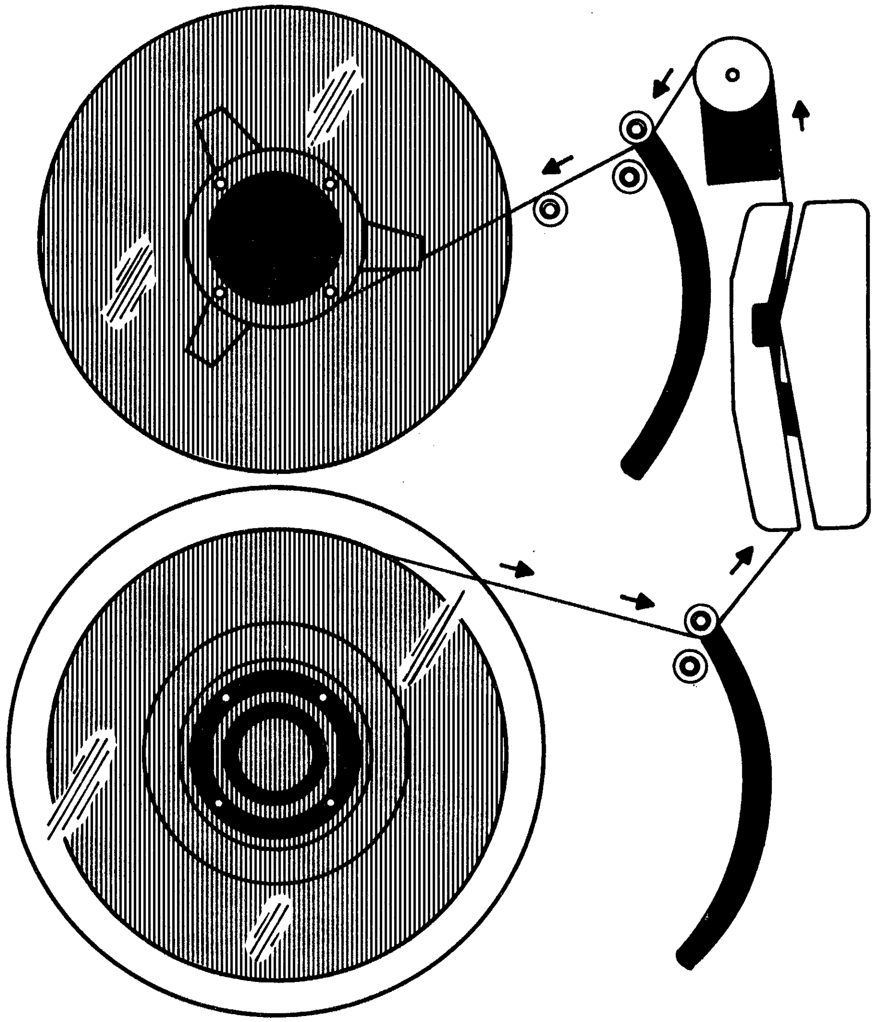

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Figure P-2. Model MT1600 Tape Transport Threading Diagram

Pressing RWD when the tape is at load point and offline unloads the tape. The tape can be removed by winding all the tape on the supply reel, pulling the hub cap out, then removing the reel.

Appendix Q

Models LP300 and LP600 Line Printers

Q.1 GENERAL INFORMATION

This appendix contains operating instructions for the LP300/LP600 line printers, including the following:

- LP300/LP600 printer operator panel controls
- Other LP300/LP600 printer controls and indicators
- Ribbon installation/changing
- Paper loading
- Operating procedures

Q.2 LP300/LP600 PRINTER OPERATOR PANEL CONTROLS AND INDICATORS

Figure Q-1 shows the LP300/LP600 printer operator panel. The following six paragraphs describe the controls and indicators contained on this panel. This appendix also discusses other controls and indicators which are mounted internally on the printer.

Q.2.1 POWER Indicator

The POWER indicator illuminates after power is applied to the printer and the ac power switch is set to the ON position.

Q.2.2 CHECK Pushbutton/Indicator

The CHECK pushbutton/indicator is both a control switch and status indicator. Used as a control switch, the CHECK pushbutton/indicator is pressed and released to reset the printer after a fault condition is cleared. If the CHECK pushbutton/indicator remains illuminated, an additional fault conditon exists. All such conditions must be cleared before the printer will become operational.

As an indicator, CHECK provides status information about certain printer functions and illuminates for one or more of the following reasons:

- Form thickness adjustment lever is in load position.
- Paper has run out.
- There is no paper motion when the printer is operating.
- Internal voltage is abnormal.

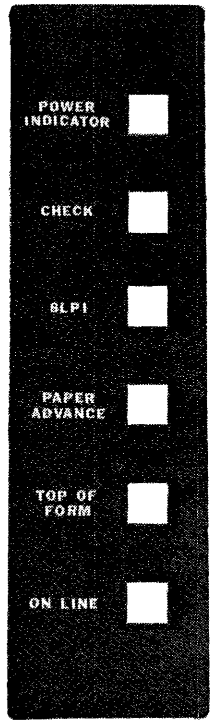

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Figure Q-1. Model LP300/LP600 Printer Operator Panel

NOTE

If the CHECK pushbutton/indicator remains lighted after all noticeable faults have been corrected, power should be removed from the printer and the customer representative should be contacted for further assistance.

Q.2.3 8LPI Pushbutton/Indicator

The 8LPI pushbutton/indicator is both an indicator and a momentary action switch that selects line spacing of either eight LPI (lighted) or six LPI (unlighted). This pushbutton/indicator is operational only when the printer is not online to the Model 990 Computer.

Q.2.4 PAPER ADVANCE Pushbutton

The PAPER ADVANCE pushbutton, when held down, causes the printer paper to advance.

Q.2.5 TOP OF FORM Pushbutton/Indicator

The TOP OF FORM pushbutton/indicator is both a momentary-action switch and a status indicator. When pressed, this pushbutton/indicator causes the paper to advance to the top of the next form. The TOP OF FORM pushbutton/indicator is operational only when the printer is offline.

When lighted, the TOP OF FORM pushbutton/indicator indicates that the Electrical Vertical Format Unit (EVFU) is loaded.

Q.2.6 ONLINE Pushbutton/Indicator

The ONLINE pushbutton/indicator is both a momentary-action switch and an indicator which, when pressed (lighted), places the printer online with the Model 990 Computer. When this indicator is not lighted, the printer is offline and cannot print data from the computer.

Q.3 OTHER LP300/LP600 PRINTER CONTROLS

The following paragraphs describe four controls not located on the LP300/LP600 printer operator panel:

- Power ON/OFF switch
- Form width adjustment
- Form thickness adjustment
- Vertical positioning adjustment

Figure Q-2 shows the location of the form width and thickness adjustments and the vertical positioning adjustment.

Q.3.1 POWER ON/OFF Switch

A toggle switch on the left side of the LP300/LP600 printer controls ac power.

Q.3.2 Form Width Adjustment

The LP300/LP600 printer may be adjusted for the form width in two ways. First, the printer mechanism may be adjusted to accept paper forms from 10 to 40 centimeters wide (4 to 16 inches) by unlocking and repositioning the tractor knobs and repositioning the tractors that engage the holes in the paper (see Figure Q-2). Once the tractor knobs are unlocked, the right-hand tractor may be moved the full width of the hammer bank. However, the left-hand tractor may be moved only 2.8 centimeters (1.1 inches) outward (left) from print column one. This tractor also has a top-of-form (TOF) mark for use in setting the TOF.

In the second method of form width adjustment, the horizontal Vernier adjustment knob allows both tractors to be moved simultaneously a maximum distance of two columns in either direction.

The procedure for adjusting the top-of-form is contained in the instructions for loading paper in the Paper Loading Instructions paragraph in this appendix.

Q.3.3 Form Thickness Adjustment

The form thickness adjustment lever is located on the left side of the printer mechanism (Figure Q-2). The lever scale is marked with approximate locations (Figure Q-3) for various form thicknesses. The actual form thicknesss determines the proper lever setting.

To position the lever satisfactorily, initiate the self-test described in the *Models LP300 and LP600 Line Printers Installation and Operation Manual* and observe the results. If the printed characters are too light, move the lever toward the rear of the printer. If the printed characters are too dark, move the lever toward the front of the printer.

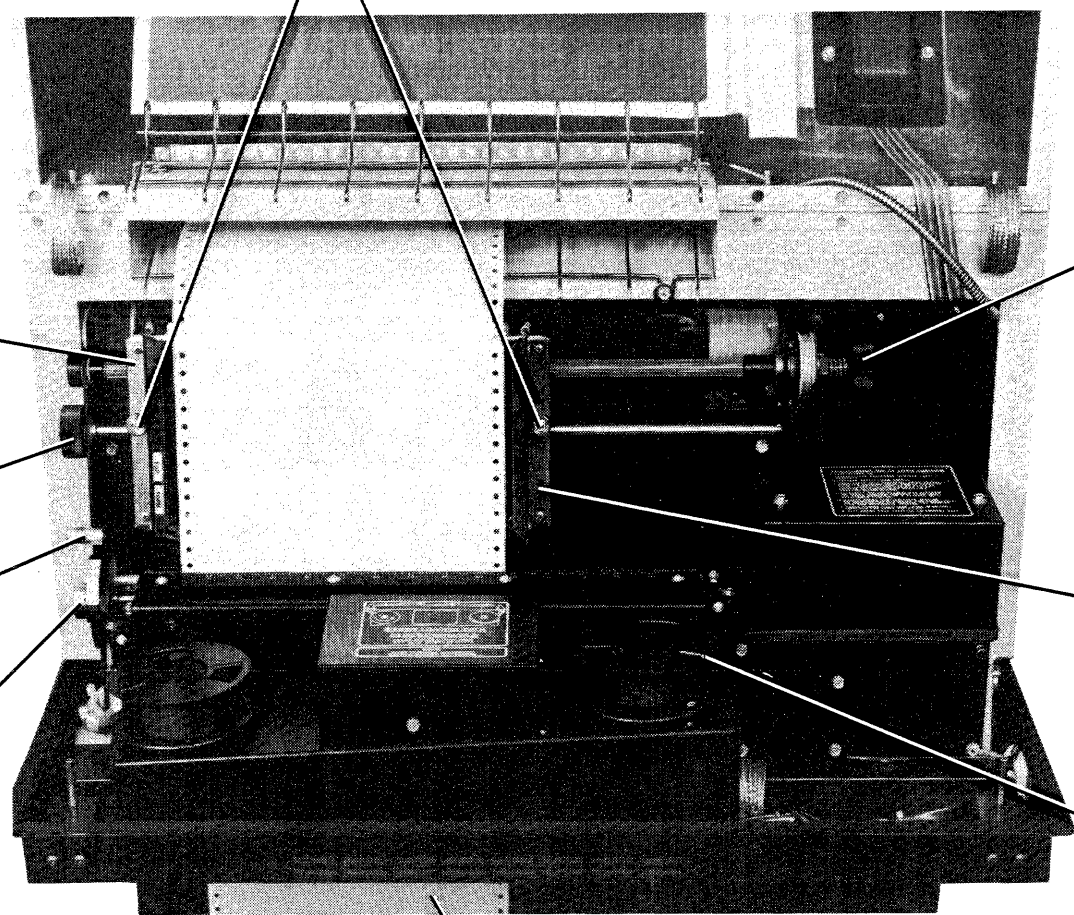

Figure Q-2. Model LP300/LP600 Printer, Detailed Internal View

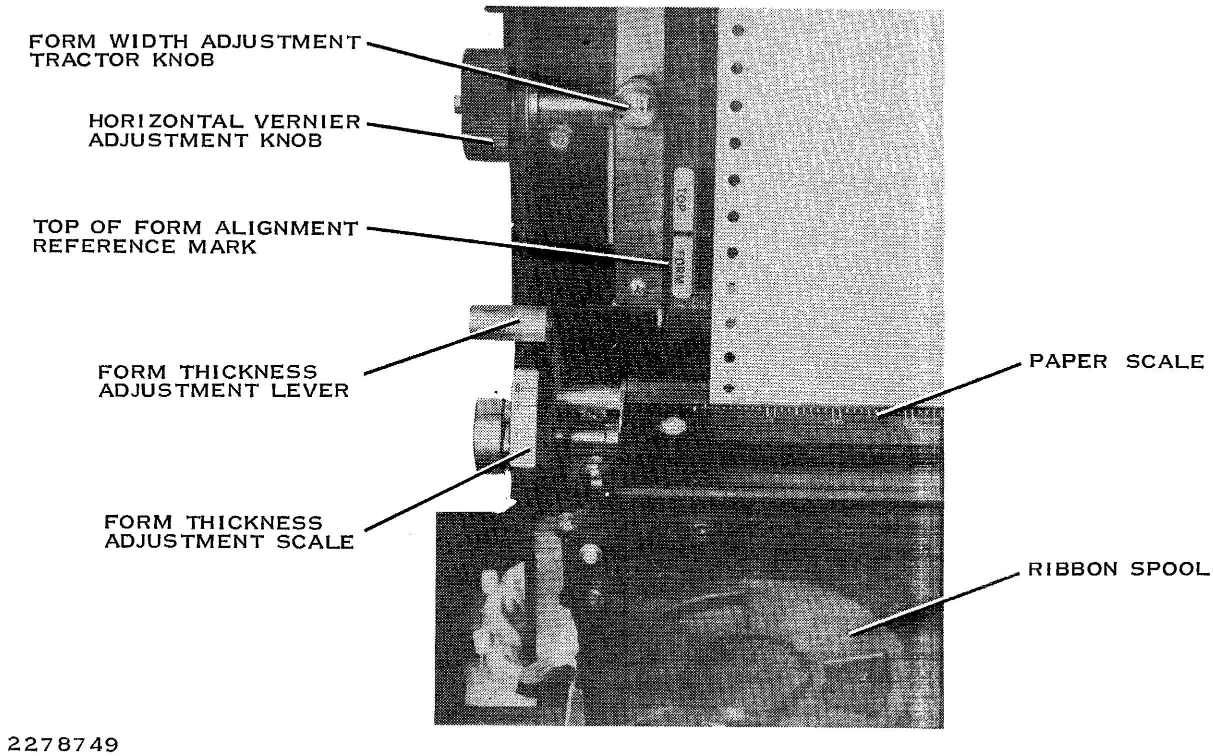

Figure Q-3. Model LP300/LP600 Form Thickness Adjustment Control

Q.3.4 Vertical Positioning Adjustment Knob

The vertical positioning adjustment knob (Figure Q-2) moves the paper up or down. It is used primarily in conjunction with the TOF tractor marks to set the TOF. The procedure for setting the TOF is included in the paper loading instructions contained in the Paper Loading Instructions paragraph in this appendix.

Q.4 RIBBON INSTALLATION/CHANGING INSTRUCTIONS

The LP300/LP600 printer uses a nylon ribbon (part number 2271784-0001) 2.5 centimeters (1.0 inch) in width. The ribbon is mounted on two spools. Install or change the ribbon in the following way:

NOTE

Power does not have to be turned off to install or change ribbon.

1. Raise the front cover of the printer.

NOTE

If the original form thickness adjustment is to be maintained, note the position of the lever before going on to step 2.

2. Place the form thickness adjustment lever in its fully raised position (Figure Q-3).

3. If the old ribbon is being replaced, follow these steps:

   a. Unlock both ribbon spools by pulling the latches toward the center of the lugs (Figure Q-4).

   b. Lift the old ribbon spools from the hubs, clearing loose ribbon from the guides and ribbon slot. Discard used ribbon and spools.

4. Place one new ribbon spool on the left spool hub with the feed-out side of the spool toward the front of the printer, and feed the ribbon out along the ribbon path as shown in Figure Q-5.

5. Place the remaining new ribbon spool on the right spool hub and rotate either spool to remove any ribbon slack.

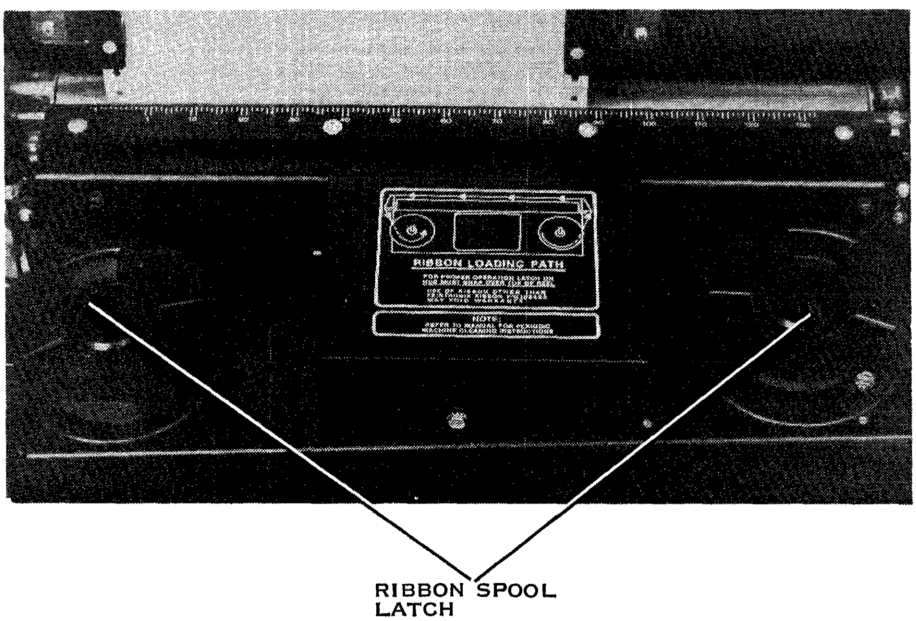

Figure Q-4. Model LP300/LP600 Printer Ribbon Assembly

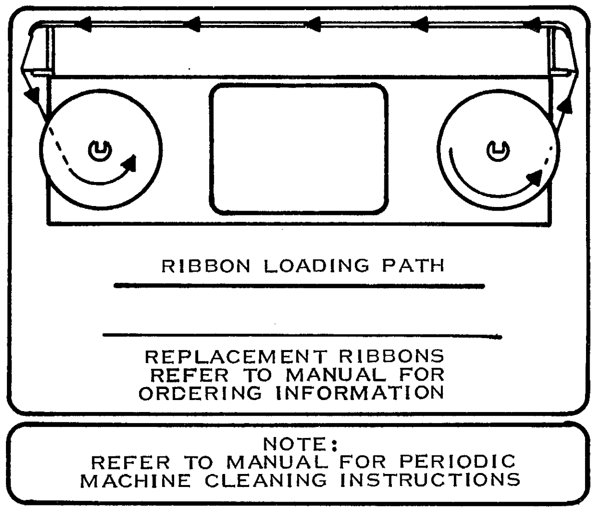

Figure Q-5. Model LP300/LP600 Ribbon Loading Path

CAUTION

Make sure the ribbon runs smoothly over the ribbon guides. A twisted or improperly installed ribbon will cause missing characters, paper jams, shorter ribbon life, and possible damage to the print hammers.

6. Readjust the form thickness adjustment lever to the desired setting.
7. Close the cover of the printer.

Q.5 PAPER LOADING INSTRUCTIONS

The LP300/LP600 printer uses continuous-form paper with standard perforations on each edge. Paper widths from 10.16 to 40.64 centimeters (4 to 16 inches) can be accommodated. Single- or multiple-part forms (up to five carbon copies plus an original) can be printed on paper with the following weight specifications:

Single-part forms:

6.8-kilogram (15-pound) stock minimum

Multiple-part forms:

Original — 5.4-kilogram (12-pound) bond

Copies — 5.4-kilogram (12-pound) stock maximum

Carbon Paper — 2.7- to 3.6-kilogram (6- to 8-pound) stock maximum

Card stock up to 0.635 millimeter (0.025 inch) thick may be used for either single- or multiple-part forms.

To load paper into the LP300/LP600 printer, use the following procedure:

1. Turn on power to the printer. Check the POWER ON indicator. If the indicator is not lighted, verify power cable connections and site voltages.
2. Place the fanfold paper under the printer and line it up with the printer paper loading slot (see Figure Q-2).
3. Press and release the TOP OF FORM pushbutton.
4. Open the front cover of the printer.

NOTE

If the original form thickness adjustment is to be maintained, note the position of the lever before going to step 5.

5. Refer to Figure Q-3 and move the form thickness adjustment lever to its fully raised position.
6. Open the left- and right-hand tractor gates on each paper tractor (Figure Q-3).
7. Insert the top edge of the paper through the slot in the printer base and pass it above the left- and right-hand tractors.

8. Loosen and reposition the tractor lock knobs (Figure Q-2) as necessary to accommodate the width of the paper.

9. Move paper up and down in both tractors until the holes are engaged in corresponding tractor pins.

10. Close tractor gates. Adjust tractors to provide very slight tension across the form. Position paper and tractors so that the first character position on the paper scale falls in approximately the desired first-column position on the paper (see Figure Q-3).

NOTE

The horizontal Vernier knob (Figure Q-2) may be adjusted at any time to move the character to the correct location in the form within a three-character range.

11. Tighten the tractor lock knobs.

12. Turn the vertical form adjustment knob (Figure Q-2) until the top edge of the form is opposite the TOP OF FORM mark on the left-hand tractor.

13. Rotate the white reference mark on the vertical form positioner disk until it is aligned with the fixed pointer (Figure Q-6).

14. Rotate the vertical form position knob exactly one full revolution to lower or raise the paper and leave the white reference marker aligned with the fixed pointer.

15. Move the form thickness adjustment lever downward to a suitable position for the paper or form in the printer (see Figure Q-3). The CHECK indicator should not be lighted.

NOTE

If the form thickness adjustment lever is not adjusted properly, the print may be too dark or too light. If necessary, refer to Form Thickness Adjustment paragraph in this appendix for the way to correct the problem.

