SMS 1000
MICROCOMPUTER SYSTEM
MODELS 40, 41 AND 50
OEM MANUAL
FEBRUARY 1987
SMS 1000

MICROCOMPUTER SYSTEM

MODELS 40, 41 AND 50

OEM MANUAL

15 FEBRUARY 1987

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HOW TO USE THIS MANUAL

Here's a brief directory that will point you to the basic things you'll need to know to understand and operate your SMS 1000.

GETTING STARTED

Site selection
Unpacking and installation
How to power-up and boot-load the system
Front panel controls and indicators
Basic operation of The SENSE Monitor
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Appendix A
Fig. 1-1  SMS 1000 Microcomputer System

(Rack-mount, floor-mount and table-mount versions)
SECTION 1

SYSTEM OVERVIEW

INTRODUCTION

The SMS 1000 (Figure 1-1) is a single- or multiple-user microcomputer system based on the DEC LSI-11 Q-bus architecture. It is made in either a rack-mount, table-mount or a floor-mount design. The basic system consists of (1) a six-slot Q-bus backplane in which user-selected CPU's, memory cards, and other modules can be installed; (2) a front panel with a sixteen-character display and switches for controlling the SENSE Monitor; (3) the system power supply; and (4) a system-integration circuit board called the Foundation Module that includes a multifunction peripheral controller, two RS-232 serial ports, and a set of special programs known as the SENSE Monitor. SENSE reports system status, performs a wide variety of diagnostic and utility functions and enables rapid changes in system parameters. The SENSE functions can be carried out either from your video display terminal or from the system's front panel 16-character display and controls.

Depending upon user requirements, various combinations of up to two fixed-disk Winchester disk drives, one removable-cartridge Winchester disk drive, one 8-inch floppy drive, up to two 5 1/4-inch floppy drives and a half-height streaming tape drive can be selected. Also, an add-on start/stop cartridge tape subsystem is available for software distribution and high-capacity backup.

The SMS 1000 is designed to be fully customer installable. It operates from standard 115- or 230-volt line power and has no special wiring or cooling requirements.

The SMS 1000 is fully software compatible with DEC LSI-11 systems. All application and system software developed for the LSI-11/23 and LSI-11/73 CPU's may be operated on the SMS 1000 without modification.
SYSTEM OVERVIEW

MANUAL APPLICABILITY: MODELS 40, 41 AND 50

This manual applies to the SMS 1000 Models 40, 41 and 50. Information on the SMS 1000 Model 41, including differences between it and the Model 40, and complete installation procedures, is given in Appendix F. A description of the SMS 1000 Model 50, including differences from the Model 40, as well as complete installation procedures, is given in Appendix G.

MODEL DIFFERENCES

The present manual describes the SMS 1000 Model 40 as a baseline system, and describes two other models in terms of their differences from the Model 40. These models are:

1. The SMS 1000 Model 41. The Model 41 is a data-storage subsystem that will operate with any MicroVAX II or LSI-11 computer system. In many respects the Model 41 is identical with the Model 40. The primary difference is that the Model 41 has no backplane slots for CPU or RAM. Instead, programs are run in the host system (to the backplane of which the Model 41 is connected by a 50-conductor cable) and the Model 41 provides additional peripheral data-storage such as hard disks, floppy's and tape. See Appendix F for a description of the Model 41.

2. The SMS 1000 Model 50. The basic difference between the Model 40 and the Model 50 is that the Model 50 has a 12-slot backplane (versus six slots in the Model 40). For a description of the Model 50, see Appendix G.

PROCESSING POWER

The SMS 1000 provides you with a high degree of flexibility and rapid data throughput by use of an enhanced version of the DEC MSCP high-speed I/O architecture, a powerful disk controller, and the availability of the latest in fast-access Winchester drives. CPU power is provided by your choice of either the LSI-11/23 or the LSI-11/73 processors. Full floating-point capability is available on the LSI-11/23 and standard on the LSI-11/73. Also, RAM is available from SMS sized in increments as small as 256K bytes, from 256KB up to 4.0 MB, by adding the appropriate boards to the backplane. The SMS 1000 has the processing power to run a wide variety of operating systems, as described in the following paragraphs.
SYSTEM OVERVIEW

SOFTWARE

The following paragraphs describe the various operating systems and languages that can run on your SMS 1000. Included is a complete list of these operating systems with a brief description of each.

1. RSX-11. This family of real-time operating systems is designed to execute multiple programs concurrently. It includes RSX-11M, RSX-11M-PLUS, RSX-11S, and MICRO/RSX. It is suitable for real-time process control or data acquisition as well as multiple-user time sharing tasks involving large-scale transaction processing and information management. SMS currently distributes RSX-11M and RSX-11M-PLUS on 8-inch diskettes and 1/4-inch tape cartridges.

2. RSTS. This includes RSTS/E and MICRO/RSTS. These are multiple-user job oriented time sharing systems. They can support either batch or real time operation. Communication with either operating system is through the Digital Command Language (DCL). MICRO/RSTS is an application-only subset of RSTS/E that leaves more space available on a hard-disk drive for application programs and user data.

3. RT-11. RT-11 is a single-user system that permits a background job to run while real-time foreground tasks are being performed. Both can have access to all the system's resources. RT-11 supports one command terminal and up to 16 additional terminals. Some typical applications of RT-11 are instrument control, process control, word processing, and record management. Communication with RT-11 is through the Digital Command Language (DCL). The RT-11 system features an interactive installation procedure. SMS currently distributes this system on 8-inch or 5 1/4-inch diskettes and on 1/4-inch tape cartridges.

4. CTS-300. This system is designed to support commercial applications. It consists of RT-11 plus the DIBOL business-oriented language. CTS-300, like RT-11, supports one command terminal plus multiple additional terminals.

5. TSX-PLUS. This system can support up to 31 concurrent time-sharing users. TSX-PLUS can simultaneously support a wide variety of jobs and programming languages including COBOL-Plus, FORTRAN, BASIC, DIBOL, DBL, Pascal, C, MACRO-11, TECO, and KED. Most programs that run under RT-11 will run without modification under TSX-PLUS.

6. MICROP/WAL. With MicroPower/Pascal you can design, build and test real-time application software on a host devel-
opment system running under a subset of RT-11. The resultant application programs can then be linked with appropriate run-time software and downloaded to a target system.

7. ULTRIX-11. This is a multiple-user system consisting of the Bell Laboratories' UNIX Timesharing System (Version 7) with enhancements for systems such as the SMS 1000. ULTRIX-11 languages include C, FORTRAN-77, a BASIC-like interpretive language, and RATFOR (FORTRAN with a C-like control structure). ULTRIX-11 is designed to be easy to install.

8. DSM-11 and MUMPS. This is a multiuser system with data-management capabilities and the high-level interactive language MUMPS. DSM-11 is oriented toward the quick production of working code. The MUMPS language has a semantic and syntactic structure aimed at solving data-base related problems.

SCOPE OF THIS MANUAL

This manual contains complete information on site selection, unpacking, installation, operation and user-performable service for the SMS 1000 Models 40, 41 and 50. Section coverage of the manual is as follows:

Section 1. Introduction, general description, list of compatible software that can run with the SMS 1000, equipment supplied, and tables of system characteristics.

Section 2. Site selection considerations

Section 3. Installation and post-installation checkout

Section 4. Includes rules governing power supply loading, bus loading, board strapping instructions, peripheral-strapping instructions, and bus priority specifications.

Section 5. How to operate your SMS 1000 system, including how to boot and run the host and how to operate the SENSE Monitor.

Section 6. Status Menu Commands for the SENSE Monitor
SYSTEM OVERVIEW

Section 7. Operation Menu Commands for the SENSE Monitor

Section 8. Evaluation Menu Commands for the SENSE Monitor

Section 9. Configuration Menu Commands for the SENSE Monitor

Section 10. Preventive and corrective maintenance, and assembly/disassembly instructions

Appendix A. Summary of SENSE commands

Appendix B. Peripheral-device Specifications

Appendix C. SMS 1000 Models 40 and 50: Table of major system components.

Appendix D. Table of Decimal/Octal/Hexadecimal equivalent numeric values

Appendix E. Error Messages

Appendix F. Description of SMS 1000 Model 41

Appendix G. Description of SMS 1000 Model 50

Appendix H. Description of file-tape option

RELATED PUBLICATIONS

The following publications provide background and reference information on the SMS 1000 microcomputer systems.


10. TSX-PLUS System Manager's Guide (no document number). S&H Computer Systems, Nashville, TN, 37212. This is the introductory volume for TSX-PLUS.

Fig. 1-2  Disassembly of SMS 1000
Fig. 1-3  Enclosure, front panel and rear panel
SYSTEM OVERVIEW

SYSTEM DESCRIPTION

PHYSICAL DESCRIPTION. An assembly view of the units that make up the SMS 1000 is shown in Figure 1-2. The system is designed for ease of disassembly. All fasteners attaching units to the frame are easily releasable either by hand or by a standard screwdriver. The units that make up the SMS 1000 are described as follows:

1. ENCLOSURE, FRONT PANEL AND REAR PANEL (Figure 1-3). The enclosure itself contains mounting brackets for the system components and two cooling fans. The front panel contains a 16-character vacuum-fluorescent display (VFD) for status-, message- or parameter-readout, and seven pushbutton switches that permit communication with the SENSE Monitor. A door in the front panel opens to allow access to the floppy disk drive(s) and to the DC ON/OFF switch.

2. FOUNDATION MODULE (Figure 1-4). The foundation module is a single PCB that is held in place by two slide rails and two latches. It plugs into two connectors at the bottom edge of the backplane.

3. BACKPLANES WITHOUT RESTRICTED C/D SLOTS (Figure 1-5A). The backplane is a group of six quad-width sockets connected together to operate as an LSI-11 bus. It contains the CPU, memory, and other modules that make up the basic SMS 1000 microcomputer. The backplane and the card cage are attached to the rear cover panel and associated brackets by twelve screws. The backplane can accommodate six quad-wide Q-bus modules, 12 dual-wide Q-bus modules or any combination of these. "Quad" and "dual" refer to the number of backplane connector sections required by a module; that is, quad occupy four connector sections and dual occupy two connector sections. NOTE: Systems with this type of backplane do NOT have a caution sticker on the left side of the cardcage supporting structure. Refer to Figure 1-6.

4. BACKPLANES WITH RESTRICTED C-D SLOTS (Figure 1-5B). The C-D connectors of backplane slots 1 and 2 on later versions of the SMS 1000 Model 40 backplane (or slots 1, 2 and 3 on Model 50 backplanes) have been connected differently from those of earlier versions. Because of this new wiring, dual-width cards plugged into the slot 1 or 2 C-D connectors of the new backplane may be damaged. If your system has this type of backplane, there will be a CAUTION label on the left rear flange of the cardcage supporting structure, as shown in Figure 1-6. This caution applies to all Model 50 backplanes.

5. POWER SUPPLY (Figure 1-6). The power supply for the system is contained on a single board which is held in place
by two slide rails and two latches. It plugs into an 80-pin card-edge connector located on the opposite side of the backplane from the foundation module.

6. 8-INCH FLOPPY DRIVE. One 8-inch floppy drive can be accommodated in the SMS 1000. This and other floppy drives used in this system are of the slim-line (i.e. half-height) design. The 8-inch floppy drive is mounted so that easy access for insertion or removal of diskettes can be gained by opening the front-panel door. See Figure 1-7 for a diagram of all currently available SMS 1000 peripheral configurations.

7. 5-1/4-INCH FLOPPY DRIVE. The SMS 1000 can accommodate up to two 5-1/4-inch, half-height floppy drives, as shown in Figure 1-7. As with the 8-inch floppy, access to the drive is gained through the front-panel door.

8. 5-1/4-INCH WINCHESTER DRIVE. The SMS 1000 can contain up to two 5-1/4-inch, full-height Winchester-type hard-disk drives. If two Winchester drives are used, they are mounted in a side-by-side configuration, as shown in Figure 1-7.

9. CARTRIDGE-TYPE TAPE DRIVE. Two types of tape drive are available. A 5-1/4-inch slimline (i.e. half-height) streaming tape drive can be mounted in the system enclosure (see Figure 1-7). This drive can be used for image backup or, if the option is selected, for file-oriented backup. For a full description of the file-oriented backup option, see Appendix H. Also, a start/stop tape drive in a stand-alone cabinet (including its own controller and power supply) can be specified. Either type of drive can be used for high-capacity backup and for software distribution.

10. CARTRIDGE-TYPE WINCHESTER DRIVE. A 5-1/4 inch slimline removable-cartridge Winchester drive can be mounted in the system enclosure. It can be used for all normal Winchester-drive purposes as well as for such functions as rapid, high-capacity backup and software distribution. Cartridge insertion and removal is rapid and simple.
SYSTEM OVERVIEW

Fig. 1-4  Foundation Module

SMS 1000  1-11
Fig. 1-5A  Backplane without restricted C-D connectors in slots 1 and 2
Fig. 1-5B  Backplane with restricted C-D connectors in slots 1 and 2
SYSTEM OPERATION

Figure 1-8 is a block diagram showing information flow between components of an SMS 1000 system. The basic SMS 1000 system is made up of the foundation module; the system enclosure, which includes the front panel with its 16-character display and accompanying controls, and the rear panel with its external connectors to user-selected video terminals, keyboards and printers; the backplane into which plug the user-selected CPU, memory boards and other modules; and the power supply. Also mounted within the system enclosure are various possible combinations of user-selected peripherals (see Figure 1-7).

FOUNDATION MODULE

As shown in Figure 1-8 the foundation module performs the following functions:

1. COMMUNICATION. The foundation module provides a two-channel RS-232 communication interface between the Q-bus and external units such as terminals and printers. Each of these asynchronous serial communication ports operates in the same manner as a DEC DLV11-J line. Transmit and receive speeds for each channel are the same. You can select baud rates for each channel by means of controls on the front panel or by means of a menu-driven video terminal. The SENSE Monitor also uses the RS-232 interface in order to communicate with external devices.

2. DISK AND TAPE I/O CONTROL. The foundation module acts as a mass-storage peripheral controller for hard- and soft-disk storage units and tape units. Communication between the Q-bus and these peripherals is handled by a DEC-compatible SMS implementation of the MSCP (Mass Storage Control Protocol) architecture. This controller architecture arbitrates all I/O resource contention, executes all peripheral access requests, provides overlapped seeking and non-interleaved disk access, and performs flaw mapping and error correction. The foundation module also supports block-mode transfers between the disk and main memory.

3. SYSTEM SUPPORT. The foundation module contains the SENSE Monitor, a ROM-resident set of programs that allow you to perform diagnostics, isolate component failures, examine system status, change various system parameters and perform utility functions such as backup and load, and format disks. Because SENSE resides in ROM, it is always available for your use without the necessity of loading or reloading. The various system-configuration parameters are stored in EEPROM so that
IF CAUTION LABEL APPEARS HERE, YOUR SYSTEM HAS A BACKPLANE WITH RESTRICTED C-D CONNECTORS IN SLOTS 1 & 2. DUAL-WIDTH CARDS PLUGGED INTO THOSE CONNECTORS MAY BE DAMAGED.

POWER SUPPLY BOARD

POWER SUPPLY 1/4-TURN FASTENERS (2)

SLOT FOR PRYING OPEN COMPARTMENT DOOR

AC POWER SWITCH

AC POWER CORD RECEPTACLE

AC FUSE AND 115V/230V-SELECTION COMPARTMENT

Fig. 1-6 Power Supply
they can be changed as necessary, through interaction with the
SENSE menu system. SENSE supplies the 16-character front-panel
display (or your video display terminal) with menus, status
indications, parameters and test results. Signals from the
seven front-panel pushbuttons (or your terminal keyboard)
permit selection of menus, choice of parameters, the selection
of other system functions, and write protection.

4. BOOT PROM. When you power-up or restart the system, the
host calls upon the boot prom for the code necessary to ini-
tially locate and load either an application or the operating
system software to be run on the LSI-11 CPU.

5. LINE TIME CLOCK. The line time clock provides a user-
selectable 50 Hz, 60 Hz, or 800 Hz signal that the system can
use to generate time-of-day information for general system
timing.

BACKPLANE

Modules such as CPU card, memory cards, interface cards, etc.,
are plugged into a common-circuit board called the backplane
(Figures 1-5A and 1-5B). The SMS 1000 backplane consists of an
LSI-11 22-bit Q-bus with six slots, each capable of taking one
quad-height printed-circuit board or two dual-height printed-
circuit boards. The backplane can accommodate any combination of
dual- or quad-height cards.

In order to allow for the use of certain newer quad-wide CPU
boards in addition to the dual-wide LSI-11/23 and LSI-11/73
CPU's, the C-D connectors of backplane slots 1 and 2 on later
versions of the Model 40 backplane have been connected differ-
ently from those of earlier versions (see Figures 1-5B and 1-6).
Dual-width boards plugged into these C-D slots may be damaged.
Backplanes with restricted C-D slots may be identified by the
presence of a CAUTION label on the left rear flange of the card-
cage supporting structure. The A-B connectors of slots 1 and 2
function in the same manner as before the change.