Q.6 OPERATING PROCEDURES

The LP300/LP600 printer has only the following operator controlled functions:

- Turning power on and off to the printer
- Verifying printer readiness and placing the printer online with the Model 990 Computer

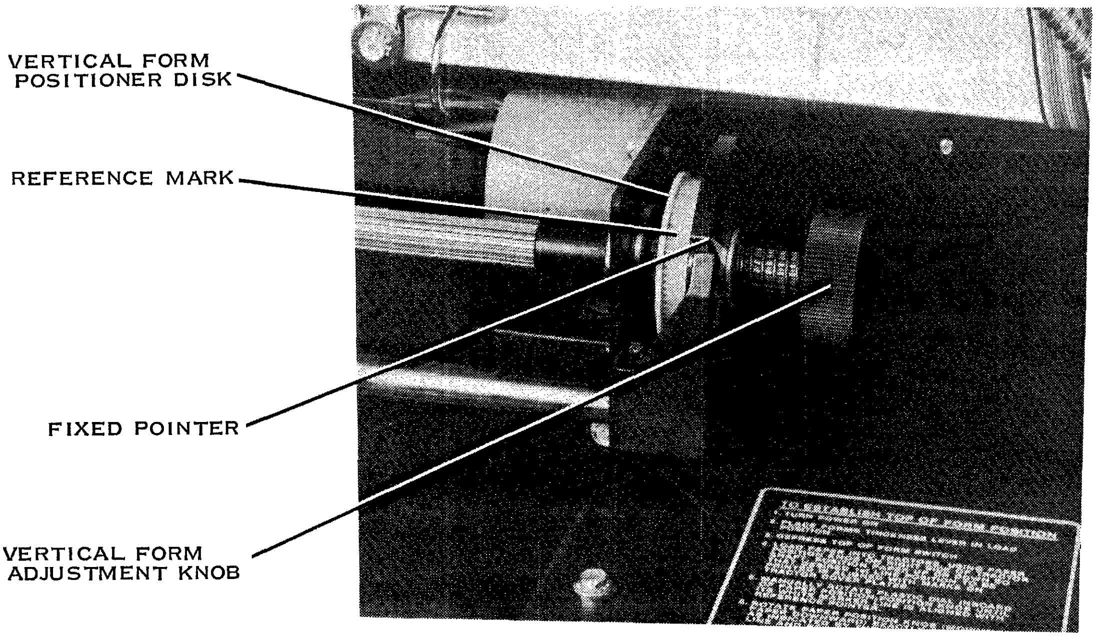

Figure Q-6. Model LP300/LP600 Printer Paper Positioning

All other operating functions for the LP300/LP600 printer are software-controlled. These functions are described in detail in the *Model LP300 and LP600 Line Printers Installation and Operation Manual.*

Q.6.1 Online Start-Up Procedure

The following procedure places the LP300/LP600 printer subsystem in the online mode of operation. Check that the ribbon and paper are properly installed before operation and proceed as follows:

1. Verify that the POWER INDICATOR is lighted. If it is not, make sure that the following installation procedures have been performed:

   a. Power has been checked at the power source.

   b. The power cable has been connected to the proper power source.

   c. The power ON/OFF switch has been placed in the ON position.

2. If the above installation procedures have been verified and the POWER INDICATOR does not light, turn the power switch to the OFF position and discontinue use. Consult your customer representative for further assistance.

3. Set the top-of-form by pressing and releasing the TOP OF FORM pushbutton (see Figure Q-1).

4. Place the LP300/LP600 printer subsystem online by pressing and releasing the ONLINE indicator/pushbutton (see Figure Q-1). Verify that the ONLINE indicator illuminates.

5. Observe printer operation. If necessary, refer to steps 12 through 15 of the paper loading instructions for form alignment procedures.

Q.6.2 Shut-Down Procedures

Use the following procedure for placing the LP300/LP600 printer in the offline mode and turning the printer off.

1. Press and release the ONLINE indicator/pushbutton (Figure Q-1). Observe that the indicator goes out.

2. Set the power switch to the OFF position. Observe that the POWER indicator goes out.

Appendix R

Model LQ45 Printer

R.1 GENERAL INFORMATION

This appendix contains operating instructions for the LQ45 printer including the following:

- Description of parts of printer mechanism
- Functions of controls and indicators
- Removal and replacement procedures
- Turn-on and turn-off procedures
- Self-help procedures

R.2 FUNCTIONS OF PRINTER MECHANISM PARTS

Figure R-1 labels parts of the printer mechanism that are important in the proper operation of the printer. The operator should become familiar with the names and functions of the labeled items. A brief functional description of each of the items is provided in the following paragraphs. Although not shown in Figure R-1, the column scale, column scale indicator, and ribbon advance switch are also described.

R.2.1 Platen

The platen holds the paper or form in printing position. The cushion face on the platen presents the proper backing for best print quality and quiet operation.

R.2.2 Platen Knobs

The platen knobs are used, as they are on a typewriter, to move the paper or form vertically during paper loading or unloading. The platen knob to the operator's right can be pressed inward for fine vertical paper adjustments.

R.2.3 Paper Bail

The paper bail holds the paper or form against the platen. This is necessary to prevent character smearing and for quiet operation. The paper bail is spring-loaded against the platen during normal operation and can be pulled forward by the operator while paper is being loaded.

R.2.4 Paper Release Lever

When the paper release lever is pulled forward (toward the operator), the tension between the feed rollers (below the platen) and the platen is removed. This allows the operator to adjust the paper or form freely in any direction. The normal operating position is to the rear. When the optional forms tractor is used, the paper release lever must always be in the released position (toward the operator).

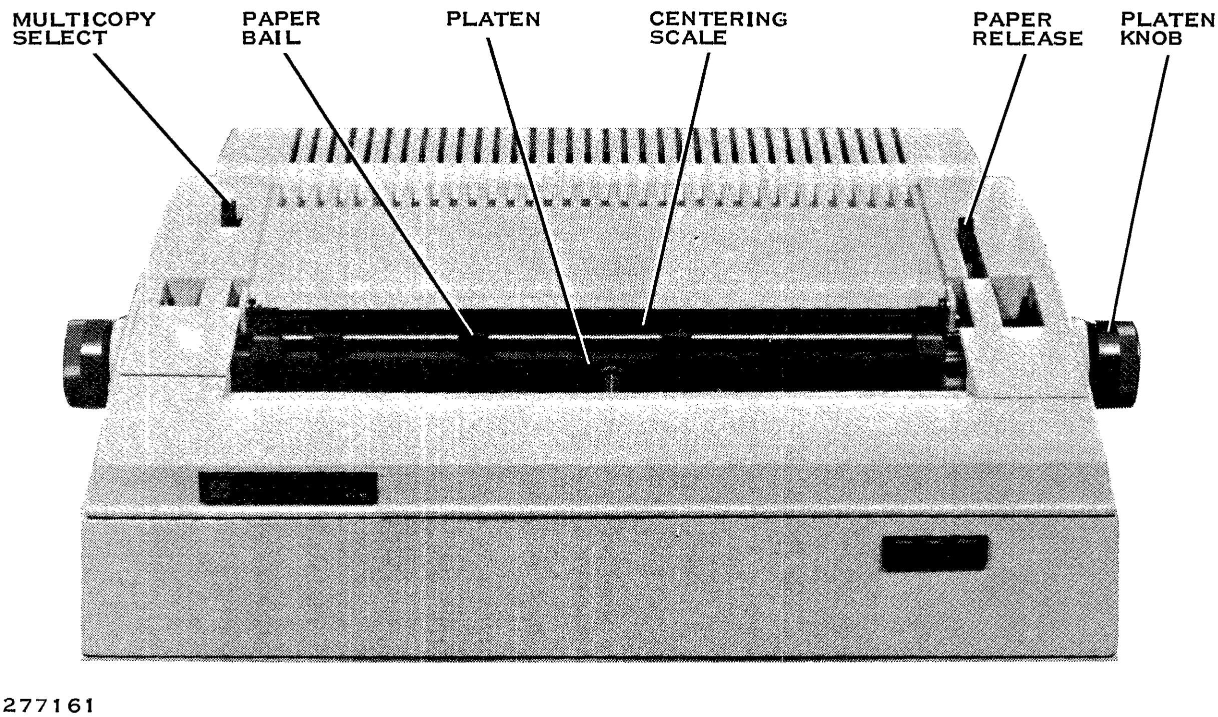

Figure R-1. Model LQ45 Printer Mechanism Parts Locations

R.2.5 Multicopy Select Lever

The multicopy select lever adjusts the spacing between the printing mechanism and the platen. For single-part forms or ordinary paper, the lever should be in the forward released position (toward the operator). For multipart forms or extremely thick stock paper, the lever can be moved one or more notches to the rear for better print quality.

R.2.6 Paper Centering Scale

The paper centering scale is similar to scales found on most typewriters. This scale aids the operator in positioning paper in the printer.

R.2.7 Column Scale and Column Scale Indicator

See Figure R-2. The column scale is a general guide to the column position of printed characters and the print mechanism. The scale is graduated for both 10- and 12-column spacings per inch. The operator should be aware that the printer can be commanded to operate with column spacings other than 10 or 12 per inch. In that case, the column scale does not accurately show the numeric column position.

The column indicator, a marker above the printhammer, shows the present printing position. When it is used in conjunction with the column scale, the column number can easily be determined.

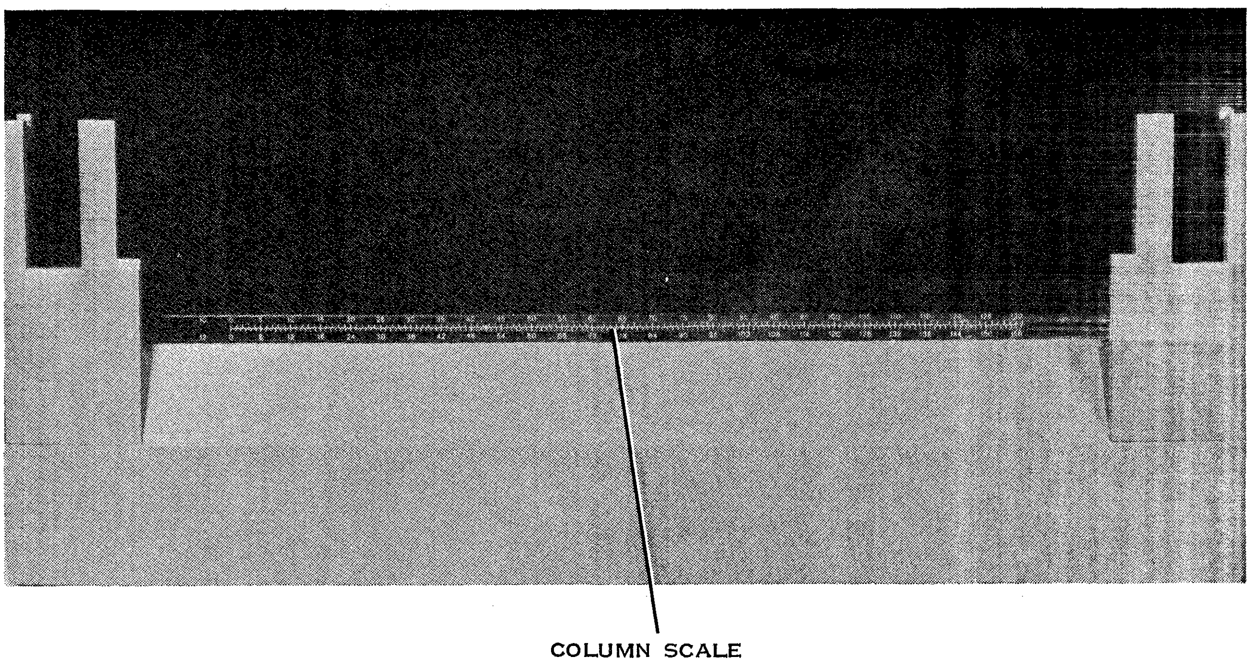

Figure R-2. Model LQ45 Printer Column Print Position Indicator

R.2.8 Ribbon Advance Switch

The ribbon advance switch (see Figure R-3) is located inside the right front corner of the printer. The ribbon advance switch is used to remove slack in the ribbon and to advance the ribbon when installing a new ribbon cartridge.

R.3 CONTROLS AND INDICATORS

The printer controls and indicators consist of three front panel indicator lamps and a power on/off switch. The indicator lamps as shown in Figure R-4 and described in Table R-1 are located at the top right of the printer front panel. The power on/off switch as shown in Figure R-5 is located at the right rear corner of the printer. The power switch is an alternate-action switch. Pressing the switch toggles the switch to the opposite state. Pushing the switch a second time returns the switch to the first state. If power is not on, as indicated by the POWER lamp when the power cord is connected to the source outlet, press the switch once to turn the power supply on.

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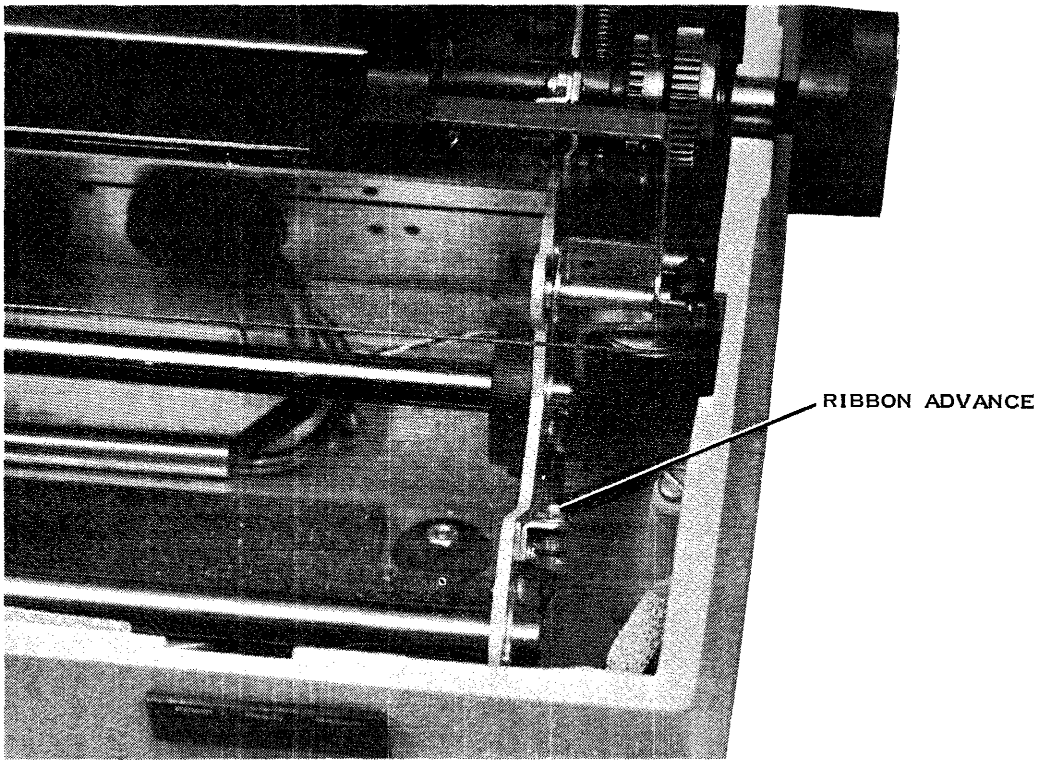

Figure R-3. Model LQ45 Printer Ribbon Advance Control

Table R-1. Model LQ45 Printer Indicator Lamps

Indicator	Function
POWER lamp	When lit, indicates that the printer power is on.
READY lamp	When lit, indicates that all printer internal systems are ready to operate and that the printer top cover is in place.
RIBBON lamp	When lit, indicates that the printer has ribbon. The lamp goes off when the printer is out of ribbon.

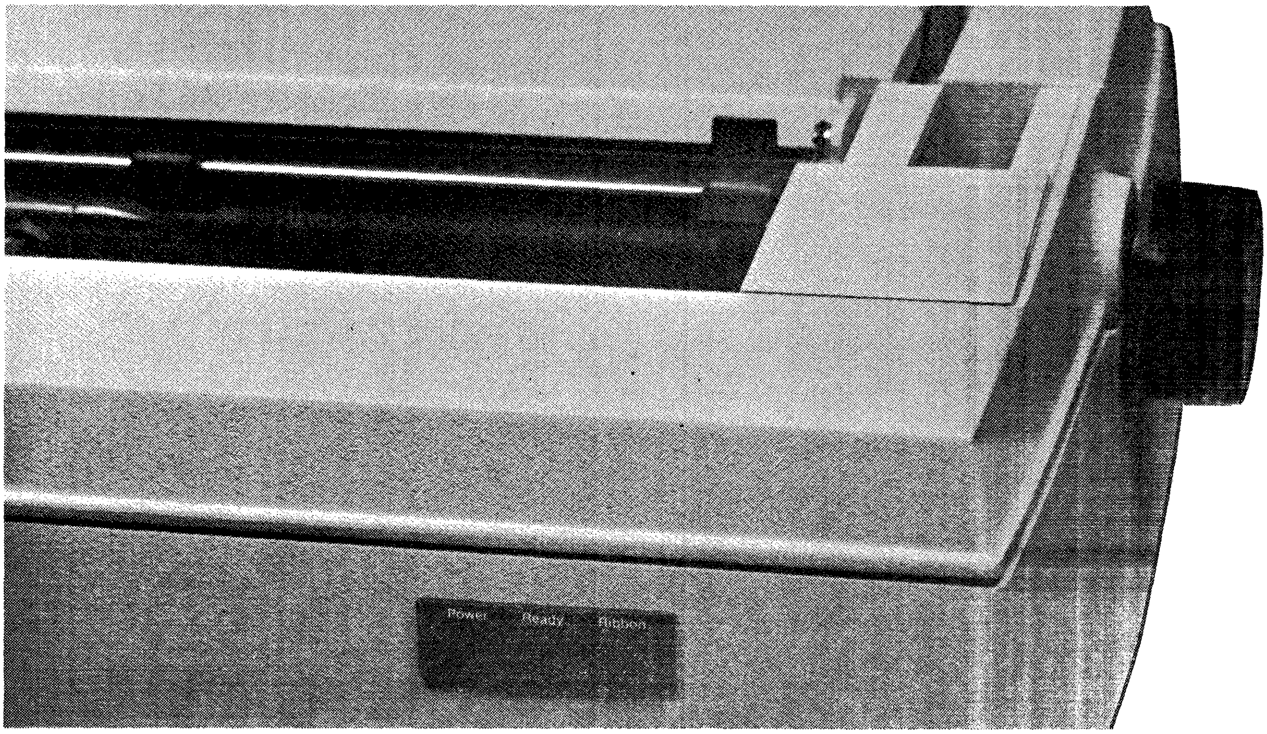

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Figure R-4. Model LQ45 Printer Indicator Lamps

R.4 REMOVAL AND REPLACEMENT PROCEDURES

Some operations, such as changing paper, replacing a ribbon, or replacing a printwheel, are performed by the printer operator. Ribbons and plastic printwheels for Qume printers are available from suppliers of business machine office supplies. Procedures for changing the paper, ribbon, and printwheel are provided in the paragraphs that follow.

R.4.1 Removing and Replacing the Printer Top Cover

The top cover must be removed to install or replace the printwheel, ribbon, or platen. The printer is protective-interlocked in the top cover and except for the manually activated ribbon advance switch, the printer does not function with the cover not in place. Remove and replace the top cover as follows:

1. To remove the cover, grasp at both front corners and pull upward and forward.

2. To replace the cover, carefully align the rear tabs on the top cover with the corresponding slots in the intermediate cover. Press the top securely into place.

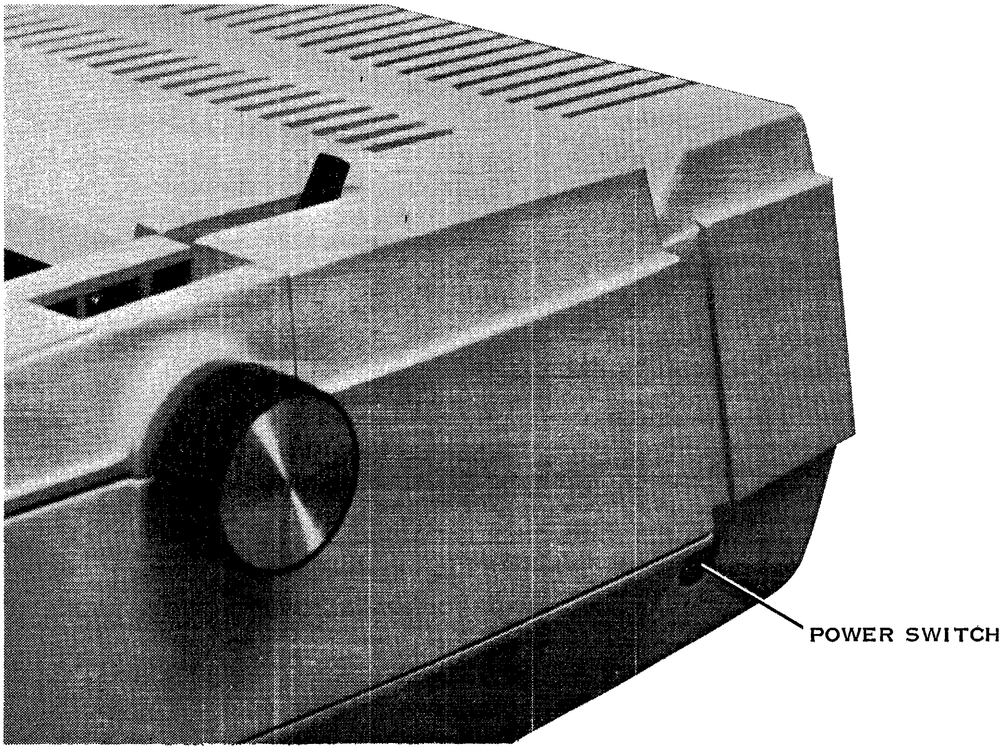

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Figure R-5. Model LQ45 Printer Power Switch Location

R.4.2 Loading Paper in Printer Without Forms Tractor

If the bidirectional forms tractor is not to be used, the paper guide supplied with the printer is installed before paper is loaded into the printer. To install the paper guide, snap the two fingers at one end of the paper guide over the front edge of the printer's intermediate cover and lay the paper guide back until the other end of the paper guide drops into a recess between the back of the intermediate cover and the power supply extension cover. Then load paper into the printer as follows:

1. Pull the paper bail forward, away from the platen.
2. Insert the form or sheet at the rear of the platen, top first, with the side to be printed away from the operator.
3. With the platen knobs, rotate the platen to feed the paper until the edge at the top of the sheet can be held against and compared with the edge of the portion that is entering behind the platen.
4. If these edges do not align, release the tension on the paper by pulling the paper release lever forward.
5. Align the paper by pinching the two edges together and moving the paper to the proper position.

6. Return the paper release lever to the rear position.

7. Move the paper bail to its normal position.

8. Rotate the platen backward until the sheet is at the top printing line.

R.4.3 Changing the Ribbon
Cloth ribbons are continuous loops. They recirculate until the lack of print quality forces replacement. Single- or multiple-strike ribbons pass through one time only and must be replaced at the end of the ribbon. The end of ribbon detect stops the printer at the point on the writing line where the ribbon runs out. Once the ribbon is replaced and the top cover is in place, the printing continues from where it stopped. A slight hesitation may be noticed when printing resumes if the printwheel was moved while changing the ribbon. To change the ribbon, remove the top cover (see paragraph Removing and Replacing the Printer Top Cover in this appendix) and proceed as follows:

1. Press the red cartridge release lever as shown in Figure R-6 and lift out the ribbon cartridge to be replaced. Unthread the ribbon from the two ribbon guides at either side of the cartridge.

RIBBON CARTRIDGE RELEASE LEVER

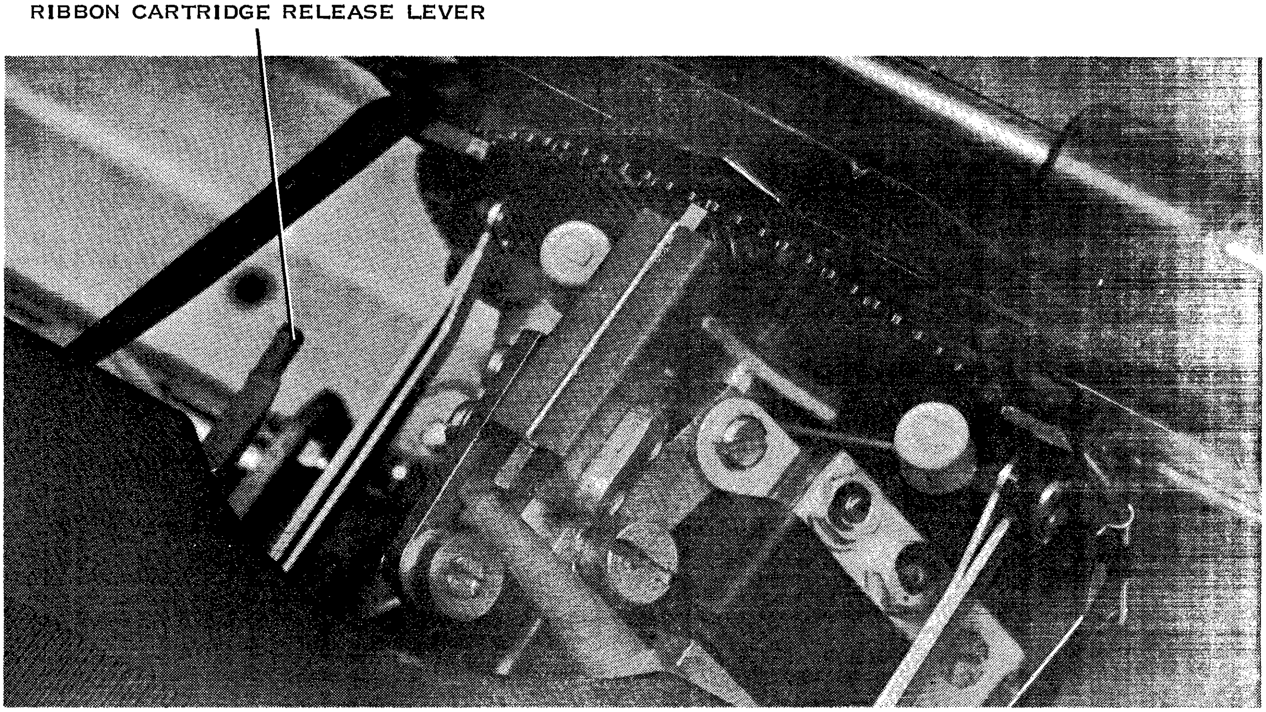

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Figure R-6. Model LQ45 Printer Ribbon Cartridge Release Lever

2. Press the release (open) button for the printwheel motor assembly, as shown in Figure R-7, and tilt it slightly toward the front of the printer.
3. Pull a small loop of ribbon out of the replacement ribbon cartridge.
4. Place the replacement ribbon cartridge into position and press downward to snap the cartridge into place.
5. Thread the ribbon through the ribbon guides and around the outside of the tensioner as shown in Figure R-8.
6. Push the printwheel motor assembly back into operating position.
7. Press the locking lever on the printwheel motor assembly (the button marked C) until a slight click is heard. This locks the assembly into place.
8. Press the ribbon feed switch until the ribbon is feeding properly and, if the ribbon is a single- or multiple-strike type, until the RIBBON lamp lights and the inked portion of the ribbon is under the printhammer.
9. Replace the top cover.

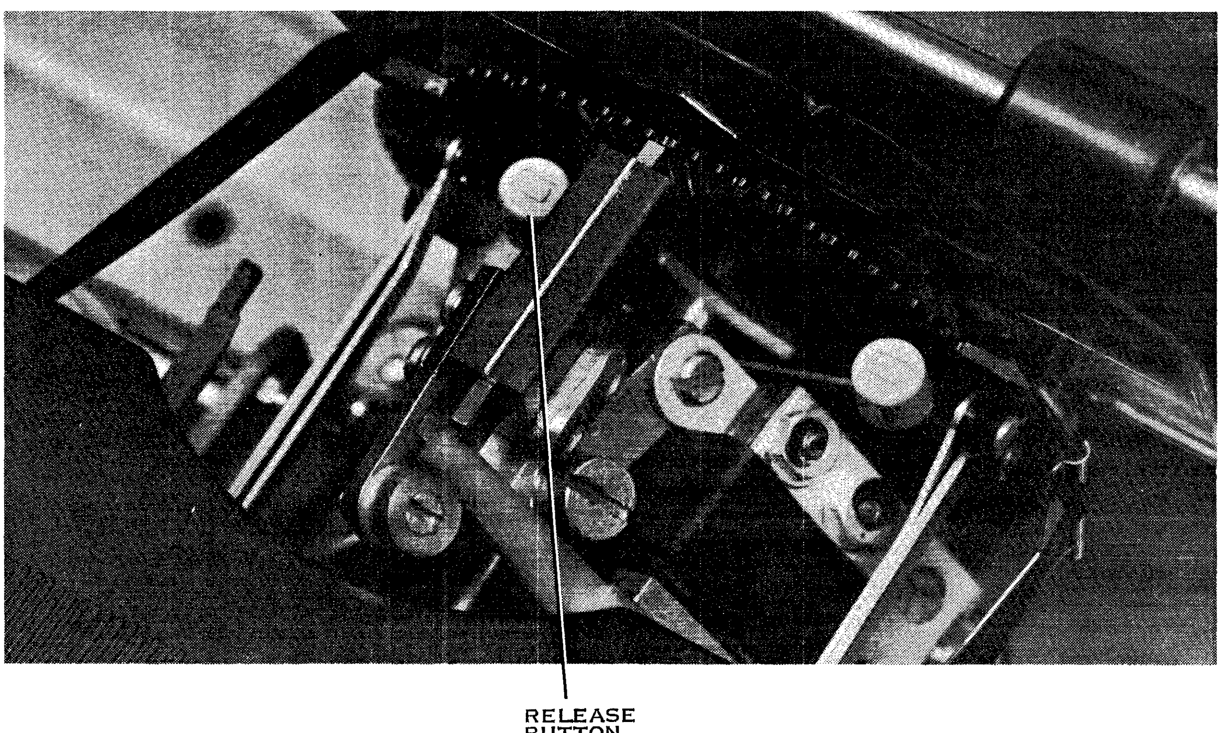

Figure R-7. Model LQ45 Printwheel Motor Assembly Release Button

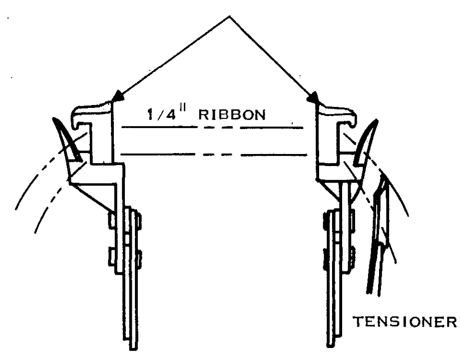

Figure R-8. Model LQ45 Printer Ribbon Guides and Tensioner

R.4.4 Replacing the Printwheel

Changing the printwheel is an operator task and is performed as follows:

1. With the printer power off, remove the top cover and the ribbon cartridge using the methods described in the Removing and Replacing the Printer Top Cover and Changing the Ribbon paragraphs in this appendix.

2. With the ribbon removed, press the release (open) button for the printwheel motor assembly.

3. Tilt the printwheel motor assembly toward the front of the printer as far as it will go.

4. Grasp the printwheel firmly by the hub and pull upward. The printwheel will slide off the end of the shaft.

5. Examine the printwheel for ink or dirt buildup and signs of wear or other damage that could impair print quality. Replace badly worn or damaged printwheels.

6. To replace the printwheel, ensure that the alignment tab on the shaft matches the slot in the printwheel. With the printwheel properly aligned, press firmly on the center hub of the printwheel until it is seated on the shaft.

NOTE

If the printwheel is not seated properly, the quality of print deteriorates. Proper seating can be checked by manually rotating the printwheel (with printer power off).

7. Return the printwheel motor assembly toward the printing position but do not lock it into place.

8. Reinstall the ribbon cartridge as described in the paragraph Changing the Ribbon in this appendix. Be sure the ribbon is threaded on the outside of the tensioner arm.

9. Place the printwheel motor assembly fully into the working position and press the locking lever (marked C for close). A slight click will be heard when the mechanism locks.

10. Turn the power back on.

11. Remove the slack in the ribbon by momentarily pressing the ribbon advance switch.

12. Replace the top cover.

R.4.5 Removing and Replacing the Platen

The platen must be occasionally removed for cleaning and general printer maintenance. Do not attempt to clean the platen while in place. Cleaning fluid damages the plastic card guides and other plastic parts of the printer. To remove the platen, use the following procedure:

1. If present, remove the bidirectional forms tractor.

2. Remove the top cover.

3. Pull the paper bail forward and out of the way.

4. Grasp both ends of the platen by the knobs.

5. With the thumbs, press the platen release levers at each end of the platen (see Figure R-9) and lift the platen up and out.

To replace the platen, use the following procedure:

1. Ensure that the lower rollers and the under cradle are clean and properly seated.

2. As the platen is placed into position, align the gear teeth of the platen on the large gear of the printer mechanism.

3. Simultaneously press down on both platen knobs. This locks the platen into place. If the platen does not lock, check the gear alignment.

4. Replace the top cover.

R.4.6 Mounting the Optional Bidirectional Forms Tractor

The optional forms tractor accepts and drives continuous feed forms with perforated edges (standard one-half inch hole spacing). The forms tractor adjusts to forms that are 5 to 36.6 centimeters (2 to 14.65 inches) wide. To mount the tractor form, proceed as follows:

1. Temporarily remove the top cover from the printer.

2. Grasp the forms tractor at both ends with the paper gates toward you.

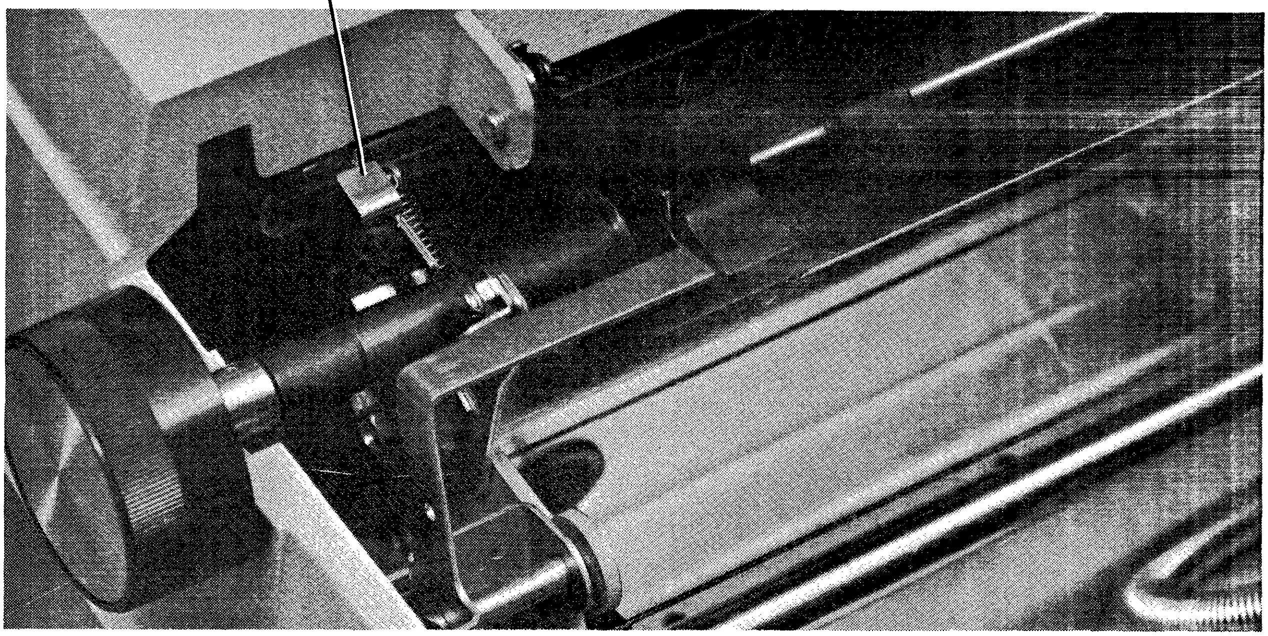

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Figure R-9. Model LQ45 Printer Platen Release Lever

3. With the thumbs, press the release latches on each end of the forms tractor. While still holding the release latches, insert the tractor into the printer. The right-hand position of the tractor straddles a groove in the platen shaft, allowing the gear mechanism to engage. The left-hand position of the tractor is just outside the left platen release lever. It may be necessary to rock the tractor slightly to properly seat the mechanism.

4. Let go of the release latches and allow the tractor to lock into place. Be sure that both release latches return to the normal position. If they do not return to normal position, rock or reposition the tractor until they do.

5. Loosen the locking clamps on the side of the paper gate (see Figure R-10), allowing the gate to slide freely along the rail.

6. Feed the forms of perforated edge paper through the back paper gates, around the platen, and through to the front.

7. Pull the paper release lever (at your right) all the way forward. Leave the lever in this released position while the forms tractor is in use.

8. Open the front paper gates and position each mechanism so that the holes at the edge of the paper are engaged by the pins on the tractor feed. Be sure the pins engage corresponding holes at each edge of the paper for both the front and back paper gates or the paper will not feed properly.
9. Close the paper gates, making sure that the paper does not buckle or disengage from the tractor pins.
10. Adjust the lateral position of the gate mechanisms slightly, if necessary, to smooth the paper and relieve any minor pulling or binding.
11. Tighten the locking clamp on each of the gate mechanisms. They should no longer slide on the rails.
12. Align paper.
13. Replace the top cover.

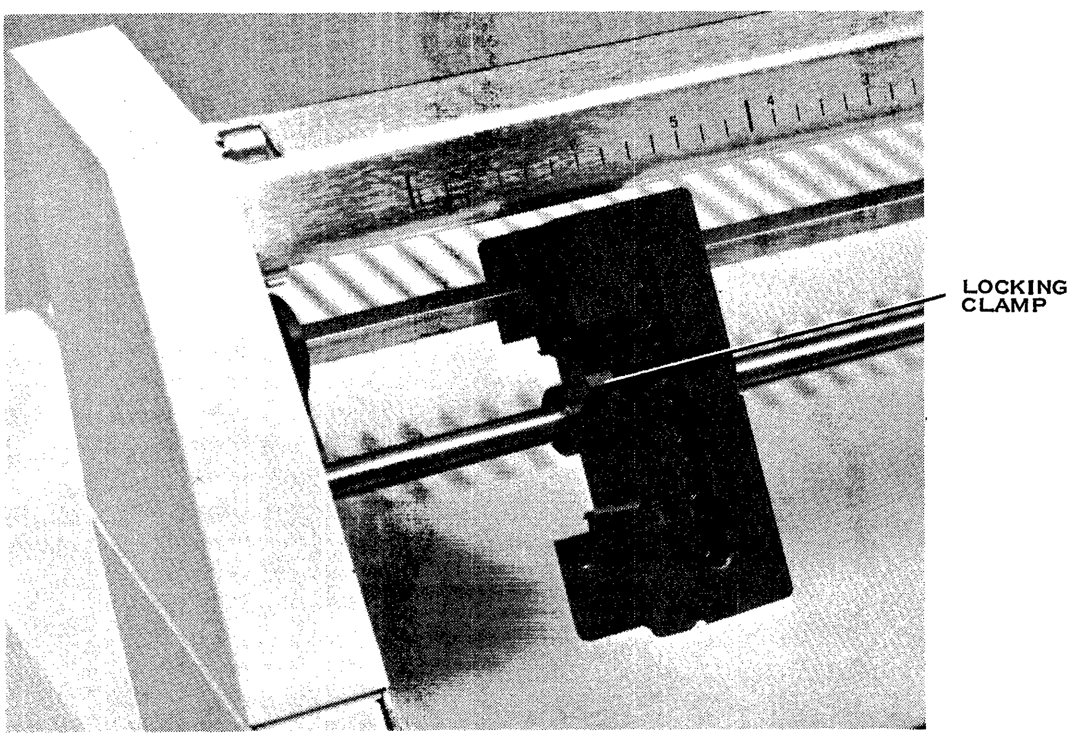

Figure R-10. Model LQ45 Printer Forms Tractor Paper Gate Locking Clamps

R.5 POWERING UP THE PRINTER

To turn the LQ45 printer on, proceed as follows:

CAUTION

To prevent possible damage to the printwheel, do not print without a ribbon or with paper that is too narrow for the printed line width. If the full column width is used, the paper must be at least 37.2 centimeters (14 7/8 inches) wide.

1. Check that ribbon and paper are properly installed. (See the Removal and Replacement Procedures paragraph in this appendix for paper loading instructions and ribbon installation procedures.)
2. Press the alternate-action power on/off switch at the right rear of the printer.
3. The printer performs a self-test. If conditions are judged to be normal by the self-test, the READY indicator lights.

At this time, the initial conditions set for the printer are as follows:

1. The form length is set for 27.2 centimeters (11 inches).
2. Line spacing is set to 2.4 lines per centimeter (6 lines per inch).
3. Character spacing is set to 4.8 characters per centimeter (12 characters per inch).
4. The printer is set for 1200 baud reception.
5. The left margin is set to column 0 and the right margin is set to the rightmost column, no horizontal tabs are set, the ribbon is set for automatic feed, the printer is set for forward print direction, and no special modes are set.

This completes the turn-on procedure if no changes to the above initial conditions are desired. All the software commands listed in the *Model LQ45 Letter Quality Printer System Installation and Operation Manual* can now be performed (to the degree permitted by the printer options) by the sending device.

R.6 TURNING OFF THE PRINTER

To turn off the printer, press the alternate-action power on/off switch which is at the right rear of the printer. Note that when power is again applied to the printer, the printer returns to those initial conditions described in the turn-on procedures. If conditions other than the initial conditions are desired at next turn-on of the printer, the conditions must be noted and reentered into the printer after power is again applied.

R.7 SELF-HELP PROCEDURES

Proper operation of the printer depends not only upon the printer itself but also upon the proper operation of the host computer and the TTY/EIA interface module, the interface cable, and the ac power source for the printer. This paragraph provides a suggested list of corrective measures that should be performed before calling a service representative. If these measures do not correct the problem, qualified service personnel should refer to the *Model LQ45 Letter Quality Printer System Field Maintenance Manual* for troubleshooting procedures. The following is a list of corrective measures that may be taken by the operator:

1. Does the printer have power? At least the POWER lamp on the front panel should be lit. If the lamp is not lit, check the ac line cord connections and the printer power switch. Try another electrical appliance in the same receptacle to verify that ac power is present at the receptacle.

2. Is the top cover off or not seated properly? The printer is disabled by the interlock and the READY lamp is extinguished when the top cover is not properly installed. Check the cover. Remove and reinstall it if there is doubt.

3. Is the ribbon cartridge empty? For printers that are equipped with the out-of-ribbon detect, the printer is usually disabled and the RIBBON lamp is extinguished when there is no ribbon.

4. Is the READY lamp lit? Except for limited situations, the READY lamp must be lit for the printer to operate properly.

5. Cycle power off and on to the printer. This resets the internal portions of the printer. If this must be done often, it indicates possible programming problems or difficulties within the printer.

6. Make sure that the printwheel is firmly and squarely in place.

7. Make sure that the printwheel motor mechanism is locked into place by firmly pressing the button marked C near the printwheel.

8. Make sure all cables are properly attached and have not been damaged.

9. If print quality is poor, examine the printwheel for dirt or wear. Replace the printwheel if necessary. Also check that the ribbon is threaded properly and is advancing as it should.

10. Command a self-test from the central processor of the associated computer. If the test completes satisfactorily but problems still exist with printer operation, call the service representative.

Appendix S

Model 810 Printer

S.1 GENERAL INFORMATION

This appendix describes the daily operation of a Texas Instruments Model 810 Printer (see Figure S-1) attached to a Model 990 or Business Systems minicomputer running under DNOS. For more detailed information, refer to the *Model 990 Computer Model 810 Printer Installation and Operation* manual.

The Model 810 Printer prints bidirectionally at a rate of 150 characters per second. The printer is available with either a limited 64 ASCII character set or a full 96 ASCII character set. It uses a standard print format of 4 characters per centimeter horizontally and 2.4 lines per centimeter vertically (10 characters per inch horizontally and 6 lines per inch vertically). It may be set for compressed printing at 6.6 characters per centimeter and 3.2 lines per centimeter (16.5 characters per inch and 8 lines per inch). All operating commands to the printer come from the printer control panel or from software running on the 990 computer.

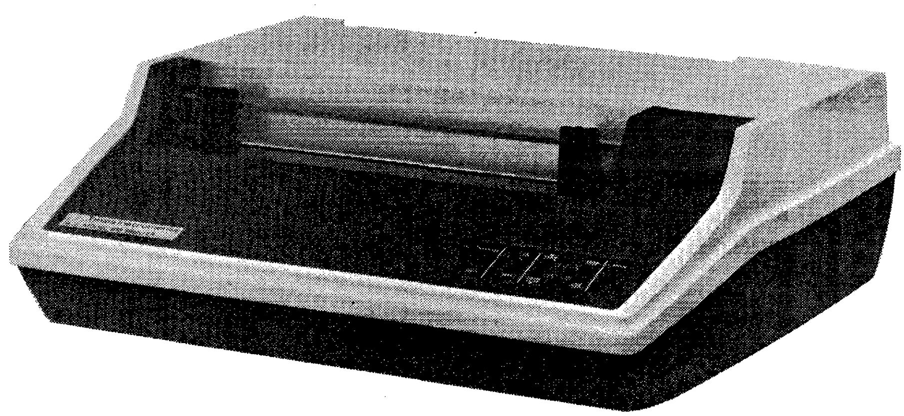

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Figure S-1. Model 810 Printer

S.1.1 Controls and Indicators

Figure S-2 shows the locations of various controls and indicators on the 810 printer. There are two control panels, the operator control panel and the auxiliary control panel.