The Q-bus provides communication among CPU, memory, peripheral
devices and system control units. There are 22 address lines in
the Q-bus, corresponding to the 22 bits of the system's physi-
cal address space. Sixteen of these 22 lines are timeshared for
data transfer. Optionally, 18-bit addressing can be selected by
opening four traces on the backplane. All bus transactions are
asynchronous.

Note that both the foundation module and the power supply board
plug into connectors along the lower edge and on opposite sides
of the backplane. This method leaves all six backplane slots free for the insertion of other system modules. The backplane is the central point from which DC power is distributed to the foundation module and to all integral peripheral storage units, as well as to the modules plugged into the backplane itself.

The backplane also provides d-c power connections to the two cooling fans. Three levels of fan speed are obtainable. Either of the two slower fan speeds is selectable from the front panel or the console (using SENSE commands), depending upon noise and cooling requirements. The third (and fastest) level of fan speed is obtainable by making jumper connections on the backplane. Depending upon the jumpers selected, either or both fans can be set to operate at a constant maximum speed.

FRONT-PANEL AND BACK-PANEL CIRCUITS

As shown in Figure 1-8, the front panel contains a 16-character display and seven pushbutton switches. The display is driven by the SENSE circuits on the foundation module. SENSE causes various menus associated with its four main system functions to appear on the display. These four functions are: Status, Configuration, Operation, and Evaluation. The seven pushbutton switches on the front panel are used to invoke and control various phases of SENSE operation. These functions include: moving from menu to menu; advance to next item within a menu; going back to previous item within a menu; selection of a displayed menu, item within a menu, or a command; restart; CPU run/halt; and write-protect of Winchester drives. See Sections 5 through 9 of this manual for a full description of SENSE operation and commands.

The front panel also contains an ON/OFF switch that controls the application of DC power to all units of the SMS 1000. This switch is located behind the door on the front panel. Power consumption with a-c on and d-c off is negligible.

The rear panel (Figure 1-8) contains all external connectors for RS-232 communication with units such as terminals, printer, or to additional users or peripherals. The rear panel also contains cutouts to permit the addition of other connectors and external cables. All cutout shapes and dimensions are DEC compatible. Jumpers behind the rear panel permit selection of the 20-ma current-loop communication mode in conjunction with user-supplied equipment.
SYSTEM OVERVIEW

SMS 1000: POSSIBLE PERIPHERAL COMBINATIONS

LEGEND:
W0 = 5¼˝ Winchester 0
W1 = 5¼˝ Winchester 1
5F0 = 5¼˝ Floppy 0
5F1 = 5¼˝ Floppy 1
8F = 8˝ Floppy
T = 5¼˝ Streaming tape drive

Fig. 1-7  System Peripheral Configurations
Fig. 1-8  Functional Block Diagram of SMS 1000 Model 40
SYSTEM OVERVIEW

POWER SUPPLY

The power supply for the SMS 1000 (Figure 1-6) is contained on a single board that plugs into an 80-pin connector on one edge of the backplane board. The a-c input power connector and the AC ON/OFF switch are located on a bracket at the rear of the power-supply board. The a-c input receptacle also includes a line filter.

The power supply provides operating voltages to all units of the SMS 1000 including peripherals mounted in the cabinet. These voltages include +5 volts, +12(P) volts (to peripherals), +12(C) volts (to the backplane), -12 volts and +24 volts. The input a-c power source can be in either of two selected ranges: 90 to 130 volts or 180 to 250 volts. The input frequency can vary from 47 Hz to 63 Hz without causing a degradation of output. The power supply has both overvoltage and overcurrent protection features. An input line fuse is also provided.

An ON/OFF switch behind the front-panel door is provided to control application of d-c power to the SMS 1000. Use of this switch effectively turns off the entire system while a-c continues to be applied to the power-supply input, ready to activate the system without turn-on delays.

EQUIPMENT SUPPLIED

The following table describes both the basic SMS 1000 system that is common to all configurations and also describes the user-selectable modules, options and peripherals that are available with this system.

<table>
<thead>
<tr>
<th>TABLE 1-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQUIPMENT SUPPLIED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAME</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC SYSTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LSI-11 0004530-0001</td>
<td>This is a 22-bit bus. It contains six quad-width slots that can accommodate any Q-bus compatible card of dual or quad height. 18-bit addressing is selectable by opening four jumpers on the backplane.</td>
<td></td>
</tr>
</tbody>
</table>
NOTE: In Model 40 systems that have a CAUTION label on the rear of the cardcage supporting structure (see Figures 1-5B and 1-6), the C-D connectors of backplane slots 1 and 2 have been rewired to allow for use of certain quad-width CPU cards. Because of this rewiring, dual-width cards plugged into the C-D connectors of slots 1 or 2 may be damaged. The A-B connectors of slots 1 and 2 function in the same manner as before the change.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Panel 0004559-0001</td>
<td>Contains 16-character readout and seven pushbutton switches that provide communication with the SENSE Monitor. Also contains d-c ON/OFF switch (behind door).</td>
</tr>
<tr>
<td>Rear Panel 0004561-0001 Assembly</td>
<td>Contains AC power switch and external connectors. Removable panels permit addition of extra connectors, depending upon configuration. Jumpers behind the rear panel permit optional selection of the 20-ma current-loop mode in conjunction with user-supplied equipment.</td>
</tr>
<tr>
<td>Floor-mount, table-mount or rack-mount system enclosure 0004562-0001</td>
<td>Provides mounting locations for all components of the system, including various choices of peripherals. Also contains cooling fans. Rack-mount configuration includes slides.</td>
</tr>
<tr>
<td>Foundation module 1002086-0001</td>
<td>Contains peripheral control circuits; two RS-232 serial ports; Q-bus control circuits; and all circuits necessary to run the SENSE monitor.</td>
</tr>
<tr>
<td>Power supply 9001076-0001</td>
<td>Switch-selectable for input a-c power of 115 or 230 volts. Provides +5, +12, +24 and -12 volts to the SMS 1000. Power-supply fuse is accessible through opening on rear panel.</td>
</tr>
</tbody>
</table>

USER-SELECTABLE CPU MODULES

<table>
<thead>
<tr>
<th>CPU Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSI-11/23 SMS No.: CPU23.</td>
<td>KDP11-AA dual-width board. 16-bit CPU with memory management.</td>
</tr>
</tbody>
</table>
LSI-11/73  
CPU73.  
KDJ11-AB dual-width board. 16-bit CPU with 8KB cache, floating point and memory management. Can accommodate FP-73 floating-point upgrade option.

<table>
<thead>
<tr>
<th>USER-SELECTABLE MEMORY MODULES</th>
</tr>
</thead>
</table>
| 256KB Card  
MEM256.  
22 bit addressing. Does not support block mode. This option includes the MSVll-LK module or equivalent, integration and test. |
| 512KB Card  
MEM512.  
22-bit addressing. Supports block mode. This option includes the MSVll-PL module or equivalent, integration and test. |
| 1024KB Card  
MEM1024  
22-bit addressing. Supports block mode. This option includes a CMV-1000 or equivalent module, SMS strapping, integration and test. |
| 2048KB Card  
MEM2048  
22-bit addressing. Supports block mode. This option includes a CMV-504 or equivalent module, SMS strapping, integration and test. |

<table>
<thead>
<tr>
<th>OTHER USER-SELECTABLE MODULES</th>
</tr>
</thead>
</table>
| Serial Line  
DLV4.  
Interfaces four asynchronous serial RS-232 I/O ports to the LSI-11 bus. This option includes the DLVII-J dual-height module, or equivalent, internal cables, rear panel plate, integration, and test. |
| Four-Port MUX  
DZQ4.  
Enables program-controlled multiplexing of four asynchronous serial lines with modem control on all lines. Interfaces RS-232 I/O lines to the LSI-11 bus. This option includes the DZQ11 dual width module, or equivalent, internal cables, rear panel plate, integration and test. |
| Eight-Port MUX  
DHV8.  
This option is an asynchronous multiplexer which provides eight full-duplex asynchronous serial data |

SMS 1000  
1-22
channels for Q-bus systems. Applications include data concentration, terminal interfacing, and cluster controlling. The DHV8 option includes the DHV11 quad width module (or equivalent), internal cables, rear panel plate, integration and test.

| Floating Point Microcode Option for LSI-11/23 CPU | SMS No.: FP11. | Provides single- and double-precision floating-point capability for the LSI-11/23 (KDF11-AA) CPU. This option consists of the KEP11-AA 40-pin dual-chip carrier, which mounts on the KDF11-AA CPU board. NOTE: When this option is added to an LSI-11/23 board, no changes to jumpers are necessary. |

| Floating Point Accelerator for LSI-11/73 CPU | SMS No.: FP73. | 15 MHz CPU accelerator for the LSI-11/73. The FP73 option consists of the FPJ11-AA accelerator board, which mounts on the KDJ11-AB CPU board. |

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**USER-SELECTABLE PERIPHERALS**

<table>
<thead>
<tr>
<th>Slimline Floppy (8&quot;&quot;)</th>
<th>SMS No.: 9001258-0001</th>
<th>Tandon Model TM848-2E, double sided/double density, or equivalent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slimline Floppy (5-1/4&quot;&quot;)</td>
<td>SMS No.: 9001256-0001</td>
<td>Panasonic Model JU465, double sided/96 TPI, or equivalent.</td>
</tr>
<tr>
<td>Winchester hard-disk drive (5-1/4&quot;&quot;)</td>
<td>SMS No.: 9001006-0001</td>
<td>12 MB. Full height. Seagate Model ST412; Computer Memories Inc. (CMI) Model CM5412; or equivalent.</td>
</tr>
<tr>
<td></td>
<td>SMS No.: 9001385-0001</td>
<td>12MB. Half height (4 Heads). Seagate Model ST212, or equivalent.</td>
</tr>
<tr>
<td></td>
<td>SMS No.: 9001468-0001</td>
<td>12MB. Half height (2 Heads). Seagate Model ST213, or equivalent.</td>
</tr>
</tbody>
</table>
9001024-0001 19 MB. Seagate Model ST419; Computer Memories Inc. (CMI) Model CM5619; or equivalent.

9001336-0001 25MB. Half height. Seagate Model ST225, or equivalent.

9001081-0001 42 MB. Quantum Model Q540, or equivalent.

9001135-0001 70 MB. Vertex Model V170, or equivalent.

9001331-0001 85 MB. Maxtor Model XT-1085, or equivalent.

9001136-0001 140 MB. Maxtor Model XTL1140, or equivalent.

5-1/4" Cartridge-type Winchester disk drive (slimline) 9001292-0001 12MB. DMA Systems Inc. Model 360, or equivalent.

9001296-0001 Removable 12MB cartridge for DMA Systems Inc. Model 360, or equivalent.

9001524-0001 12MB. SyQuest Model SQ312RD.

9001525-0001 Type SQ200 removable cartridge used with SyQuest Model SQ312RD drive.

5-1/4" Cartridge-type streaming tape drive (slimline) 9001315-0001 Tandberg TDC 3309 9-track drive with TDC 3350 Mk. II QIC-02 formatter board.

9001056-0001 DC600A-type 1/4"-inch data cartridge for use with streaming tape drive.

9001425-0001 Interface module for use with streaming tape drive when file-tape option is installed. For a full description of the file-tape option refer to Appendix H.

Start-stop SMS No.: This is a cartridge-type stand-alone unit with its own power supply. Includes cables for connection to SMS 1000.

1/4-inch Tape Drive FWT01180
SYSTEM OVERVIEW

SYSTEM CHARACTERISTICS

The following table lists various physical and operational characteristics of the SMS 1000.

<table>
<thead>
<tr>
<th>TABLE 1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM CHARACTERISTICS</td>
</tr>
<tr>
<td>CHARACTERISTIC</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Rack-mount system</td>
</tr>
<tr>
<td>Height</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Depth</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Table-mount system</td>
</tr>
<tr>
<td>Height</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Depth</td>
</tr>
<tr>
<td>Floor-mount system</td>
</tr>
<tr>
<td>Height</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Depth</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Operating temperature</td>
</tr>
<tr>
<td>Storage temperature</td>
</tr>
<tr>
<td>Humidity</td>
</tr>
<tr>
<td>Altitude</td>
</tr>
<tr>
<td>Supply voltage and current</td>
</tr>
<tr>
<td>Supply frequency</td>
</tr>
</tbody>
</table>

SMS 1000  
1-25
**SYSTEM OVERVIEW**

| DC power supply output voltages | +5 volts at 45 amps.  
|                                | +12(C) volts at 4 amps to backplane (cardcage).  
|                                | +12(P) volts at 10 amps to peripherals.  
|                                | -12 volts at 4 amps.  
|                                | +24 volts at 2 amps for peripherals and fans.  
|                                | Supply has automatic short-circuit protection. All d-c voltages are regulated.  
| Maximum peak-to-peak ripple and noise is 50 millivolts for +5 volts, and 100 millivolts for all other voltages, when measured under a constant load of at least 250 watts.  
| Maximum power output is 325 watts. |

---

| DC ON/OFF switch | Located behind door on front panel. Controls all d-c power to system. |

---

| Cooling | Two fans, each under independent front-panel control, can be set at either a low or medium speed. Also, a third (and highest) speed for either fan can be selected by means of a jumper setting on the backplane. |

---

| R-F Interference | Meets or exceeds FCC Class A requirements. |
SECTION 2

SITE SELECTION

SITE SELECTION CONSIDERATIONS

In selecting a site for installing your SMS 1000 the main considerations relate to such matters as temperature, air flow, air quality (i.e., contaminants in the air, etc.), input a-c line quality and dependability, traffic pattern near the machine, and security. In general, an office environment that is comfortable for people is suitable for the SMS 1000. Place the SMS 1000 where it has adequate air circulation. It is especially important to provide free air flow to the fan inlet, which must not be blocked by cables or mounting hardware.

In selecting a site for the SMS 1000 system, attention must also be paid to the following points:

1. ROOM ATMOSPHERE. Avoid areas having high levels of dust or other particulates, or vapor-type contaminants in the air. Also, extremes of heat, cold and humidity must be avoided. If the system is used in an environment that has very low humidity, it is advisable to employ antistatic measures. Such measures include spraying with an antistatic aerosol spray, using antistatic carpets and mats, or placing the system on a tile floor instead of a carpet.

2. TRAFFIC PATTERN. If the SMS 1000 is to be floor mounted, pay attention to the traffic pattern in the vicinity of the unit. Avoid wire runs that are not protected from floor traffic. Also, avoid locations where passing traffic is likely to raise a significant amount of dust.

3. WIRE RUNS. In planning wire runs to terminals and printers, observe the RS-232 requirements regarding line length, shielding and adequacy of grounding.

4. INPUT A-C LINE. The a-c input source to the system must be as dependable as possible and free from surges,
noise and spikes. It may be necessary to plan the use of a dedicated line and to employ line-protection and conditioning devices such as isolation transformers, line voltage regulators, surge protectors, line filters, shielding, etc.

5. MAINTENANCE ACCESSIBILITY. Be sure that the system location allows easy accessibility for routine maintenance. In particular, with floor-mounted units, be sure that cables to the unit are long enough to permit the system to operate when pulled from its normal location to an area that allows accessibility for service. For diagrams showing actual system dimensions, refer to Figures 3-1, 3-2, and 3-3 (for the Models 40 and 41); and G-2 and G-3 (Model 50).

6. SITE SECURITY. Pay attention to the security aspects of potential sites. Avoid high-traffic sites and sites in which access to your SMS 1000 cannot be adequately controlled. Remember that no system or software can be made totally secure and that there is, therefore, no substitute for the security awareness and security training of each individual who works with that system.

7. ANALYSIS OF COMPUTER SECURITY. If proprietary, financial or other sensitive information is stored in your system, having a computer-security professional perform an analysis of (1) your physical- and procedural-security policies and (2) the adequacy of their implementation, will always repay the effort.

8. PROXIMITY TO OTHER EQUIPMENT. Because magnetic fields and radiated emissions can have adverse effects on disks, the SMS 1000 system should not be located near sources of these emissions. Some typical examples of such sources include electric motors, particularly large ones that are not properly shielded; copying machines; X-ray machines; elevators; certain types of telephones; and stereo equipment.

9. RADIATION. Site planning must take note of the fact that the SMS 1000 is designated as an FCC class A computing device and is therefore designed exclusively for commercial environments. The SMS 1000 is not meant for use in residential areas.
SITE SELECTION

SYSTEM GROUNDING

The SMS 1000 signal ground is connected to the chassis at the power supply. The chassis is then connected to the ground wire of the a-c input. Safety demands that ground continuity be provided at the user's installation. The three-wire a-c line supplied with the system provides such ground continuity.
SECTION 3

SYSTEM INSTALLATION
AND
POST-INSTALLATION CHECKOUT

UNPACKING

Before unpacking the system, check the shipping containers for obvious damage. Report any damage to the shipper before unpacking the system. As unpacking proceeds, exercise normal industrial-safety precautions with respect to such matters as lifting, breakage, etc.

Next, check the system for any damage that may have happened during shipment. Also, check each item against the packing slip to be sure that all items have been received. Proceed with unpacking as follows:

1. Cut the nylon bands binding the shipping package.
2. Lift off the top cover of the shipping box.
3. Remove the four corner-type foam blocks from the inner-box top cover.
4. Lift off the inner-box top cover.
5. Remove the foam protective top from the SMS 1000 computer unit.
6. Now lift the computer unit from the shipping box. CAUTION: The computer weighs approximately 50 pounds. Because of its weight and its size, two people may be required to lift the computer out of the box.
7. Remove the plastic wrapping from the computer.
8. Remove the system's side panels (in the case of
floor-mounted units) and the front and rear panel. See Section 10 of this manual for removal/replacement instructions. Check all boards to be sure that they are firmly seated in place in the backplane. Also, make sure that all other components and connectors are securely in place. If any internal cables are not connected, refer to the appropriate interconnection cabling diagram, Figures 10-14 through 10-21, for the correct connection.

CAUTION

In the case of floor-mounted units check to be sure that all foam packing used in shipping has been removed from the pedestal. If it is not removed, the flow of cooling may be seriously impeded.

9. After completing inspection followed by replacement of panels, floor-mounted units are ready to be moved to their working locations.

INSTALLING RACK-MOUNTED SYSTEMS

After unpacking is complete, the following steps must be performed in order to install the slides of rack-mounted units:

1. Rack-mounted SMS 1000 systems come equipped with three-section slides. The inner rail of each slide is bolted to the SMS 1000 system case. The two outer sections are separable from the inner rail so that the slides can be installed in the rack before installing the computer itself. To do this, first pull apart the two outer sections of a slide until stopped by the innermost catch. The release-arm of the catch will now be visible. Press down on this catch so that the two outer slide sections can be pulled free. Do this with both slides.

2. Install the removed slide sections in the desired position on the rack using 10-32 mounting hardware.

3. Now slide the SMS 1000 back into the slide rails on the rack. Because of the size and weight of the unit, two people should be used for this operation. After partial insertion into the slide rails, the inner spring-loaded latch will close and stop further slide movement. For complete insertion press down on the levers of the spring-loaded latches on both slides and push the unit the rest of the way into the rack.
Fig. 3-2  SMS 1000 Rack-mount configuration

NOTE: THIS UNIT FITS INTO ANY 19" EIA STANDARD (RS-310) OR RETMA RACK WITH A 17.75" MINIMUM OPENING.
SELECTION OF 115-VOLT OR 230-VOLT A-C POWER

The SMS 1000 system can operate on either of two ranges of input power: (1) 90 to 130 volts ac, nominally 115 volts; or (2) 180 to 250 volts ac, nominally 230 volts. Either type of operation can be selected by making a corresponding setting of a rotor-type cam that actuates the voltage-selection switch at the rear of the system enclosure. Note, also, that for each supply voltage there is a correct size of power-supply fuse that must be used. These will be described in the following procedure. See Figure 1-6 for location of the fuse and voltage-selection compartment. To make the fuse selection and voltage setting, proceed as follows:

CAUTION

An incorrect voltage setting can damage your SMS 1000. Before applying power, be sure you know what the line voltage is, that you have made the corresponding voltage setting on the SMS 1000, and that you have the correct power-supply fuse installed.

1. REMOVAL OF POWER. Turn off the SMS 1000 a-c switch on the rear panel and then remove all input power by unplugging the a-c power cord from the receptacle at the rear of the enclosure.

DANGERS

Potentially lethal voltages can be encountered in the power supply for as long as two minutes after a-c power is removed from it. Therefore, wait at least two minutes after removing power before working on it.

2. FUSE SELECTION. Using a small screwdriver, carefully pry open the fuse- and voltage-select door at the rear of the enclosure, as shown in Figure 1-6. There is a slot for prying open the door at its left edge.
Fig. 3-3  SMS 1000 Table-mount configuration
SYSTEM INSTALLATION AND CHECKOUT

3. Using a small screwdriver, carefully pry out the white plastic fuse holder from the fuse compartment. If the system is to be set for 115-volt operation, the fuse must be a Buss type ABC (ceramic body), or equivalent, rated at 6 amps. If the system is to be set for 230-volt operation, the fuse must be the same type, but rated at 3 amps.

4. Place the correct fuse in the fuse holder, replace the holder in the fuse compartment, and press the holder all the way to the end of its travel.

5. VOLTAGE SELECTION. Carefully remove from the compartment the irregular-shaped cam having the markings "115Vac" and "230Vac". Note that the shafts on each end of the cam are of different diameters and that they fit into corresponding-width slots. Thus, the cam cannot be re-installed backwards.

6. Turn the cam so that, depending upon the system operating voltage desired, either of the two "115Vac" cam markings, or either of the two "230Vac" cam markings, is facing you after the cam is replaced in its slots.

7. After the cam has been replaced, with the desired voltage marking facing outward, firmly close the compartment door. Be sure that it is fully closed and that the selected voltage setting can be seen through the opening in the door after closure.

8. Reconnect the a-c power cord to its receptacle on the rear panel. Power can now be re-applied to the system.

FLOPPY DRIVES: REMOVAL OF SHIPPING INSERTS BEFORE USE

As received from Scientific Micro Systems, most floppy drives contain a cardboard shipping insert in the disk slot. It is imperative to remove this insert before turning on the drive. To remove the insert after unpacking, you need only open the drive's door slot and pull out the insert by its protruding tab. NEVER turn on your SMS 1000 system while one of these inserts is in a drive.

CONNECTION TO CONSOLE AND PRINTER

The next step in installation is to make connections to external units such as a video terminal or printer. Usually, a terminal is connected using the rear-panel connector marked "A0 (CONSOLE)" (see Figure 1-3). Also, a printer would use the
SYSTEM INSTALLATION AND CHECKOUT

rear-panel connector marked "Al (PRINTER)". This corresponds to the following SMS 1000 console-port default settings:

1. Console port enabled
2. Console uses port A0
3. BREAK = HALT

If you wish to change these default settings to match the special requirements of your system, refer to the ADDRESSES menus and the CONSOLE SETTING menus (under SERIAL PORTS), both part of Chapter 9 of this manual.

Your SMS 1000 can operate with virtually any type of terminal or printer having an RS-232 serial interface. Both console and printer use the same type of interconnection cable. This cable is a DEC type BC22A, or equivalent, with 25-pin female EIA RS-232 connectors at both ends. The cable must be wired in a null-modem configuration with pins 2 and 3 cross connected, that is, with pin 2 at one end connected to pin 3 at the other end, and pin 3 at the first end connected to pin 2 at the other. This cabling also requires the connection of the two pin 7's and the ground pins.

SETTING UP CONSOLE TERMINAL FOR COMMUNICATION WITH SERIAL PORT A0 OR A1

IMPORTANT

In the following procedure, if you wish to reconfigure any of the characteristics of either of the two SMS 1000 serial ports (A0 or A1), you must communicate with the CONFIGURATION menus of SENSE through the SMS 1000 front-panel controls and 16-character readout. Terminal characteristics listed in capital letters (e.g. "DUMB") refer to CONFIGURATION menu options. Refer to Section 9 of this manual.

Set the communication parameters in your terminal to match the characteristics of the selected serial port (A0 or A1) as follows:

1. TERMINAL TYPE. The terminal-type default in the SMS 1000 is DUMB. This means that your terminal, whether smart or dumb, will interact with the system as though it were dumb until you change the TERMINAL TYPE option in the SERIAL PORTS portion of the CONFIGURATION menus under SENSE. Note that the console port default is A0. If you wish to configure A1 as the console port instead of A0, refer to the CONSOLE
SETTING option of the SERIAL PORTS menus. If you have a smart terminal and want to change TERMINAL TYPE to SMART, set your smart terminal to VT100 emulation mode. Note that a dumb terminal will not operate properly with TERMINAL TYPE set to SMART.

2. BAUD RATE. The SMS 1000 baud rate default is 9600. If your terminal operates at a different rate, enter this baud rate using the BAUD RATE menu in the SERIAL PORTS section of the CONFIGURATION menus.

3. NUMBER OF DATA BITS. The SMS 1000 default for this parameter is 8 bits. If your terminal operates at 7 data bits, change to this value using the DATA BITS menu in the SERIAL PORTS section of the CONFIGURATION Menus.

4. PARITY. The SMS 1000 default for this parameter is NO PARITY. If your terminal operates with odd or even parity, make the corresponding change using the PARITY BIT menu in the SERIAL PORTS section of the CONFIGURATION menus.

5. STOP BITS. The SMS 1000 default for this parameter is ONE stop bit. If your terminal operates with two stop bits, make the corresponding change using the STOP BITS menu in the SERIAL PORTS section of the CONFIGURATION menus.

6. ADDRESS AND VECTOR ASSIGNMENTS. If you want to change the address and vector assignments for ports A0 and A1, refer to the ADDRESSES and CONSOLE SETTING portions of the CONFIGURATION menus (Chapter 9).

POST-INSTALLATION CHECKOUT

After installing your system in its working location, making connections to external units and plugging in both the SMS 1000 and the external units to a-c power, the next thing to do is to perform a confidence test of system operation. Proceed as follows:

CAUTION

Before applying power to the system for the first time, be sure that the supply voltage (i.e. 115V or 230V) shown in the window next to the power-cord receptacle is the same as
the line voltage at the wall receptacle to be used. If your system is set for 115 volts and it is plugged into a 230-volt source, a power-supply fuse will blow, and damage to other components will occur. If your SMS 1000 is set for 230 volts and it is plugged into a 115-volt receptacle, the system will not operate at all, although it will not be damaged.

1. APPLYING POWER. Apply a-c power by pressing the "l" side of the switch at the rear of the system enclosure (see Figure 1-3). A light in the a-c switch will glow as long as a-c power is applied. Next, apply d-c power to the system by opening the door on the front panel and pressing the d-c power switch to its "l" position.

2. VIDEO DATA TERMINAL. Apply a-c power to your video data terminal (refer to the terminal-connection and interfacing instructions given earlier in this section). Note that the following procedure for checking out initial system operation is based on use of a video data terminal. (Although it is possible to configure the system in such a way that booting in the absence of a terminal (i.e. from the front panel alone) is possible, it is not recommended because the front-panel controls are only set up for such things as restart, run/halt and write protect, but not for any other type of communication with a running program).

3. SELF TEST: GENERAL. For a short period after d-c power is applied, the front panel display flashes:

   POWER-ON/RESTART

and the system performs a multi-step automatic self-test sequence. Note that during the self test procedure, an LED on the front edge of the System Foundation Module (see Figure 1-4) will turn on for the duration of the tests (about a second). If the system fails any part of the self test, the LED will remain on. For diagnostic purposes, the system can be operated with the front panel removed and hanging by its safety wires so that you can observe the state of the LED during self test.

The self-test sequence includes steps 4, 5, and 6 of this procedure.

4. EPROM VERSION TEST. The first thing the system does is to compare the current controller firmware version number stored in the Foundation Module EPROM with the corresponding version
number read from the EEPROM (i.e. the electrically erasable and reprogrammable read-only memory in which various configurable system characteristics are stored). If the numbers match, the test goes to its next step (Step 5 of this procedure). If the numbers do not match, it means that the EEPROM must be reloaded from the EPROM and the following two front-panel messages are displayed in sequence:

EEPROM mismatch!
Re-load EEPROM?

You must press the "*" button on the front panel to initiate the EEPROM reload sequence. During the reload the front panel will display the message:

Changing EEPROM!

Once the EEPROM has been reloaded from the EPROM the following messages are displayed on the front panel:

Please reconfig!
Please RESTART!

These messages remind the operator that when EEPROM is reloaded from EPROM, all configuration parameters are returned to the default values stored on the EPROM and, thus, previously configured (i.e. non-default) values that were entered by means of the CONFIGURATION menus of SENSE are lost. Therefore, to start the re-configuration process, you must first press the RESTART and "*" buttons simultaneously and then enter SENSE (as described in Step 19 of this procedure). Next, reconfigure by means of the CONFIGURATION menus, as described in Section 9 of this manual. After reconfiguring, you must again restart the system by pressing the front-panel "*" and RESTART buttons simultaneously.

NOTE

At any time during the complete start-up process, as well as when the system is running applications, you can restart from the beginning of the self-test sequence by simultaneously pressing the RESTART and "*" buttons on the front panel.

5. HARDWARE SELF-TEST. After performing its test of firmware version-number compatibility (see previous step), the system then performs a self test of major hardware components. If this test runs to completion without detecting any failures, the following message is displayed, only if the system has been restarted from a power-off condition:
Self Test OK

and the test goes on to Step 6 of this procedure. This message is not displayed if the self test took place during a restart, i.e. as the result of simultaneously pressing the RESTART and "*" buttons.

If an error is detected, the following error message is displayed:

Self Test Err <nn>

where nn is the decimal number of the self-test error that was detected. The self-test error numbers and a description of the corresponding errors are listed in Appendix E. Note that some types of error are sufficiently severe that no front-panel error display is possible. In the case of all displayable errors, however, the operator has the option of continuing processing by pressing the "*" button on the front panel.

6. CHECKSUM TEST. In this test, a checksum test is performed on the contents of the EEPROM. If there is no checksum error, the system goes to Step 7 of this procedure.

If a self-test checksum error is reported, the following message is displayed on the front panel:

Self Test Err256

See Table E-1 of Appendix E for descriptions of this and other self-test error messages. The above message means that if processing continues, correct results cannot be assured. In this case, pressing the "*" button (in order to continue) produces the message:

Re-load EEPROM?

To reload the EEPROM from the EPROM you must again press the "*" button. This starts the reload process during which the following message is displayed:

Changing EEPROM!

At the completion of the reload the following two messages are flashed in sequence:

Please reconfig!
Please RESTART!
These messages remind the operator that when EEPROM is reloaded from EPROM, all configuration parameters are returned to the default values stored in the EPROM and, thus, previously configured (i.e., non-default) values that were entered by means of the CONFIGURATION menus of SENSE are lost. Therefore, to start the re-configuration process, you must first press the RESTART and "*" buttons simultaneously and then enter SENSE (as described in step 19 of this procedure). Next, reconfigure by means of the CONFIGURATION menus, as described in Section 9 of this manual. After reconfiguring, you must again re-enter the system by simultaneously pressing the front-panel "*" and RESTART buttons.

7. MEMORY SIZING. At the completion of self test the host memory size is measured, during which the message:

MEM sizing

is flashed on the front panel display. At the completion of the measurement, the memory size in K words (KW) is added to the end of the "MEM sizing" message.

NOTE

In performing tests on Winchester drives during the power-up sequence, the system tests access to each drive. The order followed in these tests is: Winchester 0, Winchester 1, cartridge-Winchester 0. The following steps apply only to those systems that are configured to include one or more Winchester drives.

8. WINCHESTER SPINUP. As soon as d-c power is applied, any Winchester drives in your system are energized and start to come up to their normal rotational speed. Note that, starting with the application of power, there is a fixed time delay before the system can load and run programs. This delay, which is configurable in the WINCHESTR SPINUP portion of the CONFIGURATION menus (see Section 9 of this manual), has a default value of 20 seconds. This corresponds to the spinup delay of most fixed-disk Winchester drives. Cartridge-type Winchesters require a delay of at least 45 seconds. During the delay period, the message

Winchestr spinup

is displayed on the front panel. When each Winchester drive is up to speed and initialized, the following message is displayed:
SYSTEM INSTALLATION AND CHECKOUT

xx ONLINE OK

where xx can be W0, W1 or C0, depending upon how your system is configured. The abbreviations W0, W1, etc. are defined as follows:

W0 = Fixed-disk Winchester 0
W1 = Fixed-disk Winchester 1
C0 = Removable-cartridge Winchester 0

9. WINCHESTER FLAW TABLES. After spinup, the system looks for the flaw table stored on each Winchester drive in order to read it into controller RAM. If this is done successfully, the following message is displayed and the system then goes on to Step 10 of this procedure:

xx FlaTbl OK

where xx can be W0, W1 or C0, depending upon how your system is configured.

If the flaw table cannot be successfully loaded, one of the following two messages is displayed:

xx FlaTbl Err nn
xx FlaTbl Bad

where xx can be W0, W1 or C0, depending upon how your system is configured; and nn is the decimal number assigned to the error as listed in Table E-3 of Appendix E.

NOTE

If the EEPROM was reloaded prior to this step and you have not yet reconfigured the system, then a flaw-table error is always generated.

The first message indicates that, for the reason listed in Table E-3, the flaw table cannot be read from disk. The second message will appear in place of the first if the table can be read but the contents are invalid. If either message is issued, you can escape by pressing the "*" button on the front panel. This causes a so-called "null" flaw table (i.e. an empty flaw table) to be built, and the following message to be displayed:

xx Entries = 0

where xx can be W0, W1 or C0, depending upon how your system is configured. CAUTION: with a null flaw table,
you must be aware that hard disk flaws are no longer known and automatically passed over, and that data already stored on spare sectors is not accessed until the flaw table is fully restored. This means that continued processing has a high degree of risk of data being corrupted. Hence, it is advisable to contact your service organization in order to restore the flaw table.

If the flaw-table error message was issued for C0, then the following additional message appears:

**C0 Ready?**

This message is issued to cover the situation in which the only problem with C0 is that you may have forgotten to insert a cartridge or to close the drive door. If this is the problem, insert the cartridge or close the door and press the front-panel "*" button. The system will now repeat the last sequence of steps, starting with Winchester spinup.

Another possible cause of the error may be that the spinup delay configured into the system is too short for a cartridge-type Winchester. This type of drive requires a spinup delay of at least 45 seconds. If this is the problem, reconfigure, using the WINCHESTRE SPINUP portion of the POWER-ON/RESTART menus, as described in Section 9 of this manual.