S.1.1.1 Operator Control Panel. The operator control panel contains the following switches and indicators:

- POWER Indicator
- PAPER OUT Indicator
- ERROR Indicator
- ONLINE Switch and Indicator

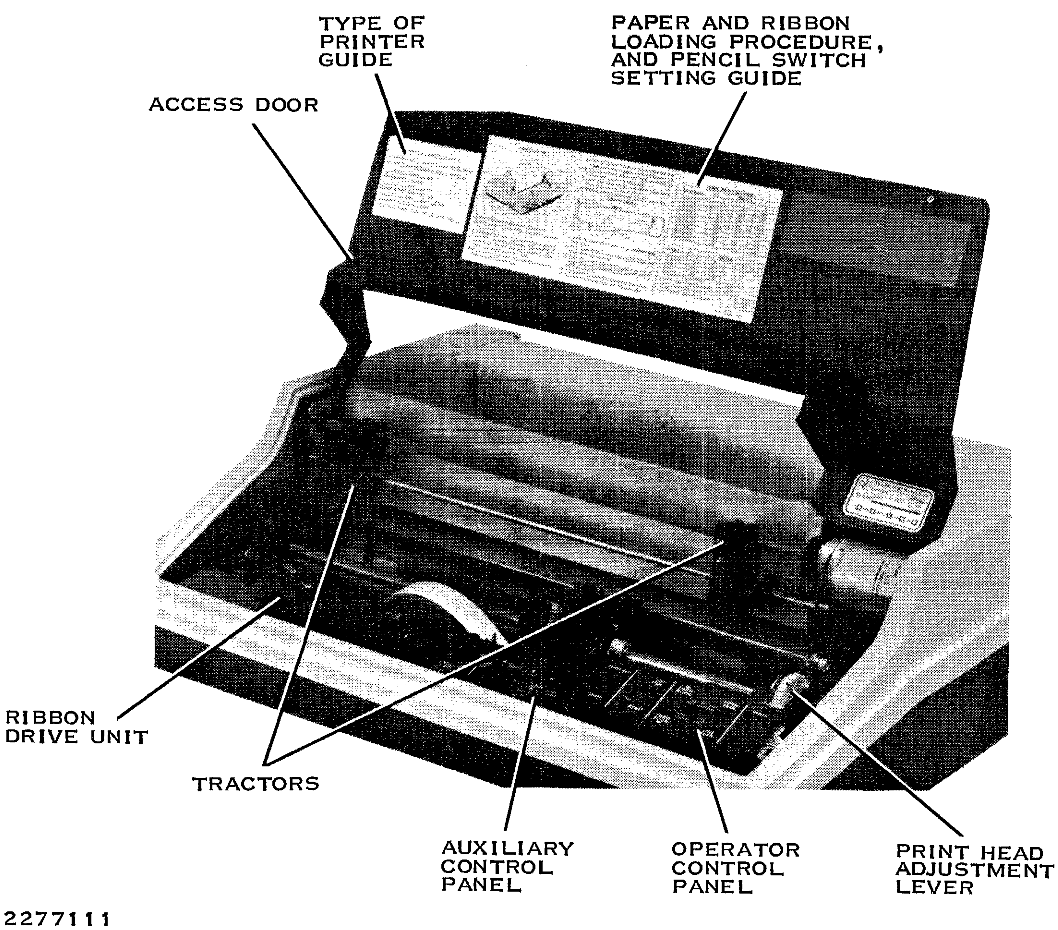

Figure S-2. Model 810 Printer Controls and Indicators

- RESET/TAB Switch
- FORM ALIGN (UP)/TAB SET Switch
- FORM ALIGN (DOWN)/TAB CLEAR Switch
- FORM FEED/SET TOP OF FORM Switch
- LINE FEED/LINE FEED Switch

The printer control panel locations are shown in Figure S-3. The operator control panel is shown in Figure S-4.

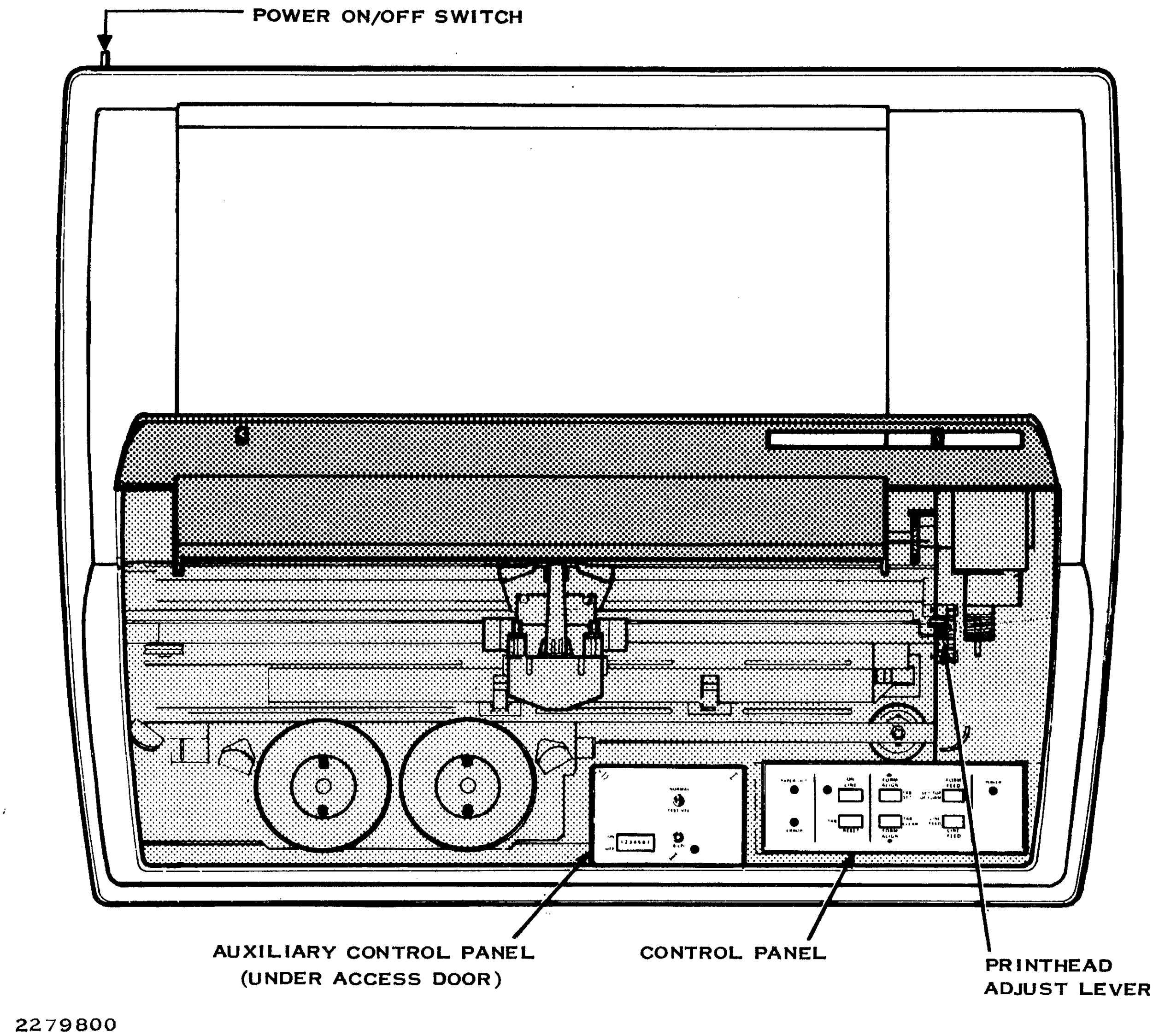

Figure S-3. Model 810 Printer Control Panel Locations

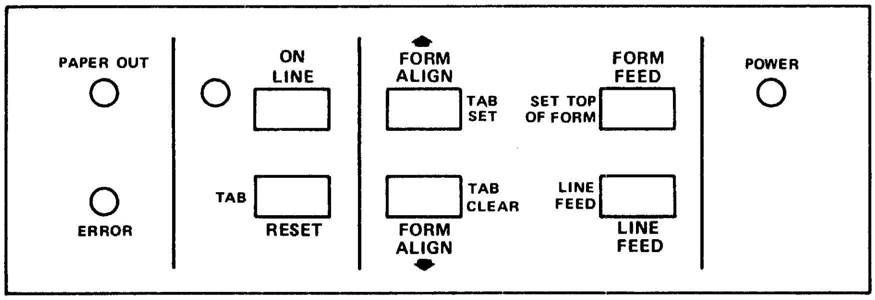

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Figure S-4. Model 810 Printer Operator Control Panel

POWER Indicator. The POWER indicator lights when power is applied to the printer.

PAPER OUT Indicator. The PAPER OUT indicator lights when the printer runs out of paper. The audible tone beeps five times. This indicator is cleared when paper is loaded and the RESET switch is pressed.

ERROR Indicator. The ERROR indicator is activated under two conditions:

1. It lights when a parity error is detected (and a special parity error indicator is printed).
2. It blinks when the printhead carriage runs into an obstacle. In this case, power to the printhead carriage motor is turned off and the audible tone beeps five times.

The ERROR indicator is cleared when the RESET switch is pressed.

ONLINE Switch and Indicator. Pressing this switch places the printer in the online condition. Pressing this switch a second time places the printer in the offline condition. The indicator lights to indicate an online condition that allows the printer to receive data from an external source.

RESET/TAB Switch. This switch repositions the printhead, clearing any out-of-paper or error conditions.

The alternate TAB function of this switch is active only in the vertical format control (VFC) mode (see the paragraph NORMAL-TEST/VFC Switch (BSC, FCO, VCO) in this appendix). When the TAB function is active, pressing the switch advances the paper to the next tab that has been set.

FORM ALIGN (Up) /TAB SET Switch. Pressing this switch causes the paper to move up .35 millimeter (1/72 inch). When the switch is held down, the paper moves in three small increments and then full line feeds are executed to accelerate paper movement. This switch is active when the printer is offline or online.

The alternate TAB SET function of this switch is active only in the vertical format control mode. When the TAB SET function is active, pressing this switch sets the vertical tab at the present line.

FORM ALIGN (Down)/TAB CLEAR Switch. Pressing this switch causes the paper to move down .35 millimeter (1/72 of an inch). While the switch is held down, the paper moves in small increments. This switch is active when the printer is either online or offline.

The alternate TAB CLEAR function of this switch is active only in the vertical format control mode. When the TAB CLEAR function is active, pressing this switch clears any vertical tab at the present line.

FORM FEED/SET TOP OF FORM Switch. Pressing this switch causes the paper to move to the top of the next form. Contents of the line buffer are printed before the paper is moved. This switch is active with the printer offline or online.

The alternate SET TOP OF FORM function of this switch is active only in the vertical format control mode. When active, pressing this switch sets the top-of-form or reads the FORM LENGTH switch setting.

LINE FEED/LINE FEED Switch. Pressing this switch moves the paper up one line. If the line buffer contains data, its contents are printed before the paper is moved. This switch is active only when the printer is offline. The normal and alternate functions of this switch are the same.

S.1.1.2 Auxiliary Control Panel Controls and Indicators. There are three versions of the auxiliary control panel:

Option Type	Configuration Code
Basic	BSC
Forms length and compressed print	FCO
Vertical format control and compressed print	VCO

These panels are shown Figure S-5. The following paragraphs describe control and indicator functions. Configuration codes (shown in parentheses) link each paragraph with the appropriate panel.

NORMAL-TEST/VFC Switch (BSC, FCO, VCO). In the NORMAL position, this switch enables normal operation of the printer. With this switch in the TEST/VFC position, pressing the ONLINE switch initiates a rotating character test pattern (barber pole). With this switch in the TEST/VFC position and the ONLINE indicator set to off, the alternate function switches TAB, TAB SET, TAB CLEAR, SET TOP OF FORM, and LINE FEED are enabled for vertical format control programming.

Pencil Switches (BSC, FCO, VCO). All auxiliary control panels have seven pencil switches. Switches 1, 2, and 3 are used to select baud rates of 110, 150, 300, 1200, 2400, 4800, or 9600 baud. Switches 4 and 5 are used to select odd, even, or ignore parity. Switch 6 activates the automatic line feed. Switch 7 activates the top of form automatic perforation skip. The automatic perforation skip causes the printer to skip three lines before printing the first line of the next form. Changes in pencil switch settings take effect when the printer goes online. Refer to the paragraphs Setting the Baud Rate and Setting Parity in this appendix for descriptions of how to set the pencil switches.

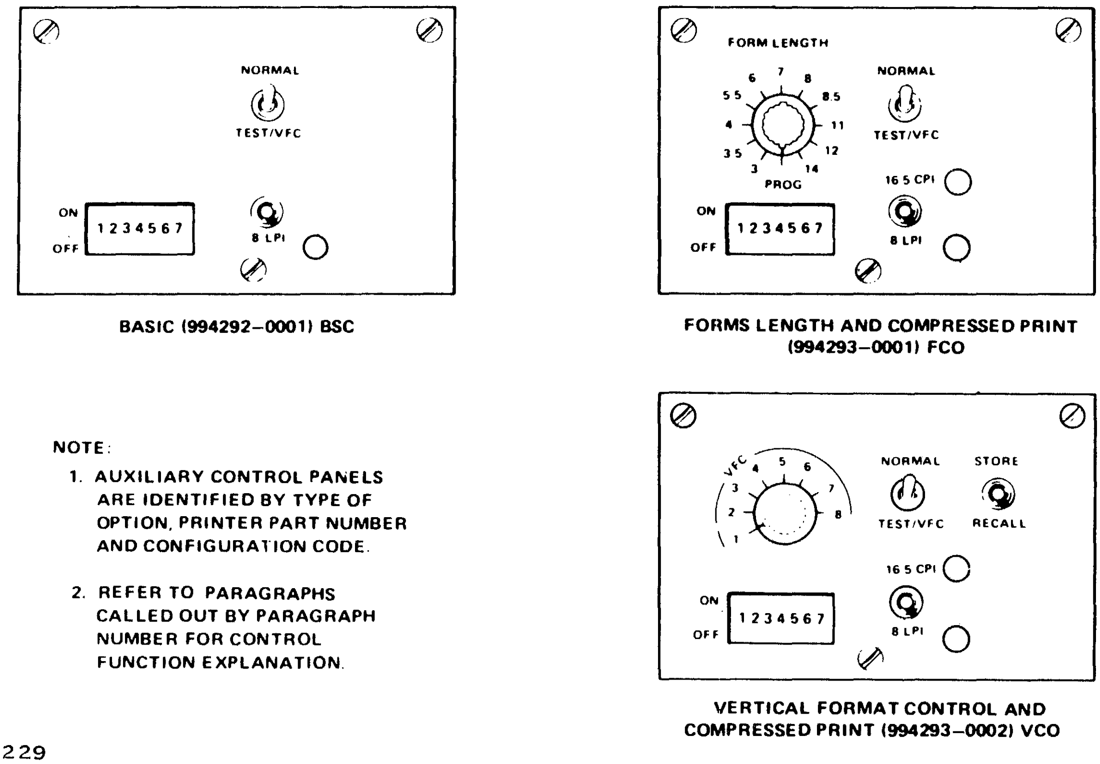

Figure S-5. Model 810 Printer Auxiliary Control Panel

LPI Switch and Indicator (BSC). In the 8 LPI position, this momentary three-position, center-off switch selects the 8 lines-per-inch mode. This mode is also software programmable through the communications interface. This indicator lights when the printer is in the 8 lines-per-inch mode. Reactivating this switch returns the printer to the 6 lines-per-inch mode.

FORM LENGTH Rotary Switch (FCO). The 12-position FORM LENGTH rotary switch allows the operator to select any one of the following 11 fixed form lengths:

7.5 centimeters (3 inches)
8.8 centimeters (3 1/2 inches)
10 centimeters (4 inches)
13.8 centimeters (5 1/2 inches)
15 centimeters (6 inches)
17.6 centimeters (7 inches)
20 centimeters (8 inches)
21.3 centimeters (8 1/2 inches)
27.6 centimeters (11 inches)
30 centimeters (12 inches)
35.2 centimeters (14 inches)

In the PROG position, this switch allows the operator to program form lengths from 4 to 112 lines. The method for programming form lengths is described in the paragraph Adjusting Form Length in this appendix.

VFC Rotary Switch (VCO). The eight-position vertical format control channel rotary switch selects one of eight vertical format programs. These eight channels are software programmable through the communications interface.

STORE/RECALL Switch (VCO). In the STORE position, this momentary, three-position, center-off switch stores manually programmed vertical tabs, form length, and lines-per-inch spacing in the selected VFC channel. In the RECALL position, the format program stored in the selected VFC channel is recalled into working memory. STORE and RECALL are active only in the vertical format control mode and both are software programmable through the communications interface.

16.5 CPI/8 LPI Switch and Indicators (FCO, VCO). In the 16.5 CPI position, this momentary three-position, center-off switch selects the 16.5 characters-per-inch compressed print mode. The 16.5 CPI indicator lights when the printer is in the compressed print mode. Setting this switch to the 16.5 CPI position a second time returns the printer to the standard 10 characters-per-inch print mode. The printhead initializes to the left margin each time a change is made between 10 and 16.5 characters per inch.

In the 8 LPI position, this switch selects the 8 lines-per-inch mode. The 8 LPI indicator lights when the printer is in the 8 lines-per-inch mode. Setting this switch to the 8 LPI position a second time returns the printer to the 6 lines-per-inch mode.

S.1.2 Loading Paper

The printer uses continuous form paper with standard feed holes on each edge. Paper widths from 7.62 to 38.1 centimeters (3 to 15 inches) can be accommodated. Paper may be loaded through the rear chute (path A) or bottom chute (path B) as shown in Figure S-6. Multiple-part forms, one original and up to five copies, can be printed. Weight specifications for paper are:

Single-part forms:

6.8- to 9.1-kilogram (15- to 20-pound paper)

Multiple-part forms:

Original — 5.4- to 6.8-kilogram (12- to 15-pound paper)

Copies — 4.1- to 5.4-kilogram (9- to 12-pound paper)

Last copy — 6.8-kilogram (15-pound paper)

Carbon paper:

3.4-kilogram (7 1/2-pound paper with medium hardness)

When using the bottom chute, card stock up to 0.1778 millimeter (0.007 inch) thick can be used as single-part or last copy only. In any case, it is recommended that total form thickness not exceed 0.533 millimeter (0.021 inch). To load paper, refer to Figure S-6 and proceed as follows:

NOTE

It is not necessary to turn the power off when loading paper.

1. If the ONLINE indicator is lit, press the ONLINE switch to take the printer offline.

2. Open the access door.

3. If the left paper-feed tractor is not locked in the desired position, loosen the lock knob, adjust the left paper-feed tractor to the desired position, and tighten the lock knob. The normal position is at the extreme left margin.

4. Open the doors on both paper-feed tractors.

5. Using the printhead lever, move the printhead away from the platen.

6. Load paper through the rear chute, Path A, as follows (or refer to step 7 for bottom loading):

   a. Place the paper supply behind the printer. If the printer is mounted on a table and the paper supply is placed on the floor, be sure the rear edge of the printer is located slightly over the edge of the table top to prevent the paper from catching on the edge of the table.

   b. Feed paper into the paper chute at the bottom rear of the printer (path A), printing side down, until the paper appears at the platen.

   c. Proceed to step 8.

7. Load the paper through the bottom chute, Path B, as follows:

   a. Align the printer bottom chute with the slot in the table.

   b. Place the paper supply under the table and align the paper path to prevent paper edges from rubbing against the table slot or ends of the bottom chute.

   c. Feed paper into the bottom chute of the printer (path B), printing side forward, until the paper appears at the platen.

8. Press the TOP OF FORM switch.

9. Loosen the lock knob on the right tractor and adjust the tractor as necessary to accommodate the paper.

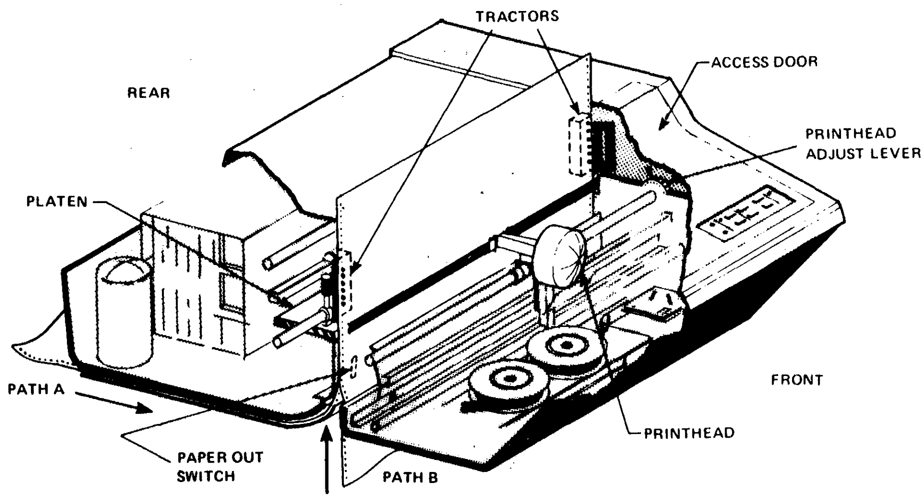

Figure S-6. Model 810 Printer Paper Loading Diagram

10. Place the top of a sheet of paper just above the printhead with the holes in the paper edges engaged in the corresponding tractor pins.

11. Close the tractor doors. Adjust the right tractor as necessary to remove any slack in the paper and tighten the lock knob. Paper must not rub the sides of the chute. Be sure that the PAPER OUT switch is covered by the paper.

12. Using the printhead lever, restore the printhead to its printing position.

13. Close the access door.

14. Place the printer online by pressing RESET and ONLINE.

S.1.3 Changing Ribbons

The printer uses a 13 centimeter (1/2-inch) wide nylon ribbon (TI part number 996241-0001 or equivalent) mounted on two 7.5 centimeter (3-inch) spools. To install the ribbon, refer to Figure S-7 and proceed as follows:

1. Using the printhead adjustment lever, move the printhead away from the platen.

2. Remove the old ribbon.

3. Place the ribbon spools on the spool hubs and feed the ribbon along the path shown.

4. Place the empty spool on the left spool hub with the feed-out side of the spool toward the front of the printer, and feed ribbon path as shown in Figure S-7.

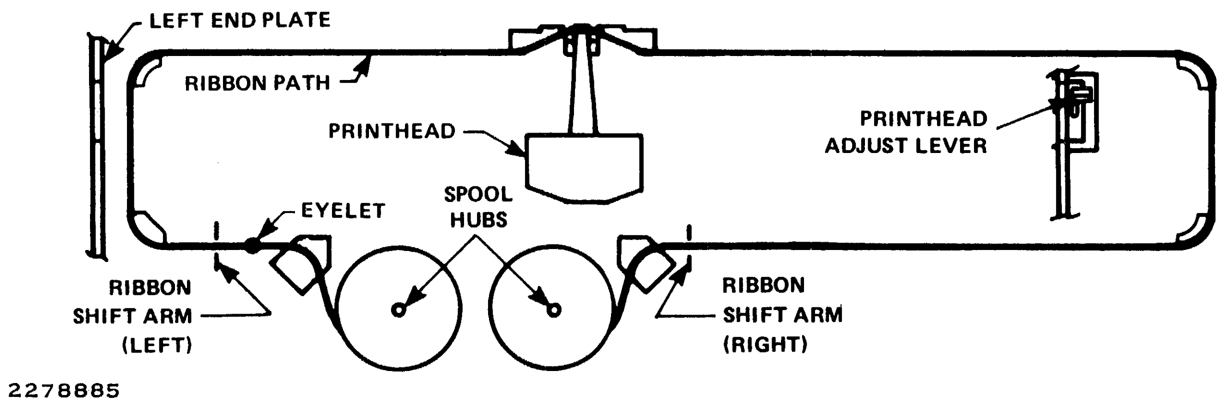

Figure S-7. Model 810 Printer Ribbon Installation Diagram

CAUTION

See that the ribbon eyelet is located on the side of the ribbon shift arm closest to the spool hub. Otherwise, the ribbon will not reverse. Also see that the ribbon is inside the left end-plate to prevent drag on the ribbon.

5. Place the full spool on the right spool hub and turn the hubs as necessary to remove slack from the ribbon.

6. See that the ribbon is centered in the slot on the right ribbon shift arm. If the ribbon is not centered, refer qualified personnel to the *Model 810 Printer Maintenance Manual* for adjustment instructions.

7. If the original printhead clearance is desired, return the printhead adjust lever to the position noted in step 1. Otherwise perform printhead adjustment as described in the paragraph Adjusting the Printhead in this appendix.

S.1.4 Turning On and Readying the Printer

Before placing the printer in service, perform the following steps:

1. Determine the printer configuration. This will be BSC, FCO, or VCO. See the configuration label on the underside of the access door or identify the printer by the type of auxiliary control panel installed.

2. Set the pencil switches to the following positions:

Switch	1	2	3	4	5	6	7
Position	On	Off	On	On	Off	On	On

This sets the standard conditions of 4800 baud rate and even parity.

3. See that the ribbon and paper are properly installed, as described in the paragraphs Loading Paper and Changing Ribbons in this appendix.

CAUTION

To prevent damage to the printhead, do not print without a ribbon or with the paper too narrow for the printed line width. If the full 132-character line is used, the paper must be at least 37.8 centimeters (14-7/8 inches) wide for the standard 10 characters-per-inch spacing and at least 21.3 centimeters (8-1/2 inches) wide for the optional 16.5 characters-per-inch compressed print spacing (FCO and VCO printers only).

4. Set the ON/OFF switch (located at the rear left of the printer) to ON.

5. Check that the control panel ONLINE indicator is off and that the printhead is at the left margin. At this point, the printer should have the following initial conditions:

Offline:	The printer is in an offline condition.
Form Length:	27.6 centimeters (11 inches) for BSC printer and FCO printer if the auxiliary control panel FORM LENGTH switch is in the PROG position. The FCO printer is set to any fixed form length selected on the FORM LENGTH switch. The VCO printer is set to the form of the last vertical format stored or recalled.
Line Spacing:	Six lines per inch for the BSC and FCO printers. The VCO printer is set to the line spacing of the last vertical format stored or recalled.
Character Spacing:	Ten characters per inch.
Horizontal Tabs:	All are cleared.
Vertical Tabs:	**All are cleared for the BSC and FCO printers. The VCO printer retains the vertical tab settings of the last vertical format stored or recalled.**
Line Counter:	**Set to zero, causing the present line location to be the first line of the form.**
Line Buffer:	Empty. All previous printable characters have been cleared.

This completes the turn-on procedure if the following are true:

- From the previous operation, the paper is aligned as desired and the printhead adjust lever is properly set.
- No changes to the above initial conditions are desired.
- The pencil switches for the baud rate, parity, automatic line feed override, and automatic perforation skip override have been previously set as desired.

S.1.5 Turning Off the Printer

To turn off the printer, set the ON/OFF switch (located at the rear left of the printer) to OFF. Remember that when power is again applied, the printer returns to the initial conditions set for the configuration. (See the paragraph Turning On and Readying the Printer in this appendix.) If conditions other than these are to be retained, they must be noted and reentered in the printer when power is again applied.

S.1.6 Changing Initial Conditions

To change the initial printer conditions, the operator may adjust the following:

- Top-of-form
- Clearance
- Number of lines per inch
- Number of characters per inch
- Automatic line feed
- Automatic perforation skip
- Vertical tab setting
- Form length
- Baud rate
- Parity

The procedures for changing these conditions are described in the paragraphs that follow.

S.1.6.1 Adjusting Top-of-Form. With the power on, set the top-of-form as follows:

1. Align top of form.
2. Set NORMAL-TEST/VFC switch to TEST/VFC.
3. Press the SET TOP OF FORM switch.
4. Press the LINE FEED switch until the next top-of-form arrives at the printhead.

5. Press the SET TOP OF FORM switch.

6. Reset the NORMAL-TEST/VFC switch to NORMAL.

S.1.6.2 Adjusting the Printhead. The printhead of the 810 printer can be adjusted to accommodate the thickness of the paper by moving the printhead adjustment lever toward the front of the printer for multiple copies or toward the back of the printer for single copies. The adjustment must be made with the power on as follows:

1. Open the access door.

2. Move the printhead adjustment lever (see Figure S-7) slightly to the right and slide it toward the front of the printer.

3. Check that the ribbon and paper are installed. (See paragraph Changing Ribbons and Loading Paper in this appendix). The printhead adjustment can be made while the printer is online and data is being printed or while the self-test pattern (barber pole) is being printed.

4. If the barber pole method is used, set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

5. Press the control panel ONLINE switch to start the printing.

6. Print a series of characters and observe the results. If the characters are not fully formed or appear too light, move the printhead adjustment lever toward the rear of the printer until the print quality is satisfactory. If smudging occurs, the printhead is too close; move the printhead adjustment lever toward the front of the printer.

7. When the adjustment is completed, return the NORMAL-TEST/VFC switch to NORMAL and press the ONLINE switch.

8. Close the access door.

S.1.6.3 Adjusting Lines-per-Inch Spacing. To set the 8 lines-per-inch spacing, proceed as follows with the power on:

1. Open the access door.

2. Momentarily set auxiliary control panel 8 LPI/16.5 CPI switch to 8 LPI.

3. See that the 8 LPI indicator lights.

4. Close the access door.

To return to the 6 lines-per-inch spacing (initial condition), repeat the procedure above, except see that the 8 LPI indicator goes out.

S.1.6.4 Adjusting Characters-per-Inch Spacing (FCO, VCO). For 16.5 characters-per-inch (compressed print) spacing, perform the following procedure:

1. See that the power is on.
2. Open the access door.
3. Momentarily set the auxiliary control panel 8 LPI/16.5 CPI switch to 16.5 CPI.
4. See that the 16.5 CPI indicator lights before the next line is printed.
5. Close the access door.

To return to the 10 characters-per-inch spacing (initial condition) repeat the above procedure, except see that the 16.5 CPI indicator goes out before the next line is printed.

S.1.6.5 Adjusting Automatic Line Feed. Open the access door and set the auxiliary control panel pencil switch 6 to OFF for automatic line feed or to ON for no automatic line feed. Close the access door.

S.1.6.6 Adjusting Automatic Perforation Skip. Open the access door and set the auxiliary control panel pencil switch 7 to OFF for automatic (three-line) perforation skip or to ON for no automatic perforation skip. Close the access door.

S.1.6.7 Adjusting Vertical Tab Settings. All printers have a working memory in which vertical tabs can be set and retained as long as the power is on. With the power on, set the vertical tabs as follows:

1. Align the top-of-form.
2. Open the access door.
3. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.
4. Press the control panel LINE FEED switch until the line where the tab is to be set arrives at the printhead.
5. Press the control panel TAB SET switch.
6. Repeat steps 4 and 5 as necessary to set all tabs wanted.
7. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.
8. Press the control panel FORM FEED switch.

9. Verify the tab settings as follows:

   a. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

   b. Press the control panel TAB switch and see whether the desired tab-set line is at the printhead. If not, press the control panel TAB CLEAR switch. This clears the unwanted tab from working memory.

   c. Repeat step b as necessary until all the desired tabs are set.

   d. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.

10. Close the access door.

S.1.6.8 Clearing Vertical Tab Settings. All printers have a working memory where vertical tabs settings are retained while the power is on. With the power on, these tabs can be cleared as follows:

1. Press the FORM FEED switch.

2. Open the access door.

3. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

4. Press the control panel TAB switch.

5. If the tab at the line location is to be cleared, press the control panel TAB CLEAR switch. If not, press the control panel TAB switch.

6. Repeat step 5 as necessary to clear all unwanted tabs.

7. When the top of the next form is reached, set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.

8. Close the access door.

For the BSC and FCO printers, all vertical tabs can be simultaneously cleared by turning the power off. This returns these printers to their initial conditions when the power is turned on again.

S.1.6.9 Adjusting Fixed Form Length Selection (FCO). On the FCO printer, the operator can select any of 11 fixed form lengths. Selecting a fixed form length clears any previous form length regardless of whether it was set by the operator or by software. With power on, select a fixed form length as follows:

1. If the form is not aligned as desired, perform the top-of-form alignment.

2. Open the access door.

3. Set the auxiliary control NORMAL-TEST/VFC switch to TEST/VFC.

4. Set the auxiliary control panel FORM LENGTH rotary switch to the desired fixed form length position.

5. Press the control panel SET TOP OF FORM switch.

6. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.

7. Close the access door.

S.1.6.10 Adjusting Form Length (FCO). On the FCO printer the operator can program any form length from 4 to 112 lines. Programming the form length clears any previous form length regardless of whether it was set by the operator or by software. With the power on, program the form length as follows:

1. If the form is not aligned as desired, perform the top-of-form alignment.

2. Open the access door.

3. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

4. Set the auxiliary control panel FORM LENGTH rotary switch to PROG.

5. Press the control panel SET TOP OF FORM switch. This sets the line counter to zero.

6. Press the control panel LINE FEED switch until the next form is aligned as desired.

7. Press the control panel SET TOP OF FORM switch.

8. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL. This sets the form length.

9. Close the access door.

S.1.6.11 Storing Vertical Format (VCO). The VCO printer has a special vertical format control that can store a different vertical format in each channel of an eight-channel memory. Vertical formats can be stored by the operator or by software. The vertical format information that can be stored consists of the form length, the vertical tab locations, and the lines-per-inch spacing. The stored vertical formats are retained even with the printer power off. With the power on, a vertical format is first entered into working memory and then stored as follows:

1. If the form is not aligned as desired, perform the top-of-form alignment.

2. Open the access door.

3. Set the auxiliary control panel VFC rotary switch to the desired channel position.

4. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

5. If 8 lines-per-inch spacing is desired, momentarily set the auxiliary control panel 8 LPI/16.5 CPI switch to 8 LPI and see that the 8 LPI indicator lights.

6. Press the control panel SET TOP OF FORM switch. This sets the line counter to zero and marks the top of the form.

7. Press the control panel LINE FEED switch until the line to be tab-set is at the printhead.

8. Press the control panel TAB SET switch.

9. Repeat steps 7 and 8 as necessary to set all desired tabs.

10. Press the control panel LINE FEED switch until the next form is aligned as desired.

11. Press the control panel SET TOP OF FORM switch; this sets the line counter to zero and marks the top of the form.

12. Momentarily set the auxiliary control panel STORE/RECALL switch to STORE.

13. Verify the vertical format as follows:

    a. Press the control panel TAB switch and see that the desired line is at the printhead. If the desired line is not at the printhead, press the control panel TAB CLEAR switch. This clears the unwanted tab from memory.

    b. Repeat step a as necessary to verify that only desired tabs are set.

    c. After the last desired tab has been verified, again press the control panel TAB switch and see that the perforation of the next form aligns correctly. If not, press the control panel TAB CLEAR switch.

14. Momentarily set the auxiliary control panel STORE/RECALL switch to STORE.

15. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.

16. Close the access door.

S.1.6.12 Recalling Vertical Format (VCO). The VCO printer has a special vertical format control that allows previously stored vertical formats to be recalled into the working memory by the operator or by software. With the power on, a vertical format in any one of the eight channels of memory can be recalled into the working memory by the operator as follows:

1. If the form is not aligned as desired, perform the top-of-form alignment.

2. Open the access door.

3. Set the auxiliary control panel VFC rotary switch to the desired channel.

4. Set the auxiliary control panel NORMAL-TEST/VFC switch to TEST/VFC.

5. Momentarily set the auxiliary control panel STORE/RECALL switch to RECALL.

6. Set the auxiliary control panel NORMAL-TEST/VFC switch to NORMAL.

7. Close the access door.

S.1.6.13 Setting the Baud Rate. To set the baud rate, perform the following:

1. Open the access door.

2. Using a ball-point pen or similar device, set the auxiliary control panel switches 1, 2, and 3 for baud rates as follows:

Baud Rate	Pencil Switches 1	2	3
110	OFF	OFF	OFF
150	ON	OFF	OFF
300	OFF	ON	OFF
1200	ON	ON	OFF
2400	OFF	OFF	ON
4800 (Standard)	ON	OFF	ON
9600	OFF	ON	ON
Parallel (Unused)	ON	ON	ON

3. Close the access door.

S.1.6.14 Setting Parity. To set parity, perform the following:

1. Open the access door.

2. Set the auxiliary control panel pencil switch for parity as follows:

Parity	Pencil Switches 4	5
Ignore Parity	OFF	OFF
Odd Parity	ON	ON
Even Parity (Standard)	ON	OFF

3. Close the access door.

S.1.7 Common Operator Problems

The following list of symptoms and recommended actions solves many common operator problems:

Symptom	Possible Actions
The PAPER OUT indicator lights and the audible alarm beeps five times. The printer stops.	The printer is out of paper. While the PAPER OUT indicator is on, the printer prints a line each time the operator presses RESET. Press RESET until form (page) is finished, load the new form into the printer, and press RESET to resume printing.
The ERROR indicator blinks and the audible alarm beeps five times. The printer stops.	A paper jam or another obstruction blocks the printhead so it cannot move. Remove the obstruction and press RESET to resume printing.
A file is not printed.	• The printer is not ready that it is both ONLINE and READY. • The file pathname does not exist. See that the pathname is valid by entering a Show File (SF) command for the pathname in question.

Appendix T

Model 850 Printer

T.1 GENERAL INFORMATION

This appendix describes the operation of the Model 850 Line Printer shown Figure T-1. For further information see the *Model 850 Printer User's Manual* and the *Model 850/851 Printer Maintenance Manual*. This printer is a low-cost, high-performance, impact printer with the following features:

- 150 characters-per-second (cps) bidirectional printing
- 9 by 9 dot matrix characters with true descenders
- 15 by 9 dot matrix enhanced print
- Mosaic graphics
- Raster graphics
- Friction feed with optional paper-roll holder
- Optional adjustable-width tractor feed with stacking tray for fanfold paper
- Parallel or serial interface
- 256-character receive buffer
- Optional 4000-character receive buffer

T.2 CONTROLS AND INDICATORS

The printer has physical controls and indicators to place the printer in various modes of operation. Some controls are located on the operator control panel and some inside the printer. Light emitting diodes (LEDs) on the operator control panel indicate the status or mode of the printer.

T.2.1 Controls

The printer has two sets of hardware controls. The most often used are on the operator panel; those used less frequently are located on the printed wiring board under the front cover.

T.2.1.1 Operator Panel Controls. The operator panel contains four touch-sensitive membrane controls for operator-controlled functions. These controls are ONLINE/OFFLINE, FORM FEED, LINE FEED, and SLF. Figure T-2 shows the location of the controls.

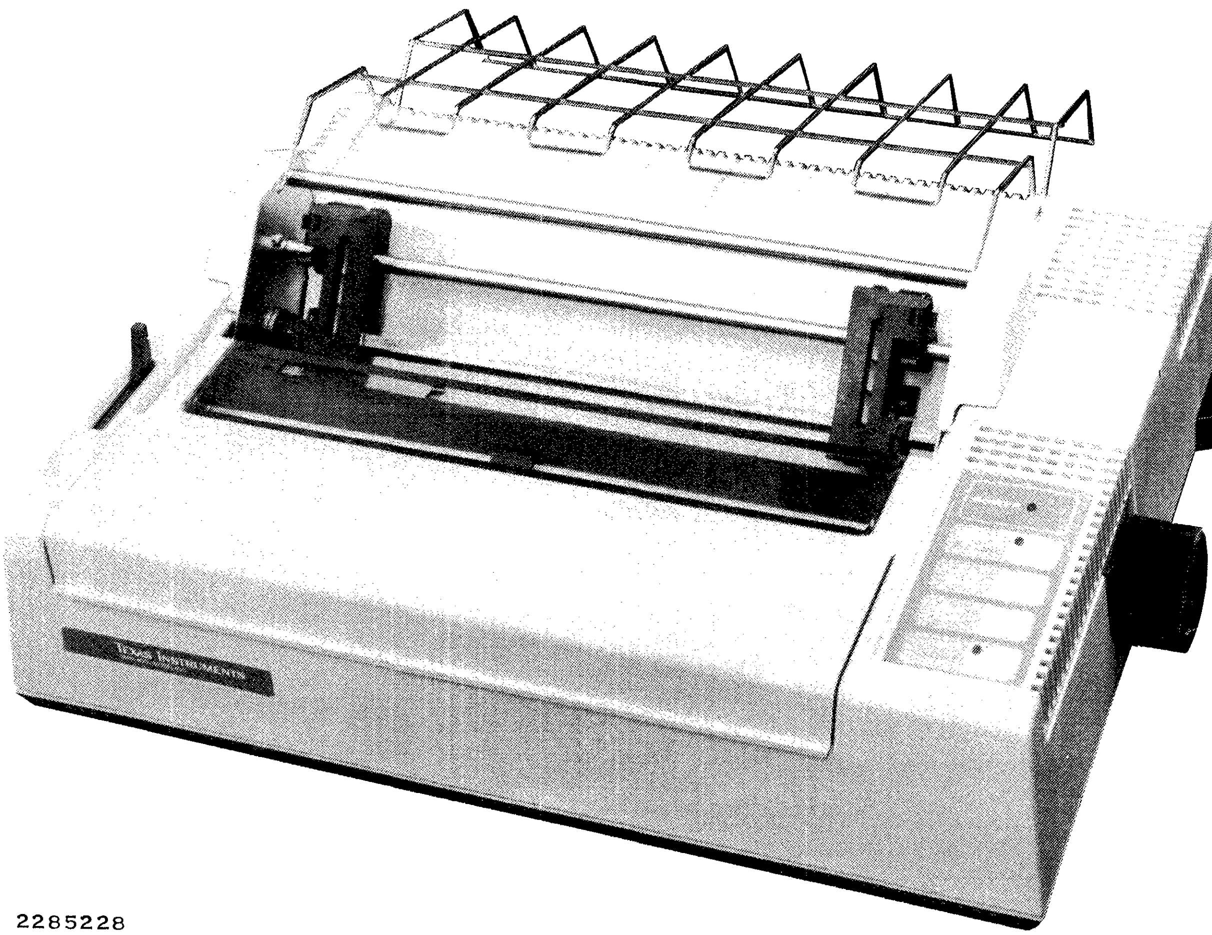

Figure T-1. Model 850 Printer

ONLINE/OFFLINE. This control switches the printer between online and offline; when online, the ONLINE LED lights. Pressing this control while online puts the printer in the offline condition and causes any remaining data in the receive buffer to be printed. Pressing this control also resets the printer when an error condition has been corrected.

FORM FEED. Pressing this control (regardless of whether the printer is online or offline) causes the printer to execute a form feed as soon as it is able; the form feed executes when the line being printed is completed. During error conditions and the set forms length mode this control is inoperative.

LINE FEED. This control is operative only in the offline and set forms length modes. In the offline mode, the printer executes a single line feed each time the control is pressed. In the set forms length mode, pressing this control sets the length of the form; the number of times the control is pressed establishes the form length.