If you deliberately did not load a cartridge into the cartridge Winchester, then press the "->" button (right arrow, indicating a "no" response). The system then displays the message:

**Not Ready?**

Press the front-panel "*" button (i.e. a "yes" response). This tells the system that the absence of a cartridge in C0 is deliberate and to continue with power-on processing.

10. WINCHESTER ACCESS TEST. An access test is now performed on each Winchester. This test attempts to read a sector from the first track on the last configured cylinder. If the access is successful, the following message is displayed and the system goes to Step 11 of this procedure:

**xx Access OK**

where xx can be W0, W1 or C0, depending upon how your system is configured.

If the track cannot be accessed, for example, because the actual number of cylinders does not agree with the configured
value stored in EEPROM, the system returns the message:

    xx Access Err nn

where xx can be W0, W1 or C0, depending upon how your system is configured and nn is the error number as listed in Table E-3 of Appendix E. Proceed by pressing the "**" button on the front panel. The system then sends the following message, which warns that there may be a conflict between the actual hardware and how the system is configured:

    Check config!

Also, any time the Winchester under test is write protected, the system sends the following message:

    xx Writ Prot

where xx can be W0, W1 or C0, depending upon how your system is configured.

11. A row of stars ("****") is now scrolled across the front-panel display. This signifies that the system is now ready to branch to the next phase of the power-up sequence: that is, either booting the host or calling SENSE.

12. OPTIONS FOR OPERATION AT THE CONCLUSION OF INITIAL TESTS. Depending upon how your system is configured, (see STARTUP MODE portion of the CONFIGURATION menus in Section 9 of this manual) there are three possible modes of going into full operation. These are:

    (1) The as-shipped (i.e. default) option is for the system to go automatically into bootstrapping the host at the completion of the initial tests described in this procedure. Bootstrapping is discussed in Step 13.

    (2) A second option is for the system to automatically call the SENSE menus. This mode can be selected by means of the POWER ON/RESTART portion of the CONFIGURATION menus.

    (3) The third option involves testing and exercising the system and is of interest primarily to system engineers.

NOTE

If you wish to run SENSE either in stand-alone mode or concurrently with the host, go to Step 19 of this
procedure.

13. BOOTING THE HOST. After the system passes all steps of the preceding tests, it then goes directly to the start of bootstrap mode. The booting process is indicated on the front panel by the rapid flashing of the message:

Booting host

The system then boots in the manner described in Step 14 of this procedure.

If any kind of hardware failure prevents booting, the following front-panel message is displayed:

Boot failure

This message could be caused by such types of failure as a bad or missing CPU card, an incorrectly strapped CPU or memory card, bad or missing memory cards, or a bad Foundation Module. If the system senses a bad or missing CPU, the "Boot failure" message is replaced by the message:

Bad CPU?

If the system senses bad or missing memory cards, the "Boot failure" message is replaced by the message:

No memory?

If any of these three messages appears, the booting process goes no further and your support organization should be informed. NOTE: In this case, it is still possible to enter the SENSE menus by pressing the "*" button on the front panel.

14. AUTOBOOT TIMEOUT DELAY. After the display of the message "Booting host", there are three possible modes of booting the system, depending upon the configured autoboot delay. This delay period is configurable using the AUTOBOOT TIMEOUT portion of the CONFIGURATION menus (Section 9). The three delay modes are:

(1) ZERO DELAY. System immediately searches for first valid boot block among configured devices (see Section 9) in order to load and run bootstrap.

(2) CONFIGURED DELAY. During the configured delay period you enter the logical name and unit number of the boot device and the system searches it for a valid boot block. See Step 16 of this procedure for a discussion of logical-device names and numbers.
(3) DELAY TIMEOUT. If no boot device is entered before the end of the configured delay period, the autoboot sequence automatically searches for the first valid boot block among the drives configured in the BOOTSTRAP portion of the CONFIGURATION menus.

MODE (1). In the first mode, autobooting is immediate, that is, the timeout delay is zero. The user is informed of this mode by the message:

AUTO - BOOT

The configurable autoboot drive sequence (see BOOTSTRAP portion of CONFIGURATION menus) is used to load the first valid boot block.

MODE (2). In the second mode, the boot device name and unit number is entered manually and the time allotted for this purpose is configurable. The time can range from zero to an indefinite period. The as-shiped default value supplied with the system is 10 seconds. The following typical display (see sample screen below) appears on your video display terminal screen if the delay is non-zero. The sample screen shows typical responses of the RT-11 operating system and includes operator responses to the prompt:

ENTER DEVICE NAME AND UNIT NUMBER:

The purpose of this prompt is to allow you to choose an alternate drive for booting when special circumstances require it. For example, the stand-alone add-on tape unit (device name MS) is not part of the autoboot sequence and must be specified manually in order to be used as a boot device. The response "DUI" (see sample screen) means that a DU device with a unit number of 1 is being selected. In the sample screen, the operator responses are underlined.

MODE (3). The third mode occurs automatically if a valid device name and unit number is not entered within the autoboot timeout period. At the end of that period the response:

AUTO - BOOT

appears at the end of the "ENTER DEVICE NAME AND UNIT NUMBER" prompt on your terminal. The autoboot sequence then looks for the first valid boot block among the configured devices, booting takes place, and the logical-device unit number containing the boot block is displayed in the following format:

BOOTING FROM DEVICE <unit No.> [Displayed in autoboot only. See following sample screen.]
IMPORTANT

In order to boot from a peripheral device such as a floppy-disk drive it must contain a DU-bootable diskette. Similarly, to boot from a Winchester drive, it must have been created as a DU-bootable device.

---

SAMPLE SCREEN WHEN BOOTING SYSTEM (USING RT-11 SYSTEM)

- SMS 1000
- BOOTSTRAP
- 256KW MEMORY
- 11/73 CPU

BOOTABLE DEVICES:

<table>
<thead>
<tr>
<th>DEVICE NAME</th>
<th>DEVICE TYPE</th>
<th>UNIT NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DU</td>
<td>DSA</td>
<td>0-3</td>
</tr>
<tr>
<td>MS</td>
<td>TS</td>
<td>0</td>
</tr>
</tbody>
</table>

ENTER DEVICE NAME AND UNIT NUMBER: DU1 [Entry consists of two parts: Device name ("DU"), and Unit No. ("1"). Operator then presses Return.]

BOOTING FROM DEVICE 1 [Appears in autoboot only]

RT-11SJ V05.01

.SET TT SCOPE
.SET KMON IND
.SET EDIT KED

. (The RT-11 dot prompt shown at left means that the operating system is now ready for commands)

---

LEGEND

- DU - Disk device
- MS - External tape device
- DSA - Digital Storage Architecture
- TS - Tape System
15. BOOTSTRAP ERROR MESSAGES. If the specified boot device does not exist or is not recognized (for any reason) the following message appears on your terminal:

    ***DEVICE NOT IN SYSTEM***

If the response was misspelled, the following message is displayed and the prompt is repeated:

    ***ILLEGAL DEVICE***
    ENTER DEVICE NAME AND UNIT NUMBER:

If no boot block is found, the following message is displayed:

    ***NOT A BOOTABLE DEVICE***

If the specified unit is not online, the system returns the following message:

    ***UNIT OFF LINE***

If you are attempting to boot from an external tape device (device name MS) and a bad or blank tape is detected, the following message is displayed:

    ***TAPE READ ERROR***

If a valid boot block is not found on any of the devices searched in the autoboot sequence, the following message is displayed:

    ***NO BOOTABLE DEVICE IN SYSTEM***

At the conclusion of this message, the standard bootstrap screen (see sample screen above) is again displayed.

16. DESIGNATION OF LOGICAL DEVICE NAMES. Floppy and Winchester drives are designated with the prefix DU followed by a number. The numbers are assigned by SENSE according to the following rules:

(1) Fixed-disk Winchester drives are assigned the lowest DU numbers (starting with DU0).

(2) Floppy drives are assigned the next higher DU numbers.

(3) Removable-cartridge Winchester drives are assigned the highest DU numbers.

(4) No more than four devices can be specified.
NOTE

At present, no logical (i.e. DU) device name for host-type access exists for the integral image-oriented streaming tape drive that may be part of your SMS 1000 system. That is, booting cannot take place from an image-oriented streaming tape drive. Booting can, however, take place from a streaming tape drive operating in conjunction with a TSVO5 file-oriented tape interface module (see Appendix H), or from an external TSVO5-equivalent tape unit such as the SMS FWT01180.

For example, in a system with two fixed-disk Winchesters and two floppy drives, the device numbering would be as follows:

Winchester 0 = DU0
Winchester 1 = DU1
Floppy 0 = DU2
Floppy 1 = DU3

A second example might be a system with a cartridge Winchester drive, one fixed-disk Winchester drive, and one floppy drive. In this case the device designations would be:

Winchester 0 = DU0
Floppy 0 = DU1
Cartridge Winchester = DU2

In the sample screen shown above, the "DU" portion of the operator response (i.e. the response to the query "ENTER DEVICE NAME") designates a Winchester of either type or a floppy drive. Similarly, the response "MS" designates an external tape unit. The logical unit numbers 0 to 3 (for DU devices) and 0 (for an MS device) are designated in response to the portion of the query: "AND UNIT NUMBER".

17. CONVENTIONS WHEN SPECIFYING A BOOT DEVICE. When responding to the prompt "ENTER DEVICE NAME AND UNIT NUMBER", type the selected boot-device name and unit number (see previous steps) without a space (e.g. DU3) and followed by a carriage return.

18. SYSTEM RESPONSE AFTER BOOTING. If you have successfully bootstrapped from the designated unit, an operating-system message such as: "RT-11SJ" and a version number (as in the current example) now appears. In the operating system example shown here, these messages are also followed by a command string, and the RT-11 operating system's normal prompt of a single dot (i.e. ".") at the completion of the command string. The system is now in its normal operating mode and is ready to run your
applications, accept commands, etc.

19. RUNNING THE SENSE MONITOR IN STAND-ALONE MODE. Referring back to Step 12 of this procedure, if you wish to access SENSE at the conclusion of the initial system tests, press the front panel MENU button any time between the start of initial self tests and the display of a group of stars scrolling across the front-panel display (see step 11 of this procedure). This tells the system to display the SENSE menus rather than boot the operating system. When the group of stars moving across the front panel display goes away (after having pressed MENU), they are replaced by the message:

VDU prompting

which tells you to look at your video terminal (i.e. "VDU") for the message:

*HIT ANY KEY WITHIN TIME LIMIT*

You have a (configurable) time delay period in which to press any key on your terminal in order to select terminal display of the SENSE menus. If you wish to select front-panel operation of SENSE menus, simply allow the delay to expire or press the front-panel MENU button before the expiration of the delay. See the following steps.

20. SELECTING SENSE OPERATION FROM THE TERMINAL. When the message "*HIT ANY KEY WITHIN TIME LIMIT*" is displayed on your terminal you have about ten seconds in which to press a key on the keyboard. (NOTE: The delay period is configurable by means of the VDU ONLINE DELAY portion of the CONFIGURATION menus. The default value is ten seconds.) Pressing a key transfers control to the console. The system now indicates that you are at the start of the SENSE menus by displaying and highlighting the first word of the menus:

STATUS

on the video display. At the same time, the front panel displays a user-selected logo (entered from the SPECIAL section of the CONFIGURATION menus) or the "SMS 1000" default logo. Note that the RESTART, RUN/HALT, and WRT PROT buttons on the front panel can still be used during console operation.

NOTE

At any time during the complete start-up process, as well as when the system is running applications, you can restart from the beginning of the self-test sequence by simul-
SYSTEM INSTALLATION AND CHECKOUT

taneously pressing the RESTART and "*" buttons on the front panel.

21. SELECTING SENSE OPERATION FROM THE FRONT PANEL. During the (configurable) time delay period (the default is ten seconds) during which you can select either the front panel or the terminal, the message "VDU prompting" is displayed on the front panel. By allowing the time delay to elapse without hitting a key on the terminal keyboard (or by simply pressing the MENU button before the end of the delay), control of SENSE is given to the front panel, from which its menus can be accessed. The system now indicates that you are at the start of the SENSE menus by displaying the word:

STATUS

on the front-panel display.

22. RUNNING SENSE CONCURRENTLY WITH THE HOST. Once the host is booted and running applications, you can still run certain areas of SENSE at the same time as the host. To do this, after the host is running and a logo appears on the SMS 1000 front panel, press the front-panel MENU button. This will call SENSE and, after a brief delay, the word STATUS will appear on the front-panel display to indicate that you are at the start of the SENSE menu system. While in the menu system, if you attempt to perform a task that interferes with the host, the error message:

HOST IS RUNNING

is issued and the task is aborted.
SECTION 4

HARDWARE CONFIGURATION

INSTRUCTIONS

POWER-SUPPLY LOADING RULES

All of the following four basic power-supply loading rules, power-consumption specifications and individual-supply current limits must be observed when adding or changing modules in the card cage and when changing or adding peripheral units that receive their d-c power from the SMS 1000 power supply. The four basic rules are:

1. TOTAL POWER OUTPUT. The total power output must not exceed 325 watts (Model 40) or 500 watts (Model 50).

2. CURRENT OUTPUT PER SUPPLY. The total current drawn from any individual supply must not exceed the following values:

<table>
<thead>
<tr>
<th>SUPPLY</th>
<th>MAXIMUM CURRENT (AMPERES) (MODEL 40)</th>
<th>MAXIMUM CURRENT (AMPERES) (MODEL 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5 VOLTS</td>
<td>45</td>
<td>75</td>
</tr>
<tr>
<td>+12(C) VOLTS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>+12(P) VOLTS</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>-12 VOLTS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>+24 VOLTS</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

3. TOTAL 12-VOLT CURRENT (Model 40 only). The aggregate total current drawn from the three 12-volt supplies (i.e., +12(C) volts, +12(P) volts, and -12 volts) must not exceed 12 amps.

4. CURRENT CONSUMPTION OF INDIVIDUAL UNITS. The following table lists the current consumption (by supply) of SMS 1000 individual system components including some typical backplane modules. (For the current consumption of other modules consult

SMS 1000 4-1
the manufacturer's literature.) Use these values when computing the total power consumption of a projected system configuration (where power (in watts) is expressed as the product of volts times amperes). See sample computations in Tables 4-2 and 4-3 below. NOTE: For Winchester drives, the range of current-consumption values is expressed as "maximum except surge".

<table>
<thead>
<tr>
<th>TABLE 4-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT CONSUMPTION OF INDIVIDUAL UNITS</td>
</tr>
<tr>
<td>COMPONENT NAME</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Foundation Module</td>
</tr>
<tr>
<td>Each Winchester drive</td>
</tr>
<tr>
<td>(Range of typical values)</td>
</tr>
<tr>
<td>Each 5 1/4-inch floppy</td>
</tr>
<tr>
<td>8-inch floppy</td>
</tr>
<tr>
<td>Streaming tape drive (Tandberg TDC 3309/3350)</td>
</tr>
<tr>
<td>File tape 3.0 interface board</td>
</tr>
<tr>
<td>Each cooling fan</td>
</tr>
<tr>
<td>KDF11-AA (LSI-11/23)</td>
</tr>
<tr>
<td>KDJ11-AB (LSI-11/73)</td>
</tr>
<tr>
<td>MSV11-LK (256KB)</td>
</tr>
</tbody>
</table>
HARDWARE CONFIGURATION INSTRUCTIONS

<table>
<thead>
<tr>
<th>Device</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Value 5</th>
<th>Value 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSV11-PL</td>
<td>3.60</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(512KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMV-250</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(256KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMV-500</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(512KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMV-1000</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(1024 KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMV-254</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(1024 KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMV-504</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(2048 KB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DLV11-J</td>
<td>1.0</td>
<td>0.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(Serial line unit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DZQ11</td>
<td>1.15</td>
<td>0.39</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(Four-port MUX)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHV11</td>
<td>4.3</td>
<td>0.475</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>(Eight-port MUX)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXAMPLES OF TYPICAL SYSTEM CONFIGURATIONS

The following two examples (Table 4-2 and Table 4-3) show typical ways the system might be configured within the limits of the previously given power supply loading rules.
TABLE 4-2

EXAMPLE 1:
TYPICAL SYSTEM CONFIGURATION WITHIN
POWER-SUPPLY LOADING RULES

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>QUANTITY</th>
<th>CURRENT CONSUMPTION (BY SUPPLY) (AMPERES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>+5V</td>
</tr>
<tr>
<td>FOUNDATION MODULE</td>
<td>1</td>
<td>7.0</td>
</tr>
<tr>
<td>COOLING FANS</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>WINCHESTER DRIVE</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>8-INCH FLOPPY</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>KDF11-AA (LSI-11/23)</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>MSV11-LK (256KB)</td>
<td>1</td>
<td>3.45</td>
</tr>
<tr>
<td>TOTAL CURRENT:</td>
<td></td>
<td>14.45</td>
</tr>
<tr>
<td>(BY SUPPLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER (WATTS):</td>
<td></td>
<td>72.25</td>
</tr>
<tr>
<td>(BY SUPPLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL POWER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSUMPTION:</td>
<td>168.25 WATTS</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SINCE NO CURRENT AND POWER LIMITS HAVE BEEN EXCEEDED (SEE RULES ABOVE), THIS IS A WORKABLE CONFIGURATION.
TABLE 4-3
EXAMPLE 2:
TYPICAL SYSTEM CONFIGURATION WITHIN
POWER-SUPPLY LOADING RULES

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CURRENT CONSUMPTION (BY SUPPLY) (AMPERES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+5V</td>
</tr>
<tr>
<td>NAME</td>
<td>QUANTITY</td>
</tr>
<tr>
<td>FOUNDATION MODULE</td>
<td>1</td>
</tr>
<tr>
<td>COOLING FANS</td>
<td>2</td>
</tr>
<tr>
<td>WINCHESTER DRIVES</td>
<td>2</td>
</tr>
<tr>
<td>5 1/4-INCH FLOPPIES</td>
<td>2</td>
</tr>
<tr>
<td>KDJ11-AA (LSI-11/73)</td>
<td>1</td>
</tr>
<tr>
<td>MSV11-PL (512KB)</td>
<td>2</td>
</tr>
<tr>
<td>DZQ11 (FOUR-PORT MUX)</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL CURRENT:</strong> (BY SUPPLY)</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>POWER (WATTS):</strong> (BY SUPPLY)</td>
<td>125.0</td>
</tr>
<tr>
<td><strong>TOTAL POWER CONSUMPTION:</strong></td>
<td>251 WATTS</td>
</tr>
</tbody>
</table>

NOTE: SINCE NO CURRENT AND POWER LIMITS HAVE BEEN EXCEEDED (SEE RULES ABOVE), THIS IS ANOTHER WORKABLE CONFIGURATION.
BUS-LOADING SPECIFICATIONS

DEFINITIONS. For the LSI-11 Q-bus, one A-C unit load is defined as 9.35 pF of shunt capacitance, measured between a given signal line and ground. One D-C unit load is defined as a leakage current of 105 microamperes, measured between a given bus line and ground, when the line is in the high (i.e. undriven or unasserted) condition. Bus-loading figures for various modules are listed in the following table (Table 4-4).

MAXIMUM BUS LOADING. For any configuration, the maximum bus loading must not exceed 20 dc loads and 35 ac loads.

<table>
<thead>
<tr>
<th>MODULE DESIGNATION</th>
<th>A-C LOAD</th>
<th>D-C LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation Module</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>KDP11-AA (LSI-11/23)</td>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>KDJ11-AB (LSI-11/73)</td>
<td>3.4</td>
<td>1</td>
</tr>
<tr>
<td>MSV11-LK (256KB)</td>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>MSV11-PL (512KB)</td>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>CMV-1000 (1024KB)</td>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>CMV-504 (2048KB)</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>CMV-254 (1024KB)</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>CMV-250 (256KB)</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>CMV-500 (512KB)</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>DLV11-J</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>DZQ11</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>DZV11</td>
<td>4.1</td>
<td>1</td>
</tr>
<tr>
<td>DHV11</td>
<td>2.9</td>
<td>1</td>
</tr>
<tr>
<td>File-tape interface board</td>
<td>2.0</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTE: For any system configuration, the maximum bus loading must not exceed 20 DC loads and 35 AC loads.
ASSIGNING BUS PRIORITY: STRAPPING E1-E16 ON SMS 1000 MODEL 40 BACKPLANES WITHOUT RESTRICTED C-D SLOTS

IMPORTANT

The following procedure refers to SMS 1000 Model 40 backplanes that do NOT have restricted C-D slots. These backplanes can be identified by the ABSENCE of a CAUTION label on the left rear flange of the cardcage supporting sheet metal. See Figure 1-6.

The SMS 1000 Model 40 backplane priority-assignment jumper pins, E1 through E16 (see Figure 1-5A) can be strapped to implement any of three possible priority schemes. These are:

1. SMS AS-SHIPEP CONFIGURATION:

   (1) HIGHEST PRIORITY: CPU (J1A/B on backplane)

   (2) SECOND HIGHEST PRIORITY: Foundation Module

   (3) NEXT HIGHEST PRIORITY: Backplane slots J1C/D, J2C/D, J2A/B, J3A/B, and J3C/D

   (4) LOWEST PRIORITY: Backplane slots J4C/D, J4A/B, J5A/B, J5C/D, J6C/D, J6A/B

NOTE

Backplane priority runs in a serpentine path, starting with J1A/B (highest), then to J1C/D, next J2C/D, followed by J2A/B, J3A/B, etc. Using this scheme in the following discussion, backplane slots are listed in order of descending priority. That is, J1C/D has a higher priority than J2C/D; J2C/D has a higher priority than J2A/B, etc.

The SMS-shipped jumper connections are as follows (refer to Figure 1-5A for the location of bus-priority jumper pins):

   E1 TO E2
   E3 TO E4
   E5 TO E6
   E7 TO E8
   E9 TO E10
   E11 TO E12
   E13, E14, E15, E16: NO CONNECTION
HARDWARE CONFIGURATION INSTRUCTIONS

2. FIRST OPTIONAL CONFIGURATION:

(1) HIGHEST PRIORIT Y: CPU (J1A/B on backplane)

(2) SECOND HIGHEST PRIORIT Y: Backplane slots J1C/D, J2C/D, J2A/B, J3A/B, J3C/D

(3) NEXT HIGHEST PRIORIT Y: Foundation Module

(4) LOWEST PRIORIT Y: Backplane slots J4C/D, J4A/B, J5A/B, J5C/D, J6C/D, J6A/B

To implement this priority scheme, make the following connections:

E1 TO E9
E2 TO E8
E3 TO E11
E4 TO E6
E5 TO E12
E7 TO E10
E13, E14, E15, E16: NO CONNECTION

3. SECOND OPTIONAL CONFIGURATION:

(1) HIGHEST PRIORIT Y: CPU (J1A/B on backplane)

(2) SECOND HIGHEST PRIORIT Y: Backplane slots J1C/D, J2C/D, J2A/B, J3A/B, J3C/D

(3) NEXT HIGHEST PRIORIT Y: Backplane slots J4C/D, J4A/B, J5A/B, J5C/D, J6C/D, J6A/B

(4) LOWEST PRIORIT Y: Foundation Module

To implement this priority scheme, make the following connections:

E2 TO E8
E4 TO E6
E5 TO E15
E7 TO E13
E9 TO E10
E11 TO E12
E1, E3, E14, E16: NO CONNECTION
ASSIGNING BUS PRIORITY: STRAPPING JUMPERS ON SMS 1000 MODEL 40 BACKPLANES WITH RESTRICTED C-D SLOTS

IMPORTANT

The following procedure refers to SMS 1000 Model 40 backplanes that HAVE restricted C-D slots. These backplanes can be identified by the PRESENCE of a CAUTION label on the left rear flange of the cardcage supporting sheet metal (see Figure 1-6).

BACKPLANES WITH RESTRICTED C-D SLOTS

In order to allow for the use of certain newer quad-wide CPU's in addition to the dual-wide LSI-11/23 and LSI-11/73 CPU's, the C-D connectors of backplane slots 1 and 2 on later versions of the Model 40 backplane have been connected differently from those of earlier versions (see Figure 1-5B). Because of this new wiring, dual-width cards plugged into the slot 1 or 2 C-D connectors of the new backplanes may be damaged. Systems containing the newer backplane can be identified by the presence of a CAUTION label on the left rear flange of the cardcage supporting structure. See Figure 1-6 for the location of these labels on the newer systems. Note that the CAUTION label also shows the serpentine priority path in the modified backplanes. The CAUTION label has the following appearance:

SPECIAL JUMPER CONNECTIONS ON BACKPLANES WITH RESTRICTED C-D SLOTS

Make the following jumper assignments (see Figure 1-5B):

1. CONNECT jumpers between jumper pairs W8, W9 and W12.
2. REMOVE all jumpers from jumper groups or pairs W7, W10 and W11

PRIORITY ASSIGNMENT FOR BACKPLANES WITH RESTRICTED C-D SLOTS

With the exception of the special jumper connections described in the previous paragraph, the priority assignment procedure for the newer backplanes is the same as that for the older backplanes (see previous procedure describing priority assignment for backplanes without restricted C-D slots).

USING THE SMS 1000 BUS-GRANT CONTINUITY CARD

If the priorities of the modules you insert in the backplane require a dual module to be located between two quads, you will have to insert a bus-grant continuity card (part number 004670) next to the dual module. The bus-grant continuity card is a dual-width module with two pairs of shorted contacts that provide an uninterrupted path for the interrupt-request and DMA request lines. The card must be inserted so that its contacts are plugged into a or C connectors only, except in backplanes with restricted C-D slots 1 and 2, as described in the rules given below. In using a bus-grant continuity card the following rules must be observed:

1. When plugging it into a backplane socket, the solder side of the bus-grant continuity card must always face the Power Supply.

2. Do NOT insert the card into C-D slots 1 or 2 of backplanes with restricted C-D slots. Such backplanes have a CAUTION sticker on the cardcage supporting structure (see Figure 1-6).

STRAPPING THE SMS 1000 SYSTEM MODULES

GENERAL. The following instructions describe how to perform strapping, i.e. adding configuration jumpers, to various SMS 1000 modules. These instructions describe, first, the default (i.e. as shipped by SMS) jumper configuration for each module, followed by data on how to jumper for user-specific requirements. These instructions cover the following modules:

1. KDF11-AA (LSI-11/23) CPU (Figure 4-1).
2. KDJ11-AB (LSI-11/73) CPU (Figure 4-2).
3. MSV11-LK (256K byte memory module). These instructions cover the installation of up to eight MSV11-LK modules (Figure 4-3).

4. MSV11-PL (512K byte memory module). These instructions cover the installation of up to eight MSV11-PL modules (Figure 4-4).

5. CMV-1000 (1024K byte memory module). These instructions cover the installation of up to two CMV-1000 modules (Figure 4-5).

6. CMV-504 (2048K byte memory module); CMV-254 (1024K byte memory module); CMV-500 (512K byte memory module); CMV-250 (256K byte memory module). These instructions cover the installation of up to two of any of these modules (Figure 4-6).

7. DLV11-J Serial Line Unit. These instructions cover the installation of up to two DLV11-J modules. Instructions are given for DLV11-J boards made by both DEC and Camintonn (Figures 4-7A and 4-7B).

8. DZQ11 (Four-Port MUX). These instructions cover the installation of up to two DZQ11 modules (Figure 4-8).

9. DHV11 (Eight-Port MUX). Instructions are for strapping DHV11 boards made by both DEC and Camintonn (Figures 4-9A and 4-9B).

10. System Foundation Module

11. File-tape interface module. For strapping information see Appendix H and Figure H-2.

ADJUSTING JUMPERS. Generally, when a module has jumpers in groups of two pins, jumpering is most easily performed by adding standard shorting plugs between them. When the jumper options require making selections from groups of three or more pins, wire wrapping is usually the fastest and easiest method. Normally, there should be no more than two wire wraps per jumper pin.

SMS-SHIPPED CONFIGURATION. In the following tables, the column heading "SMS-SHIPPED CONFIGURATION" refers to the actual strapping that Scientific Micro Systems (SMS) performs on boards that are shipped to users for operation with the SMS 1000. In some cases this strapping differs from that performed by the board manufacturer. Thus, the SMS-shipped strapping represents the baseline or default board configuration for the SMS 1000 that you receive.

MULTIPLE MODULES. The "SMS-shipped configuration" applies only to the first module if more than one of a given type is being used. An example of this would be the installation of several MSV11 memory boards on the backplane. In this case, the SMS-
shipped configuration applies to the first board, i.e. the board with memory location 00000000. The proper strapping for the second and subsequent boards can be determined from the instructions given in this section.

**STRAPPING THE KDF11-AA (LSI-11/23) CPU**

The KDF11-AA has eighteen pairs of jumper pins that can be configured to implement various user-selectable features. These jumpers, the various configuration options, and the SMS-shipped jumper configuration are listed in Table 4-5. Refer to Figure 4-1 for locations of jumper pins.

**TABLE 4-5**

**KDF11-AA**

<table>
<thead>
<tr>
<th>JUMPER DESIGNATION</th>
<th>JUMPER FUNCTION</th>
<th>SMS-SHIPPED CONFIGURATION</th>
<th>ALTERNATE CONFIGURATION AND/OR REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Enable master clock</td>
<td>IN</td>
<td>Do not remove (Manufacturing only)</td>
</tr>
<tr>
<td>W2</td>
<td>Reserved (Mfg. only)</td>
<td>REMOVED</td>
<td>Do not install</td>
</tr>
<tr>
<td>W3</td>
<td>Reserved (Mfg. only)</td>
<td>IN</td>
<td>Do not remove</td>
</tr>
<tr>
<td>W4</td>
<td>BEVENT line enable</td>
<td>REMOVED</td>
<td>Jumper IN = disable BEVENT line</td>
</tr>
<tr>
<td>W5</td>
<td>Power-up Mode 2.</td>
<td>W5 REMOVED</td>
<td></td>
</tr>
<tr>
<td>W6</td>
<td>Execute boot.</td>
<td>W6 IN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power-up Mode 0.</td>
<td>W5 REMOVED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PC@24, PS@26 (octal)</td>
<td>W6 REMOVED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power-up Mode 1.</td>
<td>W5 IN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enter ODT.</td>
<td>W6 REMOVED</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 4-1  Location of jumper pins on KDF11-AA (LSI-11/23)
Power-up Mode 3.  W5 IN  
Reserved  W6 IN  
(exextended  
microcode)  

W7 Enter ODT  
on halt  

W8 Power-up bootstrap  
address =  
173000 (octal)  

W9 Select the high  
seven bits of the  
bootstrap starting  
address  

W10  
W11  
W12  
W13  
W14  
W15  

W16 Reserved  
(Mfg. only)  

W17 Reserved  
(Mfg. only)  

W18 Wake-up circuit  
disable  

Jumper IN = Trap  
to location 10  
(octal) on halt  

Jumper REMOVED =  
power-up bootstrap  
address is  
given by jumpers  
W9-W15  

This address  
disregarded when  
jumper W8 is IN  

Do not remove  

Do not remove  

Jumper REMOVED =  
enable wake-up  
circuit
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE KDJ11-AB (LSI-11/73) CPU

The KDJ11-AB has nine pairs of jumper pins that can be configured to implement various user-selectable features. These jumpers, the various configuration options, and the SMS-shipped jumper configuration are listed in Tables 4-6 and 4-7. Refer to Figure 4-2 for locations of jumper pins.

<table>
<thead>
<tr>
<th>JUMPER DESIGNATION</th>
<th>JUMPER FUNCTION</th>
<th>SMS-SHI PPED CONFIGURATION</th>
<th>ALTERNATE CONFIGURATION AND/OR REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Set bit 15 of bootstrap start address in Power-up Option 3.</td>
<td>IN</td>
<td>System is jumpered to operate in Power-up Option 2. Hence, this setting is ignored.</td>
</tr>
<tr>
<td>W2</td>
<td>Set bit 14 of bootstrap address in Power-up Option 3.</td>
<td>IN</td>
<td>System is jumpered to operate in Power-up Option 2. Hence, this setting is ignored.</td>
</tr>
<tr>
<td>W3</td>
<td>Power-up option selection</td>
<td>REMOVED</td>
<td>W3 OUT and W7 IN select Power-up Option 2. See Table 4-7 for Power-up options resulting from various connections of W3 and W7.</td>
</tr>
<tr>
<td>W4</td>
<td>Set bit 13 of bootstrap start address in Power-up Option 3.</td>
<td>IN</td>
<td>System is jumpered to operate in Power-up Option 2. Hence, this setting is ignored.</td>
</tr>
<tr>
<td>W5</td>
<td>Determines processor response to a HALT.</td>
<td>IN</td>
<td>With W5 IN, a HALT causes processor to enter Micro-ODT mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With W5 REMOVED, a HALT causes the processor to trap to</td>
</tr>
</tbody>
</table>

TABLE 4-6

KDJ11-AB

SETTING UP JUMPERS W1 THROUGH W9
HARDWARE CONFIGURATION INSTRUCTIONS

---

W6  Set bit 12 of bootstrap start address in Power-up Option 3.  
IN  System is jumpered to operate in Power-up Option 2. Hence, this setting is ignored.

---

W7  Power-up option selection  
IN  W3 OUT and W7 IN select Power-up Option 2. See Table 4-7 for Power-up options resulting from various connections of W3 and W7.

---

W8  Disable wakeup circuit  
IN  With W8 IN, the KDJ11-AB wakeup circuit is disabled. The BDCOK signal is sequenced from logic on the System Foundation Module.

With W8 REMOVED, the KDJ11-AB wakeup circuit is enabled.

---

W9  BEVENT register enable. Permits external-event interrupt request to processor.  
REMOVED  With W9 removed, the BEVENT input is recognized and is under control of bit 6 of the line time clock register.

With W9 IN, the BEVENT feature is disabled. Line time clock register is also disabled.

POWER-UP OPTIONS FOR THE KDJ11-AB

The user can select four possible power-up options by making various settings of the jumpers W3 and W7. These options are described as follows (and summarized in Table 4-7):

1. POWER-UP OPTION 0. The processor reads physical memory locations 24 and 26 (octal) and loads the data into the PC and PS,
Fig. 4-2  Location of jumper pins on KDJ11-AA (LSI-11/73)
respectively. The processor then either services pending interrupts or starts program execution beginning at the memory location pointed to by the PC.