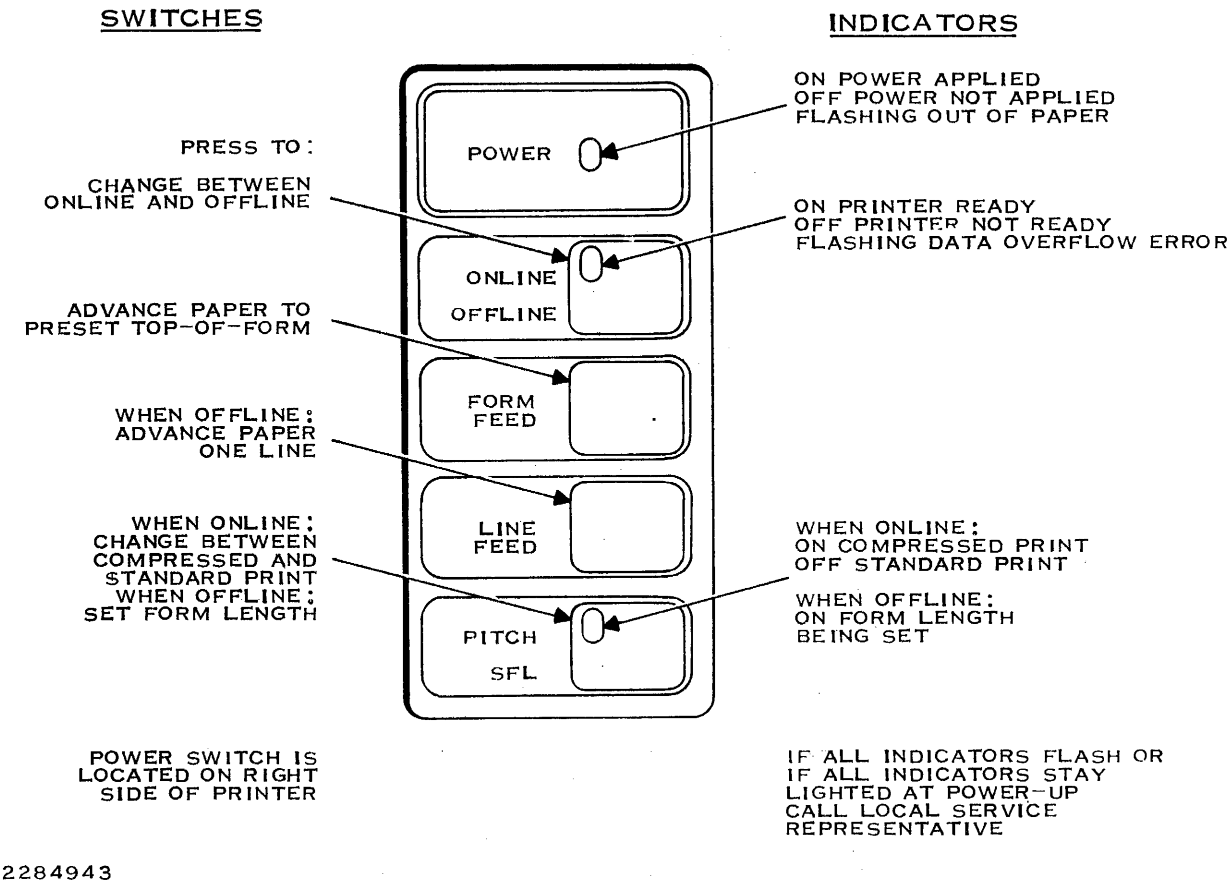

Figure T-2. Model 850 Operator Control Panel

SFL. Pressing this control while the printer is offline puts the printer in the set forms length (SFL) mode; pressing the control a second time exits the SFL mode. Pressing the LINE FEED control while in the SFL mode enters the form length in the printer memory. A zero length form is not allowed. If the operator accidentally presses the SFL control, the SFL mode can be nullified by immediately pressing the SFL control again before pressing any other control; the form length already in memory will not be altered.

This control is also used in a special power-up test. (See the Power-Up Tests paragraph in this appendix.)

T.2.1.2 Internal Set-up Controls. The printer has eight internal set-up controls for configuring the printer to various applications. These controls are located under the front cover directly below the carriage on the printed wiring board. These controls select seven or eight-bit characters, automatic line feeds, character set, baud rate, and interface.

Figure T-3 shows the internal set-up controls. Controls 2, 3, 4, and 5 are turned on; the rest are turned off.

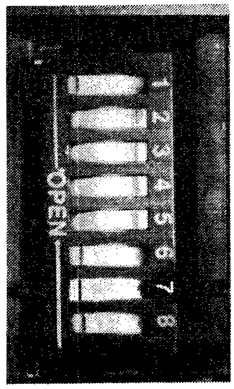

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Figure T-3. Model 850 Printer Internal Set-up Controls

Turn the power off before changing the setting of these controls. The printer reads the setting of these controls when power is turned on; if the settings are changed, the printer will ignore the change until the power is turned off and on again.

Seven- or Eight-Bit Character Selection. Control number one determines whether the printer recognizes seven or eight-bit character codes. If the control in the ON position, the printer recognizes eight-bit character codes. When the control is off, the printer recognizes seven-bit character codes; the eighth bit is still received but the printer ignores it.

Automatic Line Feed Selection. Control number two determines whether or not the printer performs an automatic line feed when a carriage return is received. An automatic line feed is executed everytime a carriage return is received when this control is in the ON position.

Character Set Selection. Controls three, four, and five select the character set the printer produces. Table T-1 shows the control settings for each character set. The national character sets are shown in appendixes in the *Model 850 Printer User's Manual* and the *Model 850/851 Printer Maintenance Manual.*

Table T-1. Model 850 Character Set Selection

Control 3	Control 4	Control 5	Character Set
Off	Off	Off	United States
On	Off	Off	United Kingdom
Off	On	Off	French
On	On	Off	German
Off	Off	On	Danish/Norwegian
On	Off	On	Swedish/Finnish
Off	On	On	Spanish
On	On	On	Swiss

Baud Rate and Interface Selection. Controls six, seven, and eight select the baud rate and interface port the printer uses. Table T-2 shows the control settings for each selection.

Table T-2. Model 850 Baud Rate and Interface Selection

Control 6	7	8	Selection
Off	Off	Off	200 Baud
On	Off	Off	300 Baud
Off	On	Off	600 Baud
On	On	Off	1200 Baud
Off	Off	On	2400 Baud
On	Off	On	4800 Baud
Off	On	On	9600 Baud
On	On	On	Parallel Port

Recommended Settings. Use the following settings (shown in Table T-3) with Business System computers:

Table T-3. Model 850 Recommended Internal Set-up Switch Settings

Control	Setting	Meaning
1	Off	7-Bit Data
2	Off	No Automatic Linefeed
3–5	On	Set according to Table T-2
6	On	4800 Baud
7	Off	4800 Baud
8	On	4800 Baud

T.2.2 Indicators

The operator panel shown in Figure T-3 has three LEDs that indicate the operating condition of the printer. Table T-4 lists the operating modes and the corresponding condition of the LEDs.

Table T-4. Model 850 Operator Panel LED Indications

Mode	Power LED	ONLINE LED	PITCH/SFL LED
Offline	On	Off	Off
Online	On	On	On or Off
Set Forms	On	Off	Off
Error Paper Out	Flashing	Off	On or Off
Error Buffer Overflow	On	Flashing	On or Off
Error Power Unsafe	Flashing	Flashing	Flashing

NOTE

The printer performs a self-test when powered up, and all three LEDs will light. After these tests complete, the LEDs light according to the printer configuration. All LEDs remaining lit could indicate an error condition (such as self-test incomplete) or a valid configuration (such as power on, online, or compressed print).

T.2.2.1 POWER LED. The POWER LED lights when power is turned on; it also flashes under certain error conditions.

T.2.2.2 ONLINE LED. The ONLINE LED indicates the printer is online; it also flashes under certain error conditions.

T.2.2.3 PITCH/SFL LED. The PITCH/SLF LED lights when the printer is online and compressed print (16.7 characters per inch) is active. When this LED is not lighted, the printer is in the standard pitch mode (10 characters per inch). If the printer is offline, this LED lights when the printer is in the set forms length (SFL) mode. Under certain error conditions the LED also flashes.

T.3 POWER-UP TESTS

When the printer is turned on, various tests are performed automatically to verify memory and functions. The printer loads a default forms set into memory; the default set has the following parameters:

- Six lines per inch vertical spacing
- 10 characters per inch horizonal spacing
- 66-line form length — 27.9 centimeter (11 inches)
- Left margin at column one
- Right margin at column 80
- Top margin at line one
- Bottom margin at line 66
- No horizonal tabs defined
- No vertical tabs defined
- Primary character set is United States ASCII
- Secondary character set is mosaic graphics

After successfully completing the self tests and loading this default set, the printer places itself online.

The operator can also perform the power-up barberpole test. This is a special mode the printer can be placed in only when the power is first turned on. To perform this test, press and hold the SFL control, then turn the power on. Hold the SFL control down until the barberpole pattern begins printing. While in this test mode the POWER LED is on, the ONLINE LED is off, and the SFL LED flashes. Figure T-4 shows an example of the barberpole pattern test. The barberpole pattern will continue to print until the test mode is terminated. To exit this mode, press the ONLINE/OFFLINE control; this stops the test and puts the printer online.

```
+,-./0123456789:;<=>?@ABCDEFGHIJKLM
,-./0123456789:;<=>?@ABCDEFGHIJKLMN
-./0123456789:;<=>?@ABCDEFGHIJKLMNO
./0123456789:;<=>?@ABCDEFGHIJKLMNOP
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
0123456789:;<=>?@ABCDEFGHIJKLMNOPQR
123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
23456789:;<=>?@ABCDEFGHIJKLMNOPQRST
3456789:;<=>?@ABCDEFGHIJKLMNOPQRSTV
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTVW
```

Figure T-4. Model 850 Barberpole Test Pattern

T.4 GRAPHICS CHARACTER SETS

The printer can use eight national character sets (see the Character Set Selection paragraph in this appendix) and two graphics sets. The graphics are the mosaic and raster sets. Mosaic graphics produces a pattern by printing groups of dots in a squared off pattern six dots wide by 12 dots high. Raster graphics print a dot anywhere on the print area of a page.

T.4.1 Mosaic Graphics

The printer uses hexadecimal codes >A0 through >DF (decimal 160 through 223) for the mosaic graphics set. A mosaic graphics character is composed of cells of dots three dots wide by four dots high; each character can have as many as six cells or as few as none. The mosaic character occupies the same space on a page as any of the normal printable characters.

T.4.2 Raster Graphics

Raster graphics prints a single vertical column of dots using the top eight needles in the print head. (The printhead is a vertical arrangement of nine needles. Only the top eight needles are used for printing.) As the print head moves horizonally across the paper, each dot can be printed singly or in any combination. Using this mode, a single dot or any pattern of dots can be printed anywhere on the page. Raster graphics also allows mixing of type fonts and graphics. Special ASCII character codes must be sent to the printer from the host to use raster graphics. See the *Model 850 Printer User's Manual* for more detailed information.

T.5 TYPEFACES

Two typefaces or fonts can be used — standard and enhanced. Both fonts can be modified to emphasize words or phrases.

T.5.1 Standard

Standard font prints 10 characters per inch by six lines per inch.

T.5.2 Enhanced

Enhanced font prints 10 characters per inch by six lines per inch. Enhanced characters have serifs; otherwise they are the same as standard characters.

T.5.3 Font Modifiers
Fonts can be modified by compressed, double-wide, double-strike, and emphasized printing.

T.5.3.1 Compressed Printing. Compressed printing produces 16.7 characters per inch by eight lines per inch.

T.5.3.2 Double-wide Printing. Double-wide characters are twice as wide as the normal character. Double-wide printing produces five characters per inch for standard and enhanced, and 8.33 characters per inch for compressed double-wide printing. Double-wide printing can be used with any font.

T.5.3.3 Double-Strike Printing. Double-strike characters are printed once, then the print head prints the character a second time. In essence this produces darker characters.

T.5.3.4 Emphasized Printing. The printer produces emphasized characters by printing a line in the selected font, advancing the paper one-half a dot width, then printing the emphasized characters again. These characters have less spacing between dots and closely resemble letter-quality printing. Emphasized printing can be used with any font.

T.6 SET-UP AND OPERATION

The following paragraphs discuss the ribbon cartridge installation, paper loading, paper handling accessories, and adjusting for forms thickness.

T.6.1 Ribbon Cartridge Installation
Follow these steps to install the printer ribbon. See Figure T-5.

1. If the power cord is connected, disconnect it.
2. Set the power control to off.
3. Move the printhead away from the platen with the printhead adjustment lever.
4. Manually slide the printhead to the center of the platen.
5. Holding the ribbon cartridge by the ends, insert the ribbon between the printhead nose and the ribbon guides.
6. Tilt the cartridge backward and insert the pins on each side of the cartridge arms into the hooks on the printer frame.
7. Press the front of the cartridge down gently until it snaps into position. If any resistance is felt on the left side, rotate the ribbon adjustment knob in the direction of the arrow.
8. Slide the printhead from side to side to ensure the ribbon is smooth across the face of the printhead.
9. Move the printhead adjustment lever to the middle notch. More precise adjustment is covered in the Forms Thickness paragraph in this appendix.

10. Remove any slack from the ribbon by rotating the ribbon adjustment knob in the direction of the arrow.

11. Ensure the ribbon moves freely.

T.6.2 Paper Loading

The printer can use single sheet, fanfold and roll paper.

CAUTION

Do not use the printer without paper; this can damage the printhead and the platen.

T.6.2.1 Single-Sheet Paper. Single-sheet paper is loaded into the printer in the same manner as loading a typewriter. Move the paper release lever (see Figure T-5 — toward the front of the printer). Insert and align the paper, then move the paper release toward the rear of the printer.

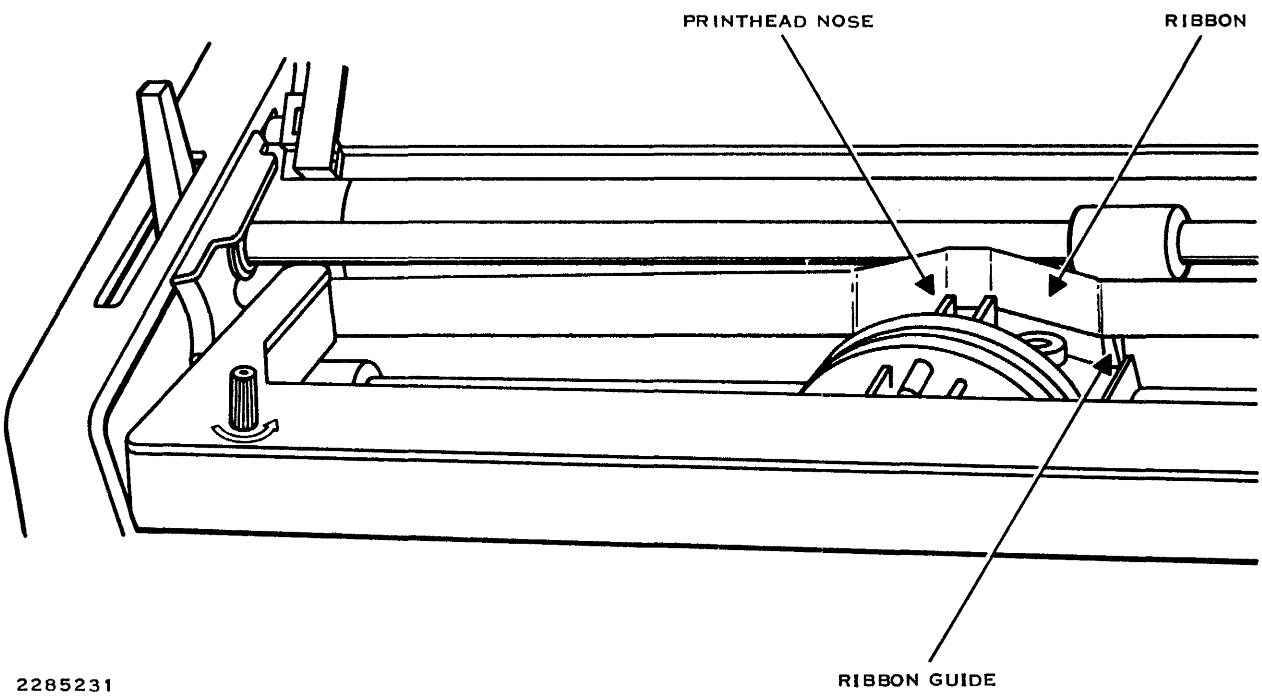

Figure T-5. Model 850 Ribbon Installation

T.6.2.2 Roll Paper. The optional paper-roll holder is required to use roll paper. The holder accepts paper rolls 76 to 254 mm (3 to 10 inches) wide and up to 127 mm (5 inches) in diameter.

Follow these steps while referring to Figure T-6 to load roll paper in the printer:

1. Move the paper release lever toward the front of the printer.
2. Feed the paper from the bottom of the roll over the top of the tension bar and between the top of the printer and the separator.
3. Slide the paper under the platen until it is between the platen and the printhead, and under the guide rollers.
4. Move the paper release lever to the rearmost position.
5. Rotate the paper advance knob until the paper clears the top opening of the printer.
6. Tear off excess paper by grasping the top of the paper at either corner and pulling the paper against the tear bar. The tear bar is the serrated edge of the window in the access door.

T.6.2.3 Fanfold. The optional tractor drive assembly is required to use fanfold paper in the printer.

Follow these steps while referring to Figure T-7 to load fanfold paper:

1. Move the paper release lever to the front of the printer.
2. Open the tractor covers.
3. Place the box or stack of fanfold paper behind and beneath the printer and aligned with the printer's platen.

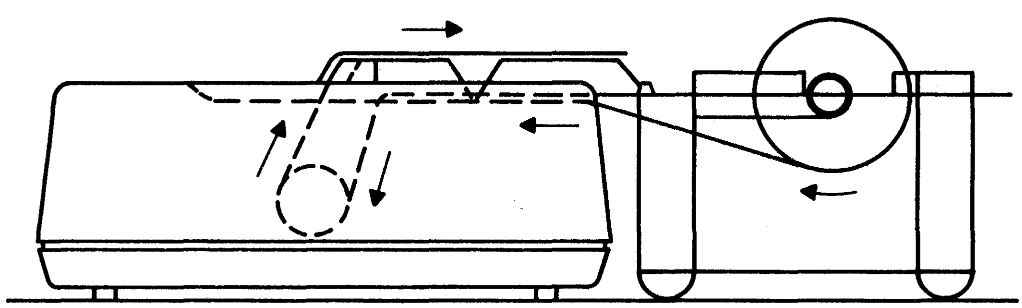

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Figure T-6. Model 850 Roll Paper Path

4. Adjust the distance between the tractors to match the paper width as follows:

NOTE

The left tractor must be positioned far enough to the left for the paper-out detector to operate.

   a. Rotate the tractor locking lever upward and adjust the left tractor left or right as necessary.

   b. Rotate the locking lever downward.

   c. Adjust the right tractor to the proper width in the same way the left tractor was adjusted. The holes in the paper must fit on the drive pins in the tractors.

5. Place the paper over the tractor drive pins and close the covers.

6. Adjust the paper position so the paper feeds straight.

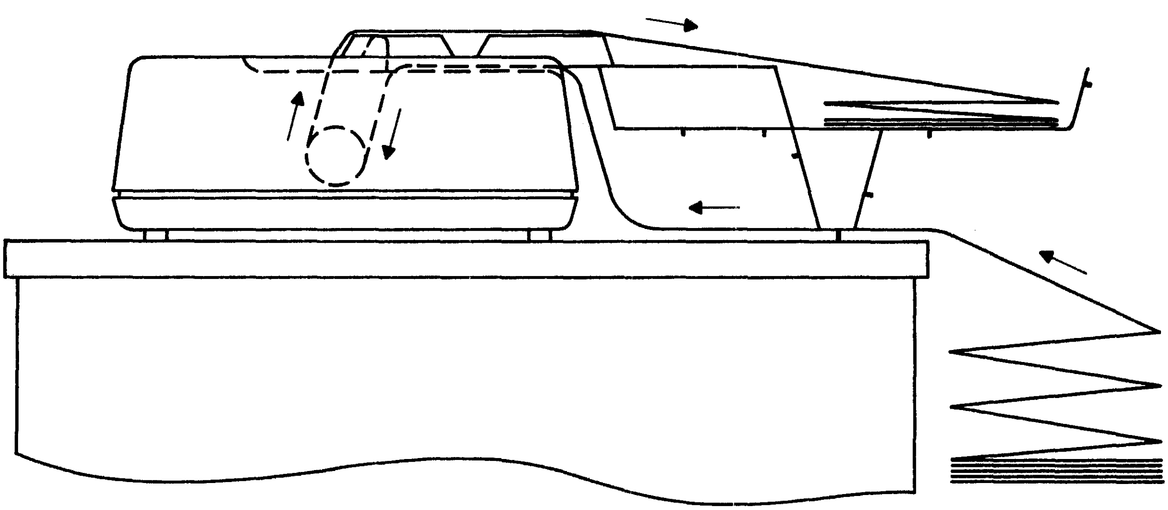

Figure T-7. Model 850 Fanfold Paper Path

T.6.3 Forms Thickness

The printhead can be adjusted to accommodate various thickness of forms, including multicopy forms. Adjustments should be made after the forms have been installed.

CAUTION

Never adjust the printhead while it or the platen is moving. This could damage the printhead.

To adjust the forms thickness, move the printhead adjustment lever (see Figure T-8) toward the platen for single thicknesses and away from the platen for multiple thicknesses. If the printhead is smudging the paper or dragging against the paper, adjust the printhead away from the paper.