2. POWER-UP OPTION 1. The processor unconditionally enters Micro-ODT with the PS cleared. Pending service conditions are ignored.

3. POWER-UP OPTION 2. Bootstrapping is controlled by the boot proms on the System Foundation Module. The KDJ11-AB boot prom is not used. The processor sets the PC at 173000 and the PS at 340 (octal). The processor then either services pending interrupts or starts program execution, beginning at the memory location pointed at by the PC. This is the SMS-shipped configuration for the SMS 1000.

4. POWER-UP OPTION 3. The processor reads the four bootstrap jumpers, W1, W2, W4, W6, and loads the result into bits 15 through 12 of the PC. Bits 11 through 0 of the PC are set to zero, and the PS is set to 340 (octal). The processor then either services pending interrupts, or starts bootstrap program execution, beginning at the memory location pointed to by the PC.

<table>
<thead>
<tr>
<th>POWER-UP OPTION NO.</th>
<th>JUMPER W3</th>
<th>JUMPER W7</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>IN</td>
<td>IN</td>
<td>PC = 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PS = 26</td>
</tr>
<tr>
<td>1</td>
<td>IN</td>
<td>REMOVED</td>
<td>Micro-ODT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PS = 0</td>
</tr>
<tr>
<td>2</td>
<td>REMOVED</td>
<td>IN</td>
<td>PC = 173000</td>
</tr>
<tr>
<td>NOTE: This strapping is the SMS-shipped configuration.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>REMOVED</td>
<td>REMOVED</td>
<td>W1, W2, W4, W6 give bootstrap starting address.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PS = 340</td>
</tr>
</tbody>
</table>

NOTE: All addresses are in octal.
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE MSV11-LK 256K-BYTE MEMORY MODULE

The process of strapping the jumper pins of the MSV11-LK falls into four main categories. These are:

1. Setting up the basic board functions (see Table 4-8)

2. Determining the Module Starting Address, the First Address Range (FAR), and the Partial Starting Address (PSA) for each MSV11 board being used (see Tables 4-9 and 4-10)

3. Selecting the CSR parity-register address for each MSV11 board in use (see Table 4-11)

4. Making the board's power jumper connections

STRAPPING SUMMARY

The following list of jumper connections summarizes the SMS-shipped configuration of the MSV11-LK. Refer to Figure 4-3 for location of jumper pins.

1. There are connections between the following jumper pins:
   
   1 TO 2
   6 TO 7
   10 TO 11
   15 TO 16
   19 TO 20
   25 TO 26
   27 TO 28
   33 TO 34
   F TO H
   R TO T

2. There are NO jumpers on any other pins.

3. The above strapping applies to the first MSV11-LK board in a system. To strap the second and subsequent boards in a system, follow the procedure in the remainder of these MSV11-LK strapping instructions.

STRAPPING PROCEDURE.

The various steps in strapping an MSV11-LK are described in Tables 4-8 through 4-11. Refer to Figure 4-3 for location of jumper pins.
TABLE 4-8

MSV11-LK

SETTING UP BASIC BOARD FUNCTIONS

NOTE: THE STRAPPING IN THIS TABLE IS THE SAME FOR ALL MSV11-LK
BOARDS IN A SYSTEM.

<table>
<thead>
<tr>
<th>JUMPER DESIGNATION OR FUNCTION</th>
<th>SMS-SHIPPED CONFIGURATION</th>
<th>ALTERNATE CONFIGURATION AND/OR REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEMORY PARITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No parity</td>
<td></td>
<td>9 to 10</td>
</tr>
<tr>
<td>With parity</td>
<td></td>
<td>11 to 10</td>
</tr>
<tr>
<td>Parity without CSR</td>
<td></td>
<td>18 to 19</td>
</tr>
<tr>
<td>With CSR</td>
<td></td>
<td>20 to 19</td>
</tr>
<tr>
<td>20arity ERROR REPORT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reported BDAL 16L (non-CR)</td>
<td></td>
<td>3 to 2</td>
</tr>
<tr>
<td>Reported BDAL 16L &amp; 17L (with CSR)</td>
<td></td>
<td>1 to 2</td>
</tr>
<tr>
<td>SET WRITE-WRONG-PARITY DIAGNOSTIC BIT (TEST ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disable</td>
<td></td>
<td>8 to 7</td>
</tr>
<tr>
<td>Enable</td>
<td></td>
<td>6 to 7</td>
</tr>
<tr>
<td>CSR SELECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-CR</td>
<td></td>
<td>J to H</td>
</tr>
<tr>
<td>With CSR</td>
<td></td>
<td>F to H</td>
</tr>
</tbody>
</table>

SMS 1000 4-20
<table>
<thead>
<tr>
<th>Peripheral Page Selection</th>
</tr>
</thead>
</table>
| 2K peripheral page         | 29 to 28  
| 4K peripheral page         | 27 to 28  

<table>
<thead>
<tr>
<th>Full or One-Half Memory Selection</th>
</tr>
</thead>
</table>
| Half memory                       | 32 to 33  
| Full memory                       | 34 to 33  

<table>
<thead>
<tr>
<th>Removal of Lower or Upper Bank (With a Fault)</th>
</tr>
</thead>
</table>
| Failed lower bank                            | 17 to 16  
| Normal operation or failed upper bank         | 15 to 16  

<table>
<thead>
<tr>
<th>Extended or Normal Memory Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>128K words. (small system) R to T OUT</td>
</tr>
<tr>
<td>Normal operation</td>
</tr>
<tr>
<td>Greater than 128K words. (large system) IN</td>
</tr>
<tr>
<td>Extended operation.</td>
</tr>
</tbody>
</table>

**Module Starting Address (MSA), First Address Range (FAR), and Partial Starting Address (PSA)**

**First MSV11 Board in a System.** The first MSV11 board in a system has a Module Starting Address (MSA) of zero, a First Address Range (FAR) of zero, and a Partial Starting Address (PSA) of zero. The SMS-shipped boards are strapped to reflect this, as shown on the first line of Tables 4-9 and 4-10. Also, the CSR address of the first board in a system is strapped by the factory at octal 17772100, as shown in Table 4-11.

**Second and Subsequent Boards.** The FAR, PSA and CSR strapping of second and subsequent MSV11 boards is listed in Tables 4-9, 4-10, and 4-11. Instructions for determining the values of MSA, FAR and PSA are given in the following paragraphs.
REQUIREMENTS. Each MSV11-LK installed in the system must be jum- pered to reflect its starting address (MSA) relative to its position within system memory; the first address in the range (FAR) of locations in which the MSA is found; and the 4K (words) starting-address boundary (PSA) if boards of unequal memory size are used in the backplane. The MSV11-LK's starting address can be set on any 4K word boundary within the system's address space.

MODULE STARTING ADDRESS. The Module Starting Address (MSA) is equal to the amount of memory (in K words of two bytes each, expressed in decimal) already present in a given system. The First Address Range (FAR) is the first address of the 128K-word range of addresses in which the MSA falls. The Partial Starting Address (PSA) identifies the 4K word boundary, within a specific group of 128K words, that the Module Starting Address falls in.

NOTE

All discussions of memory addresses and locations are expressed in decimal words, i.e. two bytes each.

SETTING FAR JUMPERS. To strap the module, first determine the MSA and then locate this figure within the various address ranges in the left-hand column of Table 4-9. For example, assume that the system has an MSA of 188K. From Table 4-9 we see that this lies within the range of 128 to 252. Hence, the FAR is 128. Therefore, as shown in the table, connect a jumper between pin L and pin K (ground).

SETTING PSA JUMPERS. The PSA is determined from the formula:

\[
\text{PSA} = \text{MSA} - \text{FAR.}
\]

Continuing the example, from the above formula the PSA is calculated as 188 - 128 or 60K. From Table 4-10 we see that a PSA of 60K requires strapping pins V, W, X and Y to pin U (ground). Note that the strapping rules require no more than two wire wraps per pin. Hence, these pins must be daisy chained and the last pin in line connected to pin U. Refer to Figure 4-3 for the location of the jumper pins.
Fig. 4-3  Location of jumper pins on MSV11-LK
### TABLE 4-9

**MSVL-LK**

**DETERMINING FIRST ADDRESS RANGE (FAR) JUMPERS**

<table>
<thead>
<tr>
<th>STARTING ADDRESS RANGE (MSA)</th>
<th>FAR VALUE</th>
<th>JUMPERS TO BE CONNECTED TO GROUND (PIN K)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DECIMAL</strong> WORDS (K)</td>
<td>OCTAL</td>
<td></td>
</tr>
<tr>
<td>000-124</td>
<td>000000000-00760000</td>
<td>0</td>
</tr>
<tr>
<td>128-252</td>
<td>01000000-01760000</td>
<td>128</td>
</tr>
<tr>
<td>256-380</td>
<td>02000000-02760000</td>
<td>256</td>
</tr>
<tr>
<td>384-508</td>
<td>03000000-03760000</td>
<td>384</td>
</tr>
<tr>
<td>512-636</td>
<td>04000000-04760000</td>
<td>512</td>
</tr>
<tr>
<td>640-764</td>
<td>05000000-05760000</td>
<td>640</td>
</tr>
<tr>
<td>768-892</td>
<td>06000000-06760000</td>
<td>768</td>
</tr>
<tr>
<td>896-1020</td>
<td>07000000-07760000</td>
<td>896</td>
</tr>
<tr>
<td>1024-1148</td>
<td>10000000-10760000</td>
<td>1024</td>
</tr>
<tr>
<td>1152-1276</td>
<td>11000000-11760000</td>
<td>1152</td>
</tr>
<tr>
<td>1280-1404</td>
<td>12000000-12760000</td>
<td>1280</td>
</tr>
<tr>
<td>1408-1532</td>
<td>13000000-13760000</td>
<td>1408</td>
</tr>
</tbody>
</table>

*"X" = connect indicated pin to pin K*
HARDWARE CONFIGURATION INSTRUCTIONS

<table>
<thead>
<tr>
<th>Start Address</th>
<th>End Address</th>
<th>Decimal</th>
<th>Octal</th>
<th>Pin Z</th>
<th>Pin Y</th>
<th>Pin X</th>
<th>Pin W</th>
<th>Pin V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1536-1660</td>
<td>14000000-14760000</td>
<td>1536</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1664-1788</td>
<td>15000000-15760000</td>
<td>1664</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1792-1916</td>
<td>16000000-16760000</td>
<td>1792</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920-2044</td>
<td>17000000-17760000</td>
<td>1920</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**TABLE 4-10**

**MSVL1-IK**

DETERMINING PARTIAL STARTING ADDRESS (PSA) JUMPERS

<table>
<thead>
<tr>
<th>Partial Starting Address (PSA)</th>
<th>Jumpers to be Connected to Ground (Pin U)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decimal Words (K)</strong></td>
<td><strong>Z</strong></td>
</tr>
<tr>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>0 0000000</td>
<td></td>
</tr>
<tr>
<td>4 0002000</td>
<td>-</td>
</tr>
<tr>
<td>8 0004000</td>
<td>-</td>
</tr>
<tr>
<td>12 0006000</td>
<td>-</td>
</tr>
<tr>
<td>16 0010000</td>
<td>-</td>
</tr>
<tr>
<td>20 0012000</td>
<td>-</td>
</tr>
<tr>
<td>24 0014000</td>
<td>-</td>
</tr>
<tr>
<td>28 0016000</td>
<td>-</td>
</tr>
<tr>
<td>32 0020000</td>
<td>X</td>
</tr>
<tr>
<td>36 0022000</td>
<td>X</td>
</tr>
<tr>
<td>40 0024000</td>
<td>X</td>
</tr>
<tr>
<td>44 0026000</td>
<td>X</td>
</tr>
<tr>
<td>48 0030000</td>
<td>X</td>
</tr>
<tr>
<td>52 0032000</td>
<td>X</td>
</tr>
<tr>
<td>56 0034000</td>
<td>X</td>
</tr>
<tr>
<td>60 0036000</td>
<td>X</td>
</tr>
<tr>
<td>64 0040000</td>
<td>X</td>
</tr>
</tbody>
</table>

Note: "X" indicates the indicated pin is to be connected to pin U.

SMS 1000 4-25
CSR ADDRESS-SELECTION JUMPERS. There are eight jumper options that permit setting in CSR register addresses. Every MSV11 module has one CSR. The CSR is a 16-bit register with an address that starts in the top 4K of system address space. The memory modules closest to the CPU have the lowest module starting address (MSA). The module with the lowest MSA is assigned the lowest CSR address and is jumpered as shown on the first line of Table 4-11, where it is designated as "first MSV11" in the system. The next module in sequence ("second MSV11" in Table 4-11) is assigned the next higher CSR address, etc. Note that the CSR addresses are given for either 18-bit or 22-bit system addressing schemes.
### TABLE 4-11

**MSV11-LK**

**DETERMINING THE STRAPPING OF CSR JUMPERS**

<table>
<thead>
<tr>
<th>SEQUENCE</th>
<th>22-BIT CSR ADDRESS (OCTAL)</th>
<th>18-BIT CSR ADDRESS (OCTAL)</th>
<th>JUMPERS TO BE CONNECTED TO GROUND (PIN E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>17772100</td>
<td>772100</td>
<td>C B A (&quot;X&quot; = connect indicated pin to pin E)</td>
</tr>
<tr>
<td>Second</td>
<td>17772102</td>
<td>772102</td>
<td>- - X</td>
</tr>
<tr>
<td>Third</td>
<td>17772104</td>
<td>772104</td>
<td>- X -</td>
</tr>
<tr>
<td>Fourth</td>
<td>17772106</td>
<td>772106</td>
<td>- X X</td>
</tr>
<tr>
<td>Fifth</td>
<td>17772110</td>
<td>772110</td>
<td>X - -</td>
</tr>
<tr>
<td>Sixth</td>
<td>17772112</td>
<td>772112</td>
<td>X - X</td>
</tr>
<tr>
<td>Seventh</td>
<td>17772114</td>
<td>772114</td>
<td>X X -</td>
</tr>
<tr>
<td>Eighth</td>
<td>17772116</td>
<td>772116</td>
<td>X X X</td>
</tr>
</tbody>
</table>

### SETTING THE POWER JUMPERS

The power-jumper setting will be the same for all MSV11-LK boards in a system. To select either battery backup or no battery backup, jumper each MSV11-LK as follows:

**NOTE**

Scientific Micro Systems does not support battery backup for the MSV11-LK.

1. **WITHOUT BATTERY BACKUP.** Refer to Figure 4-3 for location of jumper pins. Connect jumper pins 25 and 26. There is to be no connection to jumper pins 12, 13, 14, and 24. This is the SMS-shipped configuration.

2. **WITH BATTERY BACKUP.** Connect jumper pin 24 to 25 and pin 14 to 13. There is to be no connection to jumper pins 12 and 26.
STRAPPING THE MSV11-PL 512K-BYTE MEMORY MODULE

The jumpering of the MSV11-PL falls into the following categories:

1. Setting the Module Starting Address (MSA), the First Address Range (FAR), and the Partial Starting Address (PSA) for each MSV11 board being used (see Tables 4-12 and 4-13).

2. Setting the CSR parity-register address for each MSV11 board in use (see Table 4-14)

3. Configuring the power jumpers (same for all boards)

4. Connecting the bus-grant continuity jumpers (same for all boards)

5. Configuring for system size (same for all boards)

6. Configuration of miscellaneous jumpers (same for all boards)

STRAPPING SUMMARY

The following list of jumper connections summarizes the SMS-shipped strapping configuration of the MSV11-PL. Refer to Figure 4-4 for locations of jumper pins.

1. There are connections between the following jumper pins or pin pairs (the reference designation "W" indicates a pin pair):

   W1
   W2
   W4
   W5
   W9
   W13
   W15
   3 TO 9
   4 TO 10
   6 TO 7
   13 TO 15
   14 TO 16
   43 TO 44

2. There are NO jumpers on any other pins
3. The above strapping applies to the first MSV11-PL board in a system. To strap the second and subsequent boards in a system, follow the procedure in the remainder of these MSV11-PL strapping instructions.

STRAPPING PROCEDURE

The various steps in strapping an MSV11-PL are described in Tables 4-12, 4-13, and 4-14. Refer to Figure 4-4 for location of jumper pins.

MODULE STARTING ADDRESS (MSA), FIRST ADDRESS RANGE (FAR), AND PARTIAL STARTING ADDRESS (PSA)

FIRST MSV11 BOARD IN A SYSTEM. The first MSV11 board in a system has a Module Starting Address (MSA) of zero, a First Address Range (FAR) of zero, and a Partial Starting Address (PSA) of zero. The SMS-shipped boards are strapped to reflect this, as shown on the first line of Tables 4-12 and 4-13. Also, the CSR address of the first board in a system is strapped by the factory at octal 177721000, as shown in Table 4-14.

SECOND AND SUBSEQUENT BOARDS. The FAR, PSA and CSR strapping of second and subsequent MSV11 boards is listed in Tables 4-12, 4-13, and 4-14. Instructions for determining the values of MSA, FAR and PSA are given in the following paragraphs.