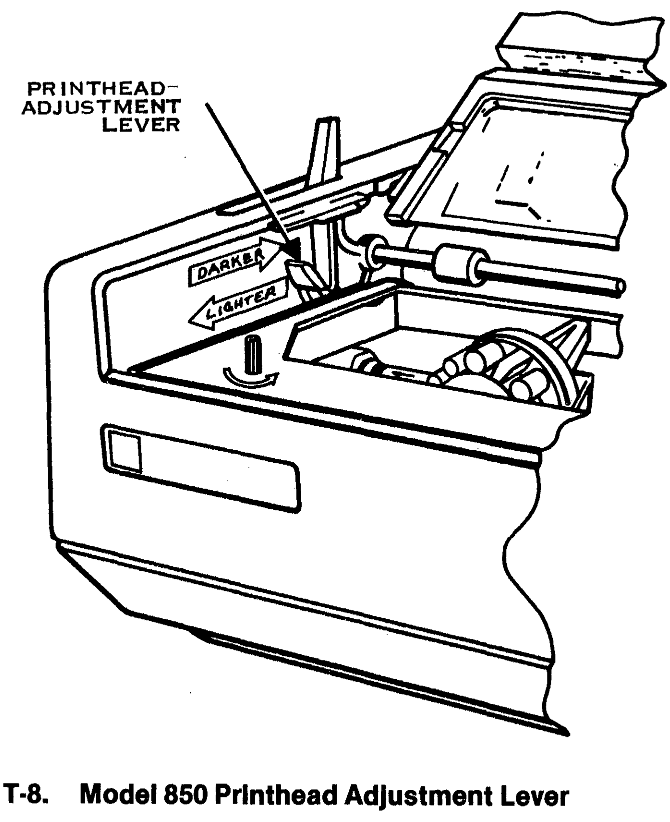

Figure T-8. Model 850 Printhead Adjustment Lever

Appendix U

Model 855 Printer

U.1 GENERAL INFORMATION

This appendix describes the operation of the Model 855 Printer shown in Figure U-1. For further information see the *Model 855 Printer User's Manual*, the *Model 855 Technical Reference Manual*, and the *Model 855/856 Printer Maintenance Manual*. The printer is a low-cost, high-performance, impact printer with the following features:

- Bidirectional printing
  - 150 characters-per-second (cps) for draft quality printing
  - 40 cps for letter quality printing
- Letter quality output — 32 by 18 or 24 by 18 dot matrix, depending on the font module used
- Dot matrix characters with true descenders — 7 by 9 or 9 by 9 matrix depending on the font module used
- Interchangeable font modules
- Mosaic graphics
- Raster graphics
- Friction feed with optional paper-roll holder
- Optional adjustable-width tractor feed with stacking tray for fanfold paper
- Parallel or serial interface
- Parity selection to match your system

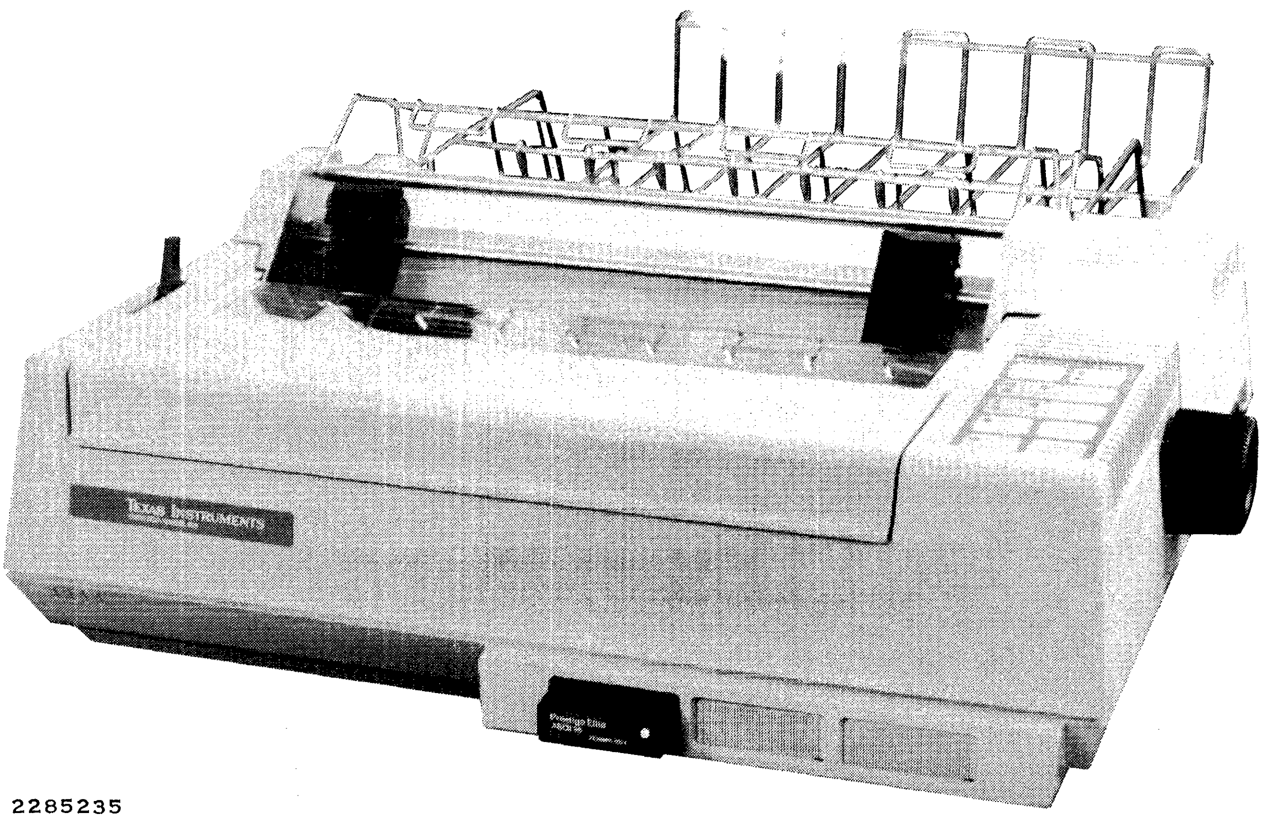

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Figure U-1. Model 855 Printer

U.2 CONTROLS AND INDICATORS

The 855 printer has physical controls and indicators to place the printer in various modes of operation. Some controls are located on the operator control panel and some inside the printer. Light emitting diodes (LEDs) on the operator control panel indicate the status or mode of the printer.

U.2.1 Operator Panel

The operator panel contains nine touch-sensitive membrane controls for operator-controlled functions. These controls are POWER, MODULE SELECT, DRAFT QUALITY, CHAR SPACING, LINE SPACING, FORM FEED, LINE FEED, SET FORM LENGTH, and ON LINE. Figure U-2 shows the location of the controls.

U.2.1.1 POWER. The POWER switch turns the printer on and off. Turning the printer on lights the POWER indicator and sets all operating parameters to the default values. The Power-up Tests paragraph in this appendix discusses these default operating parameters in more detail.

U.2.1.2 MODULE SELECT. Pressing the MODULE SELECT switch selects one of the font modules. Each module has an indicator that lights when that module is selected. If no module is inserted in a socket, the printer uses the internal-test character set.

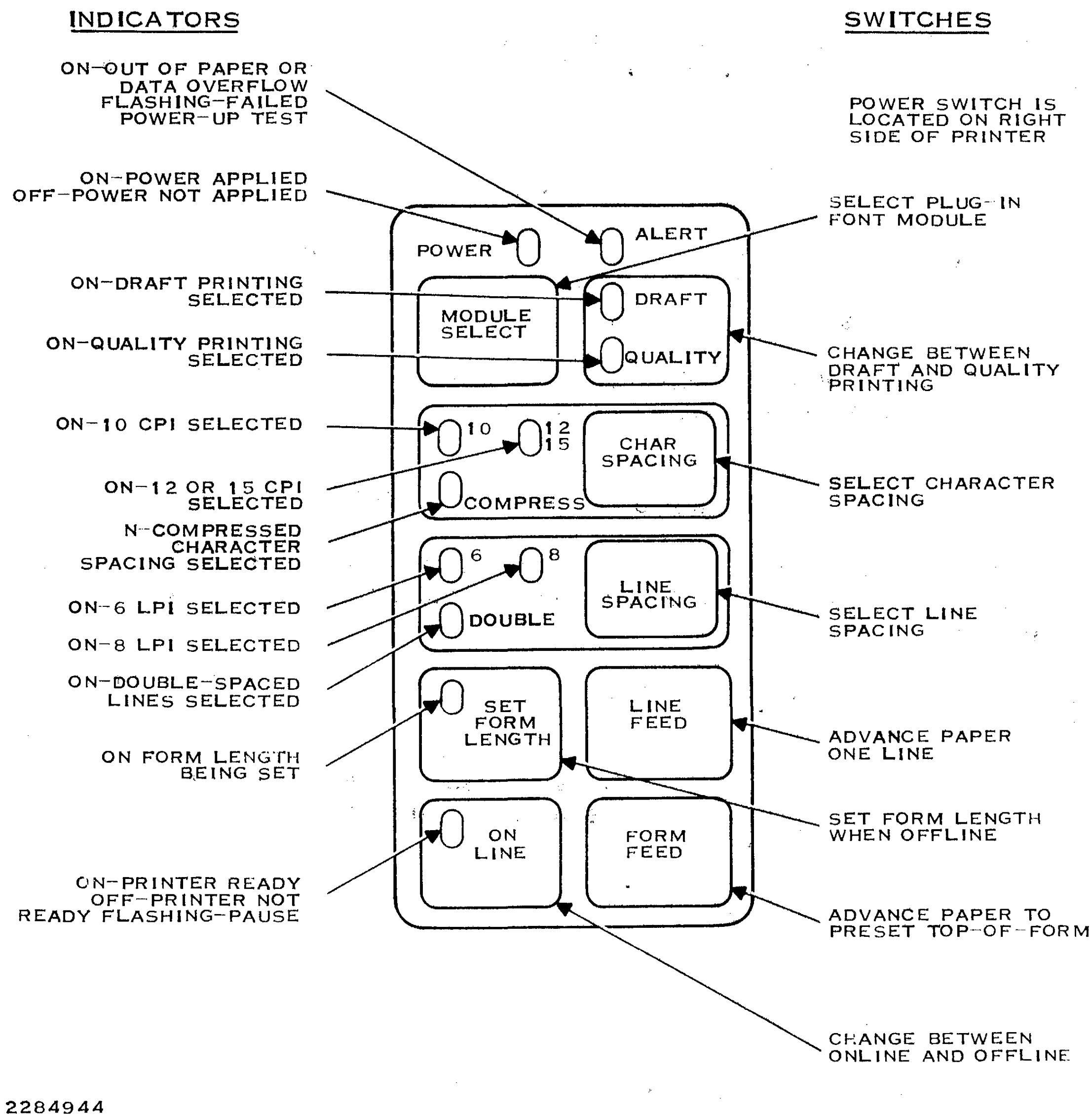

Figure U-2. Model 855 Printer Operator Control Panel

U.2.1.3 DRAFT QUALITY. Pressing the DRAFT QUALITY switch toggles between draft and letter quality modes. LEDs beside the words DRAFT and QUALITY on the panel indicate the mode selected.

NOTE

A font module must be inserted in a socket to use the QUALITY mode; if the QUALITY mode is selected when no font module is inserted, the printer executes line feeds but will not print.

The DRAFT QUALITY switch cannot be used when the ALERT or the SET FORMS LENGTH indicator is lighted.

A host computer can override the mode selected by the DRAFT QUALITY switch.

U.2.1.4 CHAR SPACING. Pressing the CHAR SPACING switch selects the character spacing (pitch) of the printed line. An LED beside the switch indicates the pitch selected. See the Pitch paragraph in this appendix.

The CHAR SPACING switch cannot be used when the ALERT or the SET FORMS LENGTH indicator is lighted.

U.2.1.5 LINE SPACING. The LINE SPACING switch selects the line spacing used. Each font can be printed in three different line spacings in both the normal and compressed mode. LEDs light to indicate the spacing selected:

- 6 — Six lines per inch (lpi)
- 8 — Eight lpi
- 6 and DOUBLE — 6 lpi and double spacing (3 lpi)
- 8 and DOUBLE — 8 lpi and double spacing (4 lpi)

The host computer can override the selected spacing.

The LINE SPACING switch cannot be used when the ALERT or the SET FORMS LENGTH indicator is lighted.

U.2.1.6 FORM FEED. Pressing the FORM FEED switch advances the paper to the top of the next form. If the printer is printing when this switch is pressed, the printer prints the entire line, then advances to the top of the next form.

This switch cannot be used when the SET FORM LENGTH indicator is lighted.

U.2.1.7 LINE FEED. The LINE FEED switch advances the paper one line; holding the switch down, advances the paper continuously until the switch is released.

The LINE FEED switch is also used in conjunction with the SET FORM LENGTH switch to set the length of a form.

U.2.1.8 SET FORM LENGTH. Pressing the SET FORM LENGTH switch puts the printer in the set form length mode and sets the line spacing to 6 lpi; pressing the switch again takes the printer out of the set form length mode.

To set the form length:

1. Press the ON LINE switch to take the printer offline; the ON LINE LED goes out.
2. Set the top of the form at the printhead using the paper advance knob.
3. Press the SET FORM LENGTH switch; the SET FORM LENGTH LED lights.
4. Press the LINE FEED switch for each line of the form; do this repeatedly until the top of the next form is under the printhead.
5. Press the SET FORM LENGTH switch; the SET FORM LENGTH LED goes out.
6. Press the ON LINE switch; the ON LINE LED lights.

The form length is now set and will not change until the form length is reset or the printer is turned off.

U.2.1.9 ON LINE. The ON LINE switch toggles the printer between online and offline; the switch also causes the printer to resume printing after the host computer has sent a pause command.

The printer is automatically in the online mode when turned on. Pressing the ON LINE switch puts the printer in the offline mode; pressing the switch again puts the printer back online.

After the host computer sends a pause command (to allow the operator to change something on the printer), pressing the ON LINE switch causes the printer to resume printing.

NOTE

The printer resumes printing where the print head is positioned; if the printhead is moved while the printer is stopped, the printhead will not return the the original position.

U.2.1.10 ALERT Indicator. The ALERT LED glows steadily when the printer is out of paper. The ALERT LED flashes when an internal problem exists in the printer. If the ALERT LED is flashing, turn off the printer and call your customer representative.

U.2.2 Internal Set-up Controls

The printer has eight internal set-up controls for configuring the printer for various applications. These controls are located under the front cover directly below the carriage on the printed wiring board. These controls select serial or parallel interface, automatic line feed, seven or eight-bit character recognition, data or word-processing mode, and baud rate.

Figure U-3 shows the internal set-up controls. Controls 2, 3, 4, and 5 are turned on; the rest are turned off.

U.2.2.1 Seven or Eight-bit Character Selection. Internal set-up controls 1 and 2 determine whether the printer recognizes seven or eight-bit character codes. The combinations are shown below:

Control 1	Control 2	Character Recognition
Off	Off	Seven-bit data, Space parity
Off	On	Seven-bit data, Odd parity
On	Off	Seven-bit data, Even parity
On	On	Eight-bit data, No parity

U.2.2.2 Automatic Line Feed Selection. Internal set-up control 3 determines whether the printer performs a line feed when a carriage return is executed. If the control is on, the printer performs a line feed when a carriage return is executed; if the control is off an automatic line feed is not performed.

U.2.2.3 Data- or Word-processing Selection. Internal set-up control 4 determines if the printer is used for data- or word-processing. If the control is on, the printer is used for word processing; if the control is off, the printer is used for data processing. When the printer is set for data processing, it recognizes commands sent to dot matrix type printers. When the printer is set for word processing, it recognizes commands sent to daisy wheel type printers.

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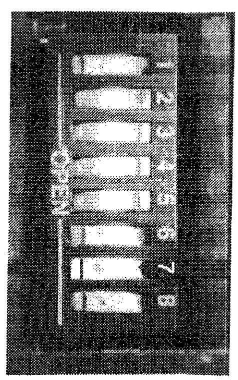

Figure U-3. Model 855 Printer Internal Set-up Controls

U.2.2.4 Baud Rate and Communications Interface Selection. Internal set-up controls 5, 6, 7 and 8 select the baud rate, communications protocol, and parallel or serial interfaces. The internal set-up switch setting are shown below:

Control 5	6	7	8	Baud Rate	Signals	Interface Port
Off	Off	Off	Off	300	Ready/Busy	Serial
Off	Off	Off	On	300	DC1/DC3 (XON/XOFF)	Serial
Off	Off	On	Off	300	ETX/ACK	Serial
Off	Off	On	On	1200	Ready/Busy	Serial
Off	On	Off	Off	1200	DC1/DC3 (XON/XOFF)	Serial
Off	On	Off	On	1200	ETX/ACK	Serial
Off	On	On	Off	2400	Ready/Busy	Serial
Off	On	On	On	2400	DC1/DC3 (XON/XOFF)	Serial
On	Off	Off	Off	2400	ETX/ACK	Serial
On	Off	Off	On	4800	Ready/Busy	Serial
On	Off	On	Off	4800	DC1/DC3 (XON/XOFF)	Serial
On	Off	On	On	4800	ETX/ACK	Serial
On	On	Off	Off	9600	Ready/Busy	Serial
On	On	Off	On	9600	DC1/DC3 (XON/XOFF)	Serial
On	On	On	Off	9600	ETX/ACK	Serial
On	On	On	On	—	—	Parallel

When a serial interface with Ready/Busy is selected, the printer sends a ready signal to the host computer when the printer's receive buffer can receive 256 characters; the printer sends a busy signal when the receive buffer has room for only 132 characters.

When a serial interface with DC1/DC3 (XON/XOFF) is selected, the printer sends a DC1 (XON) or DC2 (XOFF) character to the host computer to signal the printer's status. The printer sends a DC1 character to signal the computer that the printer has been put online after being offline, or the receive buffer has room to receive 132 characters (256 characters if the memory expansoon option is installed). The printer sends a DC3 character to the host computer if the receive buffer is within 132 characters of being full, the printer is out of paper, or the printer goes offline.

When a serial interface with ETX/ACK is selected, the printer sends an ACK character to the host computer when the printer receives an ETX character and is ready to receive more data. If ETX/ACK is not selected, the printer ignores the ETX character.

U.2.2.5 Recommended Internal Settings. To use the Model 855 Printer with TIPE, the standard DNOS utilities, and the spooler, set the internal set-up controls as follows:

Control	Setting	Meaning
1	On	7-Bit Data, Even Parity
2	Off	7-Bit Data, Even Parity
3	Off	No Automatic Line Feed
4	On	Word Processing
5	On	4800 Ready/Busy, Serial
6	Off	4800 Ready/Busy, Serial)
7	Off	4800 Ready/Busy, Serial)
8	On	4800 Ready/Busy, Serial)

U.3 POWER-UP TESTS

When the printer is turned on, various tests are performed automatically to verify memory and functions. The printer loads a default forms set into memory. The default set has the following parameters:

- Six lines per inch vertical spacing
- Pitch (cpi) of the font module installed in the lowest numbered font socket (the indicator on the module will light). If no module is installed, 10 cpi
- 66-line form length — 27.9 centimeter (11 inches)
- No horizonal tabs defined
- No vertical tabs defined

After successfully completing the self tests and loading this default set, the printer places itself online. The POWER, DRAFT, and ON LINE LEDs light; the ALERT and SET FORM LENGTH LEDs go out. If the ALERT LED remains lighted or flashes, refer to the ALERT indicator paragraph in this appendix.

The operator can also perform the power-up barberpole test. Press and hold the MODULE SELECT switch and press the POWER switch to turn the printer on. Figure U-4 shows an example of the barberpole pattern test.

U.4 GRAPHICS CHARACTER SETS

The graphics are the mosaic and raster sets. Mosaic graphics produce a pattern by printing groups of dots in a squared off pattern six dots wide by 12 dots high. Raster graphics print a dot anywhere on the print area of a page.

```
()*+,-./0123456789:;<=>?@ABCDE
)*+,-./0123456789:;<=>?@ABCDEF
*+,-./0123456789:;<=>?@ABCDEFG
+,.-/0123456789:;<=>?@ABCDEFGH
,.-/0123456789:;<=>?@ABCDEFGHI
.-/0123456789:;<=>?@ABCDEFGHIJ
-/0123456789:;<=>?@ABCDEFGHIJK
/0123456789:;<=>?@ABCDEFGHIJKL
```

Figure U-4. Model 855 Barberpole Test Pattern

U.4.1 Mosaic Graphics

A mosaic graphics character is composed of cells of dots three dots wide by four dots high; each character can have as many as six cells or as few as none. The mosaic character occupies the same space on a page as any of the normal printable characters.

U.4.2 Raster Graphics

Raster graphics prints a single vertical column of dots using the top eight needles in the print head. (The printhead is a vertical arrangement of nine needles. Only the top eight needles are used for printing.) As the print head moves horizonally across the paper, each dot can be printed singly or in any combination. Using this mode, a single dot or any pattern of dots can be printed anywhere on the page. Raster graphics also allows mixing of type fonts and graphics. Special ASCII character codes must be sent to the printer from the host to use raster graphics. See the *Model 855 Printer User's Manual* for more detailed information.

U.5 TYPEFACES

The 855 printer has an internal-test character set and three font module sockets located on the lower front of the printer. If no font module is installed, the printer uses the internal-test character set; otherwise the printer uses the font of the module on which the indicator is lighted. Pitch and print quality can be changed.

U.5.1 Pitch

The CHAR SPACING switch selects the pitch (characters per inch) desired. An LED beside the switch indicates the pitch selected:

- 10 — 10 characters per inch (CPI)
- 12 — 12 or 15 cpi depending on the font module selected
- COMPRESS — compressed character spacing
  - 16.7 cpi if the pitch is 10 or 12
  - 20 cpi if the pitch is 15

Each font module has a default pitch. When a module is selected, the 10 or 12 LED lights to indicate the pitch. Pressing the CHAR SPACING switch changes the pitch.

The host computer can override the selected pitch.

U.5.2 Print Quality

The 855 printer prints in either draft or letter quality mode. The DRAFT QUALITY switch on the operator panel toggles the printer between these two modes, or the host computer can change the mode by sending command codes.

U.6 SET-UP AND OPERATION

The following paragraphs discuss the ribbon cartridge installation, paper loading, paper handling accessories, and adjusting for forms thickness.

U.6.1 Ribbon Cartridge Installation

Follow these steps to install the printer ribbon. See Figure U-5.

1. If the power cord is connected, disconnect it.
2. Set the power control to off.
3. Move the printhead away from the platen with the printhead adjustment lever.
4. Manually slide the printhead to the center of the platen.
5. Holding the ribbon cartridge by the ends, insert the ribbon between the printhead nose and the ribbon guides.
6. Tilt the cartridge backward and insert the pins on each side of the cartridge arms into the hooks on the printer frame.
7. Press the front of the cartridge down gently until it snaps into position. If any resistance is felt on the left side, rotate the ribbon adjustment knob in the direction of the arrow.
8. Slide the printhead from side to side to ensure the ribbon is smooth across the face of the printhead.
9. Move the printhead adjustment lever to the middle notch. More precise adjustment is covered in the Forms Thickness paragraph in this appendix.
10. Remove any slack from the ribbon by rotating the ribbon adjustment knob in the direction of the arrow.
11. Ensure the ribbon moves freely.

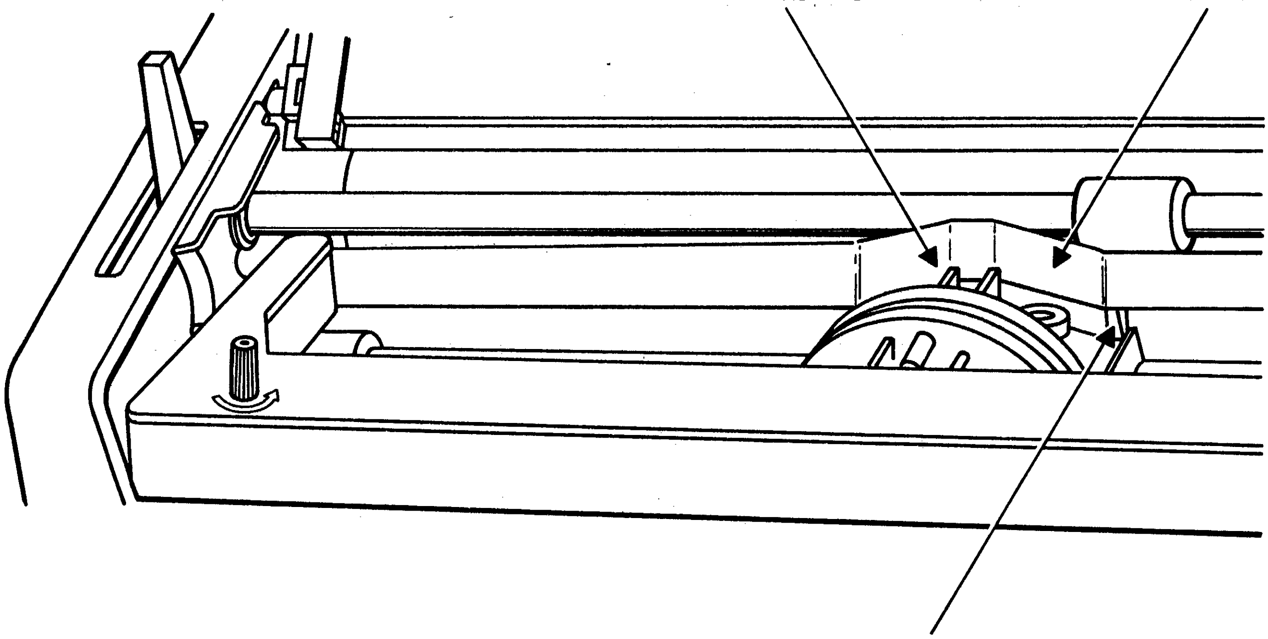

Figure U-5. Model 855 Ribbon Installation

U.6.2 Paper Loading

The printer can use single sheet, fanfold and roll paper.