GENERAL. Each MSV11-PL installed in the system must be jumpered to reflect its starting address (MSA) relative to its position within system memory; the first address in the range (FAR) of locations in which the MSA is found; and the 8K (words) starting-address boundary (PSA) if boards of unequal memory size are used in the backplane. The MSV11-PL's starting address can be set on any 8K word boundary within the system's address space.

MODULE STARTING ADDRESS. The Module Starting Address (MSA) is equal to the amount of memory (in K words of two bytes each, expressed in decimal) already present in a given system. The First Address Range (FAR) is the first address of the 256K-word range of addresses in which the MSA falls. The Partial Starting Address (PSA) identifies the 8K word boundary, within a specific group of 256K words, that the Module Starting Address falls in.

NOTE

All discussions of memory addresses and locations are expressed in decimal words, i.e. two bytes each.
HARDWARE CONFIGURATION INSTRUCTIONS

SETTING FAR JUMPERS. To strap the module, first determine the MSA and then locate this figure within the various address ranges in the left-hand column of Table 4-12. For example, assume that the system has an MSA of 336K words. From Table 4-12 we see that this lies within the range of 256 to 504. Hence, the FAR is 256. Therefore, as shown in the table, connect a jumper between pin V and pin Y (ground).

SETTING PSA JUMPERS. The PSA is determined from the formula:

\[ \text{PSA} = \text{MSA} - \text{FAR}. \]

Continuing the example, from the above formula the PSA is calculated as 336 - 256 or 80K words. From the left-hand column of Table 4-13 we see that a PSA of 80K words requires strapping pins N, and L to pin R (ground). Note that the strapping rules require no more than two wire wraps per pin. Hence, these pins must be daisy chained and the last pin in line connected to pin R. Refer to Figure 4-4 for the location of the jumper pins.

Here is a second example. Assume that the system already has 256K words of memory. Therefore, the MSA is 256K words. And, as can be seen from the table, the FAR is also 256K words. Thus, from the above formula: \( \text{PSA} = \text{MSA} - \text{FAR} \), the PSA value in this case is 256 - 256 or 0. That is, to generalize, with contiguous boards of equal size, the PSA is always 0.

<table>
<thead>
<tr>
<th>STARTING ADDRESS RANGE (MSA)</th>
<th>FAR VALUE</th>
<th>JUMPERS TO BE CONNECTED TO GROUND (PIN Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECIMAL OCTAL WORDS (K)</td>
<td></td>
<td>X W V</td>
</tr>
<tr>
<td>000- 00000000-</td>
<td>0</td>
<td>(&quot;X&quot; = connect indicated pin to pin Y)</td>
</tr>
<tr>
<td>248 01740000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>256- 02000000-</td>
<td>256</td>
<td>- - X</td>
</tr>
<tr>
<td>504 03740000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>512- 04000000-</td>
<td>512</td>
<td>- X -</td>
</tr>
<tr>
<td>760 05740000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>768- 06000000-</td>
<td>768</td>
<td>X X</td>
</tr>
</tbody>
</table>

TABLE 4-12

MSV11-PL

DETERMINING FIRST ADDRESS RANGE (FAR) JUMPERS

SMS 1000

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HARDWARE CONFIGURATION INSTRUCTIONS

1016 07740000
1024- 10000000 1024 X - -
1272 11740000 - -
1280- 12000000- 1280 X - X
1528 13740000 - -
1526- 14000000- 1526 X X -
1784 15740000 - -
1742- 16000000- 1742 X X X
2040 17740000 - -

TABLE 4-13

MSV11-PL

DETERMINING PARTIAL STARTING ADDRESS (PSA) JUMPERS

<table>
<thead>
<tr>
<th>PARTIAL STARTING ADDRESS (PSA)</th>
<th>JUMPERS TO BE CONNECTED TO GROUND (PIN R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECIMAL OCTAL WORDS (K)</td>
<td>P N M L T</td>
</tr>
<tr>
<td>(&quot;X&quot; = connect indicated pin to pin R)</td>
<td></td>
</tr>
</tbody>
</table>

0 00000000 NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED CONFIGURATION.
8 00040000 - - - - X
16 00100000 - - - X -
24 00140000 - - - X X
32 00200000 - - X - -
40 00240000 - - X - X
48 00300000 - - X X -
56 00340000 - - X X X
64 00400000 - X - - -
72 00440000 - X - - X
80 00500000 - X - X -
88 00540000 - X - X X
96 00600000 - X X - -
104 00640000 - X X X -
112 00700000 - X X X -

SMS 1000 4-31
CSR ADDRESS SELECTION. There are sixteen jumper options that permit setting in CSR register addresses. Every MSV11-PL module has one CSR. The CSR is a 16-bit register with an address that starts in the top 4K of system address space. The memory modules closest to the CPU have the lowest module starting address (MSA). The module with the lowest MSA is assigned the lowest CSR address and is jumpered as shown on the first line of Table 4-14, where it is designated as "First MSV11" in the system. The next module in sequence ("Second MSV11" in Table 4-14) is assigned the next higher CSR address, etc. Note that the CSR addresses are given for either 18-bit or 22-bit system addressing schemes.
Fig. 4-4  Location of jumper pins on MSV11-PL
HARDWARE CONFIGURATION INSTRUCTIONS

TABLE 4-14

MSV11-PL

DETERMINING THE STRAPPING OF CSR JUMPERS

<table>
<thead>
<tr>
<th>SEQUENCE OF MSV11 BOARDS IN THE SYSTEM</th>
<th>22-BIT CSR ADDRESS (OCTAL)</th>
<th>18-BIT CSR ADDRESS (OCTAL)</th>
<th>JUMPERS TO BE CONNECTED TO GROUND (PIN E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>17772100</td>
<td>772100</td>
<td>NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPED CONFIGURATION.</td>
</tr>
<tr>
<td>Second</td>
<td>17772102</td>
<td>772102</td>
<td>-</td>
</tr>
<tr>
<td>Third</td>
<td>17772104</td>
<td>772104</td>
<td>-</td>
</tr>
<tr>
<td>Fourth</td>
<td>17772106</td>
<td>772106</td>
<td>-</td>
</tr>
<tr>
<td>Fifth</td>
<td>17772110</td>
<td>772110</td>
<td>- X</td>
</tr>
<tr>
<td>Sixth</td>
<td>17772112</td>
<td>772112</td>
<td>- X</td>
</tr>
<tr>
<td>Seventh</td>
<td>17772114</td>
<td>772114</td>
<td>- X X X</td>
</tr>
<tr>
<td>Eighth</td>
<td>17772116</td>
<td>772116</td>
<td>- X X X X</td>
</tr>
<tr>
<td>Ninth</td>
<td>17772120</td>
<td>772120</td>
<td>X - -</td>
</tr>
<tr>
<td>Tenth</td>
<td>17772122</td>
<td>772122</td>
<td>X - -</td>
</tr>
<tr>
<td>11th</td>
<td>17772124</td>
<td>772124</td>
<td>X - X</td>
</tr>
<tr>
<td>12th</td>
<td>17772126</td>
<td>772126</td>
<td>X - X X</td>
</tr>
<tr>
<td>13th</td>
<td>17772130</td>
<td>772130</td>
<td>X - X -</td>
</tr>
<tr>
<td>14th</td>
<td>17772132</td>
<td>772132</td>
<td>X - X X</td>
</tr>
<tr>
<td>15th</td>
<td>17772134</td>
<td>772134</td>
<td>X - X X</td>
</tr>
<tr>
<td>16th</td>
<td>17772136</td>
<td>772136</td>
<td>X - X X</td>
</tr>
</tbody>
</table>

SETTING THE POWER JUMPERS. The power jumpers for the MSV11-PL are configured as follows:

1. W3, W10, W11: ALWAYS OUT

2. W4 and W5: ALWAYS IN

   This is the SMS-shipped configuration.
HARDWARE CONFIGURATION INSTRUCTIONS


NOTE

Scientific Micro Systems does not support MSV11-PL battery backup.

SETTING THE BUS-GRANT CONTINUITY JUMPERS. As shipped by SMS, the two MSV11-PL jumpers W1 and W2 are always installed.

SETTING THE SYSTEM-SIZE JUMPERS. To configure an MSV11-PL for the addressing size of the system, proceed as follows:

1. 22-BIT ADDRESSING. NO CONNECTION between jumper pins 2 and Y (ground). This is the SMS-shipped configuration.

2. 18-BIT ADDRESSING. Connect jumper pins 2 and Y.

MISCELLANEOUS JUMPERS. The following jumper connections are not to be altered by the user. This list describes the SMS-shipped configuration:

ALWAYS IN: 3 TO 9
4 TO 10
6 TO 7
13 TO 15
14 TO 16
22 TO 23
44 TO 45

ALWAYS OUT: 8 TO 7
F TO H
21 TO 22
43 TO 44
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE CMV-1000 1024K-BYTE MEMORY MODULE

GENERAL. These instructions cover the strapping of up to two CMV-1000 1024KB memory modules. Refer to Figure 4-5. For each board, both the board parameters and the corresponding strapping instructions are given.

PARAMETERS FOR FIRST CMV-1000

- Starting memory address = 0
- Ending memory address = 1024K
- CSR address = 17772100 (octal)
- CSR parity enabled
- 22-bit CSR address
- I/O page size = 4K words
- Block mode enabled

STRAPPING PROCEDURE FOR FIRST CMV-1000

Note that jumper pairs A & B, C & D, F & G, H & J, K & L, and W1 & W2 are each located on the board with a common pin between them. Installing a jumper on pin A, for example, means making a connection, either by a shorting plug or by wire wrapping, between pin A and the common pin (with no connection to pin B). In the same way, installing a jumper on pin B means making a connection between pin B and the common pin (with no connection to pin A). To strap the first CMV-1000, proceed as follows:

1. Install the following jumpers:
   - B, L, C, W1, R, P, N, M

2. Make the following settings on switch SW1. To make these settings use a fine-pointed tool such as the tip of a ball point pen to press directly down on the OFF or the ON side of each switch section. The SW1 settings are:

   - Section 1: ON
   - Section 2: ON
   - Section 3: ON
   - Section 4: ON
   - Section 5: ON
   - Section 6: not used

3. Make the following settings on switch SW2:

   - Section 1: ON
   - Section 2: ON
HARDWARE CONFIGURATION INSTRUCTIONS

Section 3: ON
Section 4: OFF
Section 5: OFF
Section 6: ON

PARAMETERS FOR SECOND CMV-1000

Starting memory address = 1024K
Ending memory address = 2048K
CSR address = 17772102 octal
CSR parity enabled
22 bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING INSTRUCTIONS FOR SECOND CMV-1000

Proceed as follows:

1. Install the following jumpers:
   B, L, C, W1, P, N, M

2. Make the following settings on Switch SW1:

   Section 1: ON
   Section 2: ON
   Section 3: ON
   Section 4: OFF
   Section 5: OFF
   Section 6: not used

3. Make the following settings on Switch SW2:

   Section 1: ON
   Section 2: ON
   Section 3: ON
   Section 4: ON
   Section 5: OFF
   Section 6: OFF

STRAPPING THE CMV-504 2048K-BYTE MEMORY MODULE

GENERAL. These instructions cover the strapping of up to two CMV-504 2048KB memory modules. Refer to Figure 4-6. For each board, both the board parameters and the corresponding strapping instructions are given. NOTE: THESE STRAPPING INSTRUCTIONS ARE THE SMS AS-SHIPED CONFIGURATIONS FOR FIRST AND SECOND CMV-504 BOARDS.
Fig. 4-5  Location of jumper pins on CMV-1000
HARDWARE CONFIGURATION INSTRUCTIONS

FUNCTIONS OF JUMPERS

The following table describes the functions of the CMV-504 jumpers.

**TABLE 4-15**

<table>
<thead>
<tr>
<th>JUMPER DESIGNATIONS</th>
<th>JUMPER FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V &amp; +5VB</td>
<td>Set +5 volt mode</td>
</tr>
<tr>
<td>C and D</td>
<td>Set CSR parity</td>
</tr>
<tr>
<td>A and B</td>
<td>Select 18/22 bit CSR</td>
</tr>
<tr>
<td>M, N, P, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16</td>
<td>Set starting and ending address boundary</td>
</tr>
<tr>
<td>G, H, J</td>
<td>CSR register address selection</td>
</tr>
<tr>
<td>K, L</td>
<td>2K/4K I/O page size</td>
</tr>
<tr>
<td>S and T</td>
<td>Block mode/non-block mode</td>
</tr>
</tbody>
</table>

PARAMETERS FOR FIRST CMV-504

- Starting memory address = 0
- Ending memory address = 2048K
- CSR address = 17772100 (octal)
- CSR parity enabled
- 22-bit CSR address
- I/O page size = 4K words
- Block mode enabled

STRAPPING PROCEDURE FOR FIRST CMV-504

Note that jumper pairs A & B, C & D, K & L, S & T, 15 & 16 and +5V & +5VB are each located on the board with a common pin between them. Installing a jumper on pin A, for example, means making a connection, either by a shorting plug or by wire wrapping, between pin A and the common pin (with no connection to pin B). In the same way, installing a jumper on pin B means making a connection between pin B and the common pin (with no connection to pin A). To strap the first CMV-504, proceed as follows:
HARDWARE CONFIGURATION INSTRUCTIONS

1. **INSTALL** the following jumpers:
   B, C, K, T, J, H, G, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15

2. The following jumpers are **REMOVED**:
   A, D, L, S, 14, 16

PARAMETERS FOR SECOND CMV-504

Starting memory address = 2048K
Ending memory address = 4096K
CSR address = 17772102 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR SECOND CMV-504

1. **INSTALL** the following jumpers:
   B, C, K, T, H, G, 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16

2. The following jumpers are **REMOVED**:
   A, D, L, S, J, 9, 15

JUMPER SETTINGS FOR ALTERNATE STARTING AND ENDING MEMORY ADDRESSES FOR CMV-504 AND CMV-254.

NOTE: This table applies to both the CMV-504 and the CMV-254. For the CMV-254 strapping instructions, see below.

The following tables list the jumper settings for starting and ending memory addresses that differ from the SMS factory-shipped default values.
HARDWARE CONFIGURATION INSTRUCTIONS

STARTING AND ENDING ADDRESS JUMPER CONNECTIONS IN 512K-BYTE INCREMENTS (CMV-504 and CMV-254)

<table>
<thead>
<tr>
<th>DESIRED STARTING ADDRESS (K BYTES)</th>
<th>STARTING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>I</td>
</tr>
<tr>
<td>512</td>
<td>I</td>
</tr>
<tr>
<td>1024</td>
<td>I</td>
</tr>
<tr>
<td>1536</td>
<td>I</td>
</tr>
<tr>
<td>2048</td>
<td>I</td>
</tr>
<tr>
<td>2560</td>
<td>I</td>
</tr>
<tr>
<td>3072</td>
<td>I</td>
</tr>
<tr>
<td>3584</td>
<td>I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESIRED ENDING ADDRESS (K BYTES)</th>
<th>ENDING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>512</td>
<td>I</td>
</tr>
<tr>
<td>1024</td>
<td>I</td>
</tr>
<tr>
<td>1536</td>
<td>I</td>
</tr>
<tr>
<td>2048</td>
<td>I</td>
</tr>
<tr>
<td>2560</td>
<td>I</td>
</tr>
<tr>
<td>3072</td>
<td>I</td>
</tr>
<tr>
<td>3584</td>
<td>I</td>
</tr>
<tr>
<td>4096</td>
<td>I</td>
</tr>
</tbody>
</table>

LEGEND:  I = INSTALLED
         R = REMOVED

NOTE: The above tables apply to both the CMV-504 and the CMV-254.

STRAPPING THE CMV-254 1024K-BYTE MEMORY MODULE

These instructions cover the strapping of up to two CMV-254 1024K-byte memory modules. Refer to Figure 4-6 for the location
of jumper pins. For each board, both the default (i.e. as-shipped) parameters and the corresponding strapping instructions are given. Note that the functions of these jumpers are the same as those of the CMV-504 memory module.

PARAMETERS FOR FIRST CMV-254

Starting memory address = 0
Ending memory address = 1024K
CSR address = 17772100 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR FIRST CMV-254

Note that jumper pairs A & B, C & D, K & L, S & T, 15 & 16 and +5V & +5VB are each located on the board with a common pin between them. Installing a jumper on pin A, for example, means making a connection, either by a shorting plug or by wire wrapping, between pin A and the common pin (with no connection to pin B). In the same way, installing a jumper on pin B means making a connection between pin B and the common pin (with no connection to pin A). To strap the first CMV-254, proceed as follows:

1. INSTALL the following jumpers:
   B, C, K, T, J, H, G, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15

2. The following jumpers are REMOVED:
   A, D, L, S, 13, 14, 16

PARAMETERS FOR SECOND CMV-254

Starting memory address = 1024K
Ending memory address = 2048K
CSR address = 17772102 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR SECOND CMV-254

1. INSTALL the following jumpers:
   B, C, K, T, H, G, 1, 2, 3, 3, 5, 6, 7, 10, 11, 12, 13, 16
HARDWARE CONFIGURATION INSTRUCTIONS

2. The following jumpers are REMOVED:
A, D, L, S, J, 8, 9, 14, 15

ALTERNATE STARTING AND ENDING ADDRESS JUMPER CONNECTIONS

The jumper connections for alternate starting and ending addresses are the same as those for the CMV-504 module (see above).

STRAPPING THE CMV-500 512K-BYTE MEMORY MODULE

These instructions cover the strapping of up to two CMV-500 512K-byte memory modules. Refer to Figure 4-6 for the location of jumper pins. For each board, both the default (i.e. as-shipped) parameters and the corresponding strapping instructions are given. Note that the functions of these jumpers are the same as those of the CMV-504 memory module.

PARAMETERS FOR FIRST CMV-500

Starting memory address = 0
Ending memory address = 512K
CSR address = 17772100 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR FIRST CMV-500

Note that jumper pairs A & B, C & D, K & L, S & T, 15 & 16 and +5V & +5VB are each located on the board with a common pin between them. Installing a jumper on pin A, for example, means making a connection, either by a shorting plug or by wire wrapping, between pin A and the common pin (with no connection to pin B). In the same way, installing a jumper on pin B means making a connection between pin B and the common pin (with no connection to pin A). To strap the first CMV-500, proceed as follows:

1. INSTALL the following jumpers:
   B, C, K, T, J, H, G, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15

2. The following jumpers are REMOVED:
   A, D, L, S, 12, 13, 14, 16
HARDWARE CONFIGURATION INSTRUCTIONS

PARAMETERS FOR SECOND CMV-500

Starting memory address = 500K
Ending memory address = 1024K
CSR address = 17772102 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR SECOND CMV-500

1. **INSTALL** the following jumpers:

   B, C, K, T, H, G, 1, 2, 3, 4, 5, 6, 10, 11
   12, 16

2. The following jumpers are **REMOVED**:

   A, D, L, S, J, 7, 8, 9, 13, 14, 15

JUMPER SETTINGS FOR ALTERNATE STARTING AND ENDING MEMORY ADDRESSES FOR CMV-500 AND CMV-250.

NOTE: The following tables apply to both the CMV-500 and the CMV-250. For the CMV-250 strapping instructions, see below.

The following tables list the jumper settings for starting and ending memory addresses that differ from the SMS factory-shipped default values.

**STARTING AND ENDING ADDRESS JUMPER CONNECTIONS IN 128K-BYTE INCREMENTS (CMV-500 and CMV-250)**

<table>
<thead>
<tr>
<th>DESIRED STARTING ADDRESS (K BYTES)</th>
<th>STARTING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I I I I I I I I R</td>
</tr>
<tr>
<td>128</td>
<td>I I I I R R R R I</td>
</tr>
<tr>
<td>256</td>
<td>I I I I R R R R R I</td>
</tr>
<tr>
<td>384</td>
<td>I I I I R R I R R I</td>
</tr>
<tr>
<td>512</td>
<td>I I I I R R I R R I</td>
</tr>
<tr>
<td>640</td>
<td>I I I I R R I R R I</td>
</tr>
<tr>
<td>768</td>
<td>I I I I R R R R R I</td>
</tr>
</tbody>
</table>

SMS 1000 4-44
HARDWARE CONFIGURATION INSTRUCTIONS

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>R</th>
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<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>I</td>
</tr>
</tbody>
</table>

LEGEND:  I = INSTALLED
R = REMOVED

NOTE: The above tables apply to both the CMV-500 and the CMV-250.
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE CMV-250 256K-BYTE MEMORY MODULE

These instructions cover the strapping of up to two CMV-250 256K-byte memory modules. Refer to Figure 4-6 for the location of jumper pins. For each board, both the default (i.e., as-shipped) parameters and the corresponding strapping instructions are given. Note that the functions of these jumpers are the same as those of the CMV-504 memory module.

PARAMETERS FOR FIRST CMV-250

Starting memory address = 0
Ending memory address = 256K
CSR address = 17772100 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled

STRAPPING PROCEDURE FOR FIRST CMV-250

Note that jumper pairs A & B, C & D, K & L, S & T, 15 & 16 and +5V & +5VB are each located on the board with a common pin between them. Installing a jumper on pin A, for example, means making a connection, either by a shorting plug or by wire wrapping, between pin A and the common pin (with no connection to pin B). In the same way, installing a jumper on pin B means making a connection between pin B and the common pin (with no connection to pin A). To strap the first CMV-250, proceed as follows:

1. INSTALL the following jumpers:

   B, C, G, H, J, K, T, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15

2. The following jumpers are REMOVED:

   A, D, L, S, 11, 12, 13, 14, 16

PARAMETERS FOR SECOND CMV-250

Starting memory address = 256K
Ending memory address = 512K
CSR address = 17772102 (octal)
CSR parity enabled
22-bit CSR address
I/O page size = 4K words
Block mode enabled
channels as 1, 2, 3 and 4. Later versions use the DEC designations. Throughout this documentation of the DLV11-J the four channels are referred to as 0, 1, 2 and 3.

The following table describes the default jumper configuration for DLV11-J boards as shipped by Scientific Micro Systems. Refer to Figures 4-7A (DEC) and 4-7B (Camintoff) for jumper locations. Also included is a discussion of alternate jumper connections in order to produce other configurations.

TABLE 4-16A (DEC)
DLV11-J (DEC)
SMS-SHIPPED JUMPER CONFIGURATIONS
FOR FIRST AND SECOND DLV11-J's (see Figure 4-7A)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS-SHIPPED CONFIGURATION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/5 (bit 5)</td>
<td>X to 0</td>
<td>This connection of jumpers</td>
</tr>
<tr>
<td>A/6 (bit 6)</td>
<td>I</td>
<td>A/5 through A/12 implements</td>
</tr>
<tr>
<td>A/7 (bit 7)</td>
<td>R</td>
<td>the (octal) device base-</td>
</tr>
<tr>
<td>A/8 (bit 8)</td>
<td>X to 1</td>
<td>address assignment of 176500</td>
</tr>
<tr>
<td>A/9 (bit 9)</td>
<td>X to 0</td>
<td>for the RCSR register of</td>
</tr>
<tr>
<td>A/10 (bit 10)</td>
<td>X to 1</td>
<td>channel 0 (first DLV11-J). For</td>
</tr>
<tr>
<td>A/11 (bit 11)</td>
<td>X to 1</td>
<td>a complete list of the</td>
</tr>
<tr>
<td>A/12 (bit 12)</td>
<td>X to 1</td>
<td>register base-addresses for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>each channel see Table 4-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>at the end of this table.</td>
</tr>
</tbody>
</table>

V5 (First DLV11-J)
NONE
Remove jumper to implement an interrupt base vector of 300 (combination of V5, V6, and V7) for FIRST DLV11-J used. See Table 4-17.

V6       I
V7       I
V6 and V7 set high-order bits in octal base-vector format.

NOTE: For address and vector jumpers, an installed jumper ("I") produces a bit value of 1; a jumper NOT installed ("R") produces a bit value of 0. Also, an "X to 0" connection produces a bit value of 0, and an "X to 1" connection produces a bit value of 1.

ADDRESS AND VECTOR JUMPERS FOR SECOND DLV11-J
HARDWARE CONFIGURATION INSTRUCTIONS

A/5 (bit 5)  X to 1  This connection of jumpers
A/6 (bit 6)  I  A/5 through A/12 implements
A/7 (bit 7)  R  the (octal) device base-
A/8 (bit 8)  X to 1  address assignment of 176540
A/9 (bit 9)  X to 0  for RCSR register of channel
A/10 (bit 10)  X to 1  0 (second DLV11-J). For
A/11 (bit 11)  X to 1  a complete list of the
A/12 (bit 12)  X to 1  register base-addresses for
each channel see Table 4-17
at the end of this table.

V5  X to 1  Make the X to 1 connection to
(Second  implement an interrupt base
DLV11-J)  vector of 340 (combination of
V5, V6, and V7) for the second
DLV11-J. See Table 4-17.

V6  I  V6 and V7 set high-order bits
V7  I  in octal base-vector format.

NOTE: For address and vector jumpers, an installed jumper ("I")
produces a bit value of 1; a jumper NOT installed ("R") produces a
bit value of 0. Also, an "X to 0" connection produces a bit value
of 0, and an "X to 1" connection produces a bit value of 1.

-------------------------------------
CHANNEL 3 CONFIGURATION
-------------------------------------
C1  X to 0  The X to 0 connection for C1
C2  X to 0  and C2 configures channel 3
         as a port (not a console).

-------------------------------------
CHANNEL 3 BREAK RESPONSE
-------------------------------------
B-X-H  NONE  Absence of a jumper means that
         channel 3 makes no response in
         the presence of a received
         break signal.

-------------------------------------
COMMUNICATION LINE PARAMETERS
-------------------------------------
NOTE: The following jumper instructions apply to all
four DLV11-J channels since each has the same
SMS-shipped configuration. These jumpers determine
the character format used by each channel.

Refer to Table 4-18A for information on the alternate
jumper configurations possible for each channel.

E  X to 0  Odd parity expected.
D  X to 1  Character contains 8 data bits.
S  X to 0  Selects a one-stop-bit width
HARDWARE CONFIGURATION INSTRUCTIONS

P X to 1 between adjacent characters. Parity not enabled. Parity error bit held at 0.

--- BAUD-RATE SELECTION ---

NOTE: In the SMS-jumpered configuration, the baud-rate for all four channels is set to 9600 baud. Jumpers are connected from pins 0, 1, 2, or 3, corresponding to the respective channels (see Figure 4-7A), to baud-rate selection pins K, L, N, T, U, V, W, Y, and Z. Refer to Table 4-19 for complete baud-rate selection information.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 to N</td>
<td>Sets Channel 0 to 9600 baud</td>
</tr>
<tr>
<td>1</td>
<td>1 to N</td>
<td>Sets Channel 1 to 9600 baud</td>
</tr>
<tr>
<td>2</td>
<td>2 to N</td>
<td>Sets Channel 2 to 9600 baud</td>
</tr>
<tr>
<td>3</td>
<td>3 to N</td>
<td>Sets Channel 3 to 9600 baud</td>
</tr>
</tbody>
</table>

--- CHANNEL 0-3 PERIPHERAL INTERFACE CONFIGURATIONS ---

NOTE: All four channels of the DLV11-J are set by SMS to be simultaneously compatible with both the EIA RS-423 and the RS-232C protocols. For jumpering instructions to implement the EIA RS-422 protocol or 20 mA Current-loop capability (in conjunction with the DLV11-KA module) refer to Table 4-20A.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>X to 3</td>
<td>Chan. 0 XMIT(+): RS-232C/423</td>
</tr>
<tr>
<td>N0</td>
<td>X to 3</td>
<td>Chan. 0 XMIT(-): RS-232C/423</td>
</tr>
<tr>
<td>M1</td>
<td>X to 3</td>
<td>Chan. 1 XMIT(+): RS-232C/423</td>
</tr>
<tr>
<td>N1</td>
<td>X to 3</td>
<td>Chan. 1 XMIT(-): RS-232C/423</td>
</tr>
<tr>
<td>M2</td>
<td>X to 3</td>
<td>Chan. 2 XMIT(+): RS-232C/423</td>
</tr>
<tr>
<td>N2</td>
<td>X to 3</td>
<td>Chan. 2 XMIT(-): RS-232C/423</td>
</tr>
<tr>
<td>M3</td>
<td>X to 3</td>
<td>Chan. 3 XMIT(+): RS-232C/423</td>
</tr>
<tr>
<td>N3</td>
<td>X to 3</td>
<td>Chan. 3 XMIT(-): RS-232C/423</td>
</tr>
</tbody>
</table>

--- MISCELLANEOUS ---

R10 22K-ohm resistor installed Sets channels 0 and 1 for a slew rate of 2 microseconds in RS-232C/423 operation.

R23 22K-ohm resistor installed Sets channels 2 and 3 for a slew rate of 2 microseconds in RS-232C/423 operation.
HARDWARE CONFIGURATION INSTRUCTIONS

Fuse F1 2.0-amp fuse installed  Fuses 12-volt source line for all four channels for use in 20 mA current-loop operation.

LEGEND
I = Jumper installed
R = Jumper removed

IMPORTANT

Unless otherwise specified, the above configuration instructions apply to both the first and second DLV11-J.

TABLE 4-16B (Camintonn)

DLV11-J (Camintonn)

SMS-SHIPPED JUMPER CONFIGURATIONS FOR FIRST AND SECOND DLV11-J's (see Figure 4-7B)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS-</th>
<th>REMARKS</th>
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</thead>
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<tr>
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<td>SHIPPED</td>
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</tr>
<tr>
<td>NATION</td>
<td>CONFIGURATION</td>
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</tr>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

ADDRESS AND VECTOR JUMPERS FOR FIRST DLV11-J

|         |         |         |
| A/12 (bit 12) | OUT | This connection of jumpers A/12 |
| A/11 (bit 11) | OUT | through A/5 sets eight bits of the (octal) device base address. |
| A/10 (bit 10) | OUT | The address selected is 176500 |
| A/9 (bit 9)   | IN  | for the RCSR register of channel 0 (first DLV11-J). For a complete list of the register base-addresses for each channel see Table 4-17. |
| A/8 (bit 8)   | OUT |         |
| A/7 (bit 7)   | IN  |         |
| A/6 (bit 6)   | OUT |         |
| A/5 (bit 5)   | IN  |         |
| U20/6 (bit 5) | ON  | An interrupt base vector of 300 is selected by setting sections 3, 4, 5 and 6 of DIP switch U20. |
| U20/5 (bit 6) | OFF | These set bits V8, V7, V6 and V5, respectively, of the interrupt-vector base address. |
| U20/4 (bit 7) | OFF |         |
| U20/3 (bit 8) | ON  |         |
| U20/2         | NOT USED |         |
| U20/1         | NOT USED |         |

NOTE: For address and vector jumpers on Camintonn boards, jumper IN assigns a 0 bit and jumper OUT assigns a 1 bit.

ADDRESS AND VECTOR JUMPERS FOR SECOND DLV11-J

|         |         |         |
| A/12 (bit 12) | OUT | This connection of jumpers A/12 through A/5 sets eight bits of the (octal) device base address. |
| A/11 (bit 11) | OUT |         |
| A/10 (bit 10) | OUT |         |

SMS 1000 4-54
HARDWARE CONFIGURATION INSTRUCTIONS

A/9 (bit 9)  IN  The address selected is 176540 for the RCSR register of channel
A/8 (bit 8)  OUT  0 (second DLV11-J). For
A/7 (bit 7)  IN  a complete list of the
A/6 (bit 6)  OUT  register base-addresses for
each channel see Table 4-17.
A/5 (bit 5)  OUT

U20/6 (bit 5)  OFF  An interrupt base-vector of 340 is
U20/5 (bit 6)  OFF  selected by making the indicated
U20/4 (bit 7)  OFF  settings of switches U20/3, U20/4,
U20/3 (bit 8)  ON  U20/5, and U20/6. These set bits V8,
U20/2  NOT USED  V7, V6 and V5, respectively, of the
U20/1  NOT USED  interrupt-vector base address.

NOTE: For address and vector jumpers on Camintonn boards, jumper IN assigns a 0 bit and jumper OUT assigns a 1 bit.

-----------------------------
CHANNEL 3 CONFIGURATION

CON  IN  The IN connection for the CON jumper pins configures Channel 3 as a serial port.

-----------------------------
CHANNEL 3 BREAK RESPONSE

E4  OUT  Absence of these jumpers means that
E5  OUT  Channel 3 makes no response in the presence of a received break signal.

-----------------------------
COMMUNICATION LINE PARAMETERS (same for each channel)

NOTE: The following jumper instructions apply to all four DLV11-J channels since each has the same SMS-shipped configuration. These jumpers determine the character format used by each channel. Refer to Table 4-18B for information on the alternate jumper configurations possible for each channel.

B5  IN  Odd parity expected.
B1  IN

B3  OUT  Character contains 8 data bits.
B4  OUT

B2  IN  Selects a one-stop-bit width between adjacent characters.

-----------------------------
BAUD-RATE SELECTION

NOTE: In the SMS-jumpered configuration, the baud rate for all four channels is set to 9600 baud.

SMS 1000  4-55
HARDWARE CONFIGURATION INSTRUCTIONS

All four channels have the same strapping. Remember that when a channel is strapped for a given baud rate, no other baud-rate jumpers must be installed for that channel. To change baud rates, move jumper plugs to the correspondingly marked jumper pin pairs. Only one jumper plug must be IN per channel. See Figure 4-7B.

<table>
<thead>
<tr>
<th>CHAN</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/9600</td>
<td>IN</td>
<td>Sets Channel 0 to 9600 baud</td>
</tr>
<tr>
<td>1/9600</td>
<td>IN</td>
<td>Sets Channel 1 to 9600 baud</td>
</tr>
<tr>
<td>2/9600</td>
<td>IN</td>
<td>Sets Channel 2 to 9600 baud</td>
</tr>
<tr>
<td>3/9600</td>
<td>IN</td>
<td>Sets Channel 3 to 9600 baud</td>
</tr>
</tbody>
</table>

-------------------------------------------
CHANNEL 0-3 PERIPHERAL INTERFACE CONFIGURATIONS
-------------------------------------------

NOTE: All four channels of the DLV11-J are set by SMS to be simultaneously compatible with both the EIA RS-232C and the RS-423 protocols. See Table 4-20B for RS-422 strapping and for instructions on strapping to permit 20-mA current-loop operation. (