CAUTION

Do not use the printer without paper; this can damage the printhead and the platen.

U.6.2.1 Single-Sheet Paper. Single-sheet paper is loaded into the printer in the same manner as loading a typewriter. Move the paper release lever (see Figure U-5 — toward the front of the printer). Insert and align the paper, then move the paper release toward the rear of the printer.

U.6.2.2 Roll Paper. The optional paper-roll holder is required to use roll paper. The holder accepts paper rolls 76 to 254 millimeters (3 to 10 inches) wide and up to 127 millimeters (5 inches) in diameter.

Follow these steps while referring to Figure U-6 to load roll paper in the printer:

1. Move the paper release lever toward the front of the printer.
2. Feed the paper from the bottom of the roll over the top of the tension bar and between the top of the printer and the separator.

3. Slide the paper under the platen until it is between the platen and the printhead, and under the guide rollers.

4. Move the paper release lever to the rearmost position.

5. Rotate the paper advance knob until the paper clears the top opening of the printer.

6. Tear off excess paper by grasping the top of the paper at either corner and pulling the paper against the tear bar. The tear bar is the serrated edge of the window in the access door.

U.6.2.3 Fanfold. The optional tractor drive assembly is required to use fanfold paper in the printer.

Follow these steps while referring to Figure U-7 to load fanfold paper:

1. Move the paper release lever to the front of the printer.

2. Open the tractor covers.

3. Place the box or stack of fanfold paper behind and beneath the printer and aligned with the printer's platen.

4. Adjust the distance between the tractors to match the paper width as follows:

NOTE

The left tractor must be positioned far enough to the left for the paper-out detector to operate.

   a. Rotate the tractor locking lever upward and adjust the left tractor left or right as necessary.

   b. Rotate the locking lever downward.

   c. Adjust the right tractor to the proper width in the same way the left tractor was adjusted. The holes in the paper must fit on the drive pins in the tractors.

5. Place the paper over the tractor drive pins and close the covers.

6. Adjust the paper position so the paper feeds straight.

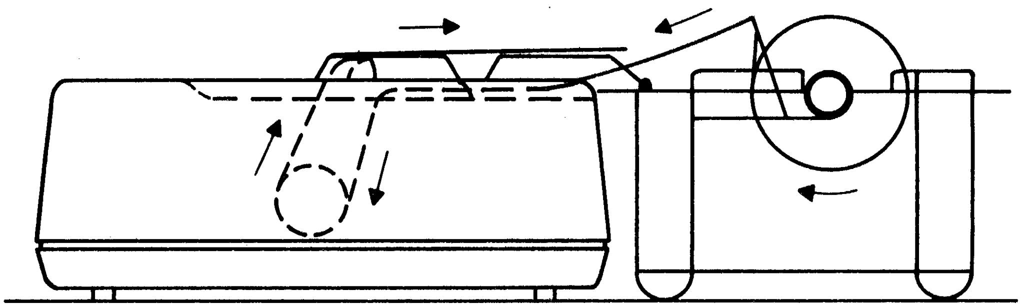

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Figure U-6. Model 855 Roll Paper Path

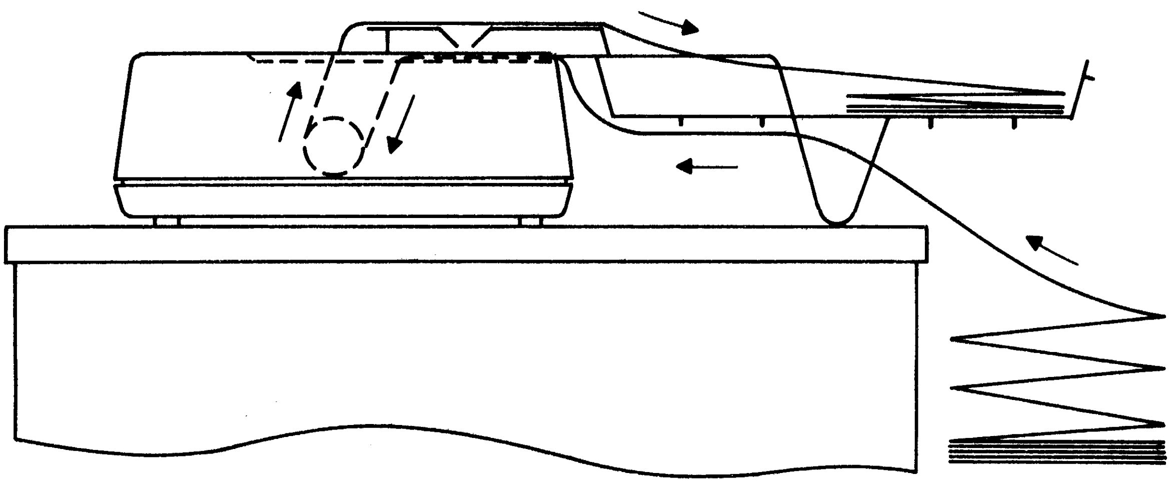

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Figure U-7. Model 855 Fanfold Paper Path

U.6.3 Forms Thickness

The printhead can be adjusted to accomodate various thickness of forms, including multicopy forms. Adjustments should be made after the forms have been installed.

CAUTION

Never adjust the printhead while it or the platen is moving. This could damage the printhead.

To adjust the forms thickness, move the printhead adjustment lever (see Figure U-8) toward the platen for single thicknesses and away from the platen for multiple thicknesses. If the printhead is smudging the paper or dragging against the paper, adjust the printhead away from the paper.

U.6.4 Installing Font Modules

Figure U-1 shows a font module installed in the Model 855 printer. The printer can have three modules installed at the same time. To install a module grasp the textured portion so the label is facing away from the printer and insert it into the printer. The modules can be inserted in only one way.

Do not insert or remove modules while the printer is printing.

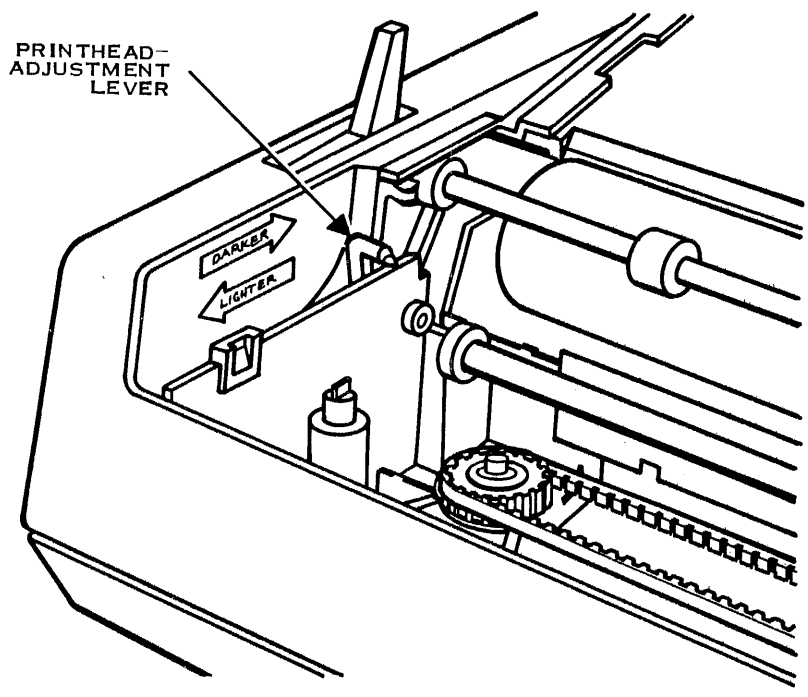

Figure U-8. Model 855 Printhead Adjustment Lever

Appendix V

Model 804 Card Reader

V.1 GENERAL INFORMATION

This appendix describes how to operate the Model 804 Card Reader shown in Figure V-1. For more detailed information, refer to the *Model 804 Card Reader Installation and Operation Manual.*

The Model 804 Card Reader is a column-oriented, serial card reader. It can read data from 80-column punched cards or mark-sense cards.

With power applied and the card reader online and loaded, operation of the reader is automatically controlled by the computer. Data is read from the punched cards at a rate of about 400 cards per minute.

V.2 CONTROLS AND INDICATORS

The operator panel is located on the front left side of the card reader cabinet (see Figure V-2). The operator panel contains indicators for POWER ON, RESET (reader ready), HOPPER, STACK, and READ CHECK. Momentary action switches on the panel are RESET and READ CHECK. The ON/OFF toggle switch is located at the rear of the card reader cabinet (see Figure V-3). The functions of these controls and indicators are described as follows:

OFF toggle switch is located at the rear of the card reader cabinet (see Figure V-3). The functions of these controls and indicators are described as follows:

POWER ON

This green indicator lamp lights when power is applied to the card reader via the toggle switch on the rear of the cabinet.

RESET

This is a combined white indicator lamp and momentary contact switch. Pressing the switch/indicator reverses the ready status of the card reader. If the RESET indicator is off (reader not ready), pressing RESET will light the lamp and ready the reader. Also, pressing the switch will reset any existing error conditions such as a READ CHECK condition.

HOPPER

This red indicator lamp lights to alert the operator that the hopper is empty or a feed failure condition exists. A feed failure condition results when two consecutive feed attempts fail to move a card into the read station. Also, an illegal feed (unsolicited) causes both the HOPPER indicator and the READ CHECK indicator to light. The HOPPER indicator extinguishes when the problem is corrected and the RESET switch is pressed.

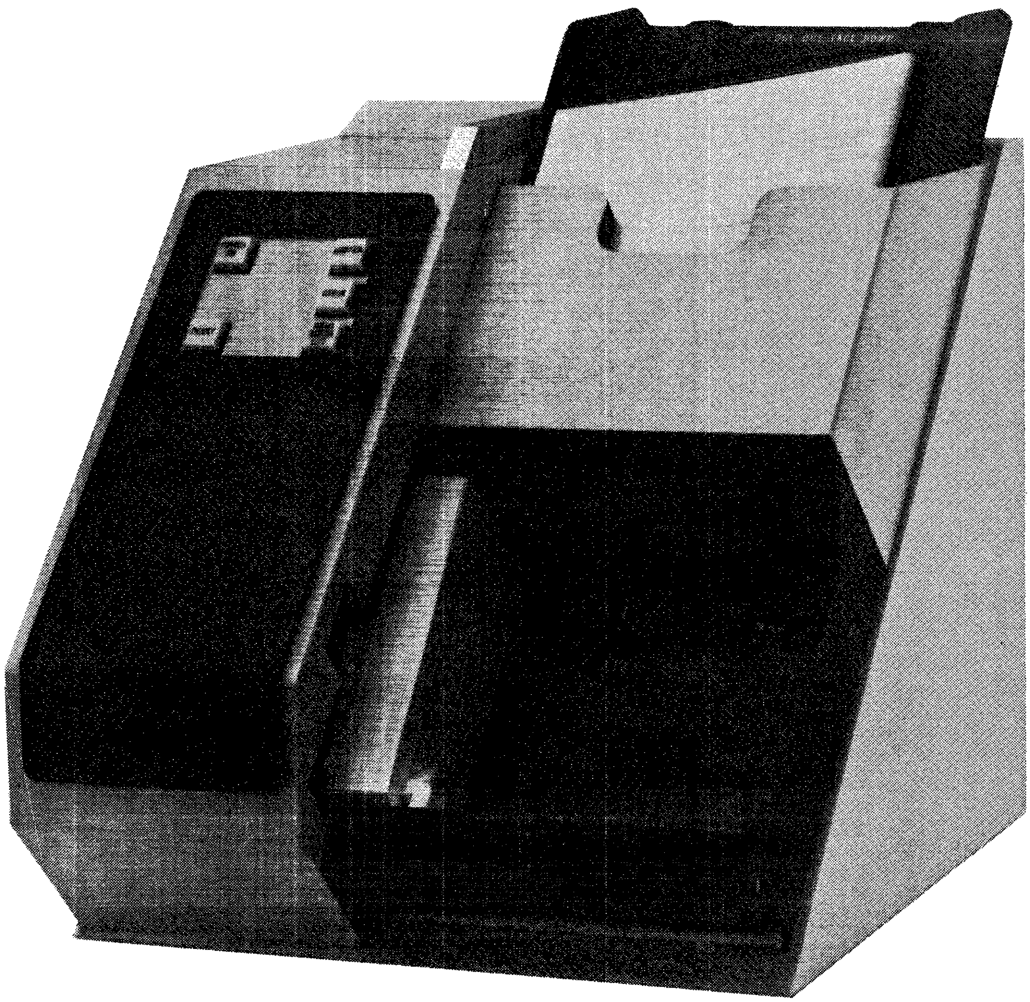

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Figure V-1. Model 804 Card Reader

STACK

This red indicator lamp lights to alert the operator that the stacker is full, a double feed has occurred, or a card jam exists. The STACK indicator goes off when the problem causing the condition is corrected and the RESET switch is pressed.

READ CHECK

This is a combined red indicator lamp and a momentary contact switch. The occurrence of a data error, card damage, or timing problem causes the READ CHECK lamp to light and the card reader to stop. Pressing the RESET switch turns off the READ CHECK lamp. The momentary switch feature of this READ CHECK switch/indicator tests all the lamps on the control panel. Pressing the switch causes all the indicator lamps to light, provided the card reader is not ready.

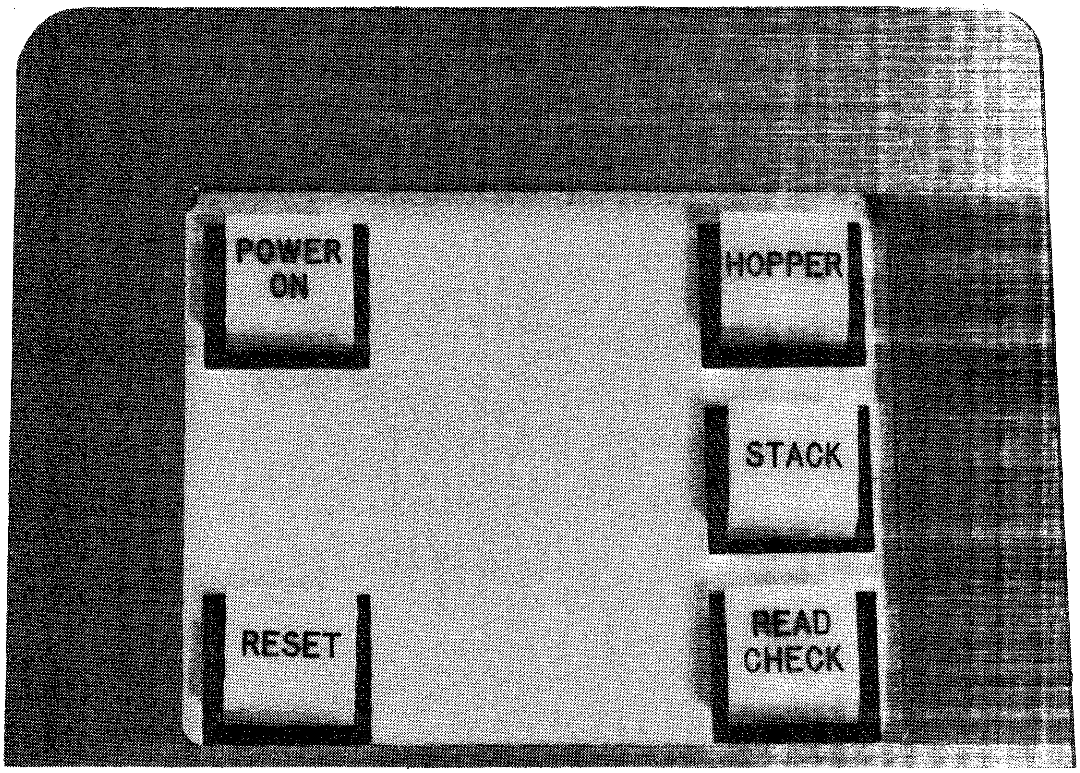

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Figure V-2. Model 804 Card Reader Operator Control Panel

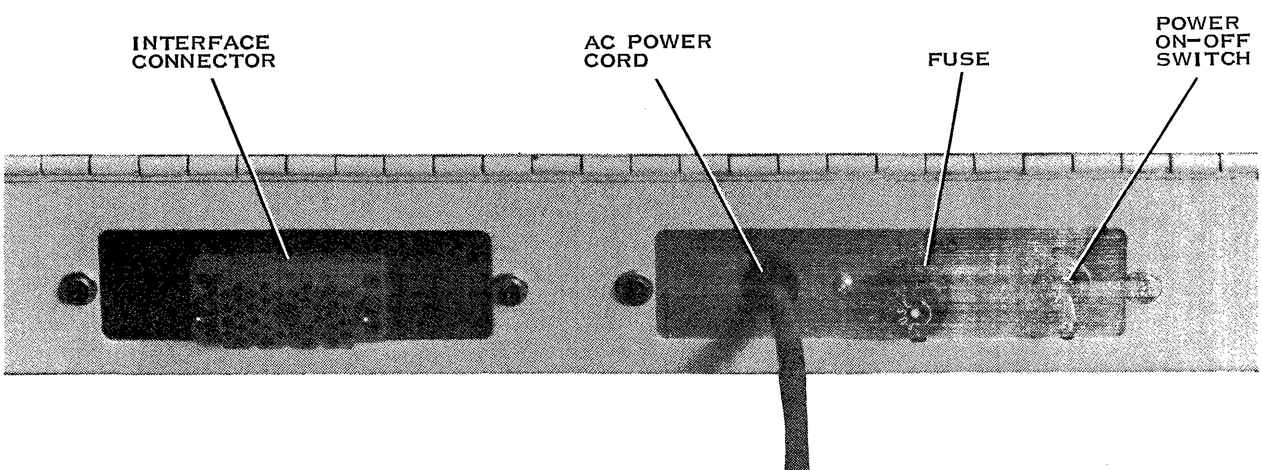

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Figure V-3. Model 804 Card Reader Rear Cabinet Controls and Connectors

V.3 OPERATING PROCEDURES

To load and operate the card reader, proceed as follows:

1. Prior to loading the cards, fan and rack them.
2. Remove the hopper weight.
3. Place the punched card deck into the input hopper with the printed side down and column one on the left.
4. Replace the hopper weight.
5. Press the RESET switch if it is not already lit.
6. Cards may be added to the input hopper or removed from the output stacker during a processing cycle without affecting the reading operation. However, errors in feeding may occur if less than 75 cards remain in the input hopper when the hopper weight is removed.

NOTE

The 804 is a reflective card reader. Any dark markings on the back of the card may be read as a punch. Cards read by the 804 must be visually clean on the backside to ensure readability.

Alphabetical Index

Introduction

HOW TO USE INDEX

The index, table of contents, list of illustrations, and list of tables are used in conjunction to obtain the location of the desired subject. Once the subject or topic has been located in the index, use the appropriate paragraph number, figure number, or table number to obtain the corresponding page number from the table of contents, list of illustrations, or list of tables.

INDEX ENTRIES

The following index lists key words and concepts from the subject material of the manual together with the area(s) in the manual that supply major coverage of the listed concept. The numbers along the right side of the listing reference the following manual areas:

- Sections — Reference to Sections of the manual appear as "Sections x" with the symbol x representing any numeric quantity.

- Appendixes — Reference to Appendixes of the manual appear as "Appendix y" with the symbol y representing any capital letter.

- Paragraphs — Reference to paragraphs of the manual appear as a series of alphanumeric or numeric characters punctuated with decimal points. Only the first character of the string may be a letter; all subsequent characters are numbers. The first character refers to the section or appendix of the manual in which the paragraph may be found.

- Tables — References to tables in the manual are represented by the capital letter T followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the table). The second character is followed by a dash (-) and a number.

  Tx-yy

- Figures — References to figures in the manual are represented by the capital letter F followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the figure). The second character is followed by a dash (-) and a number.

  Fx-yy

- Other entries in the Index — References to other entries in the index preceded by the word "See" followed by the referenced entry.

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6.3.2 Verifying a Directory Copy

The Verify Copy (VC) command verifies a copy made by Copy Directory. The VC command compares a set of files in a master (source) directory to a set of files in a copy directory to determine whether the files match. The VC command detects matches by comparing the file type, file use, file name, and file contents of files at corresponding levels of each set. When the VC command completes, a listing of all directories and files that were verified is displayed. If discrepancies are found, error messages are included in the listing. If the VC command is executed in the background mode or the listing must be preserved, the listing can be written to file by responding to the LISTING ACCESS NAME: prompt with a file pathname. Figure 6-3 shows an example of such a listing.

```
  VERIFY COPY              14:28:17 TUESDAY, OCTOBER 26, 1982.

ORIGINAL SOURCE:        VOL2.DIR1
ORIGINAL DESTINATION:   VOL2.DIR2
ORIGINAL OPTIONS:       ALIASES, NODATE, ADD, NOSPRL, NORPRL, SYSFILE
CONTROL FILE:
LIST FILE:              LP

  **      DIRECTORY  VOL2.DIR1
  **  FILE2
  **  FILE3
  **  PROGRAMS - PROGRAM FILE

  **  TASK       ID
  **  PROGA     >03
  **  PROGB     >0E

  **  PROCEDURE  ID

  **  OVERLAY    ID
  **       END OF PROGRAM FILE

  **  FILE1

ELAPSED TIME = 0 MINUTES   58 SECONDS
SIZE OF INPUT = 439 ADU'S

****** VERIFY COPY COMPLETED
```

Figure 6-3. Verify Copy Output Listing

If a control file is specified with the VC command, it limits the files in the master directory that are compared against files in the copy directory in the same manner as it limits the copy operation of a Copy Directory (CD) command. For more information, refer to the *DNOS System Command Interpreter* (SCI) *Reference Manual.*

6.3.3 Backup Directory (BD)

T[illegible] directory to magnetic tape or any sequential file, the directory must be changed from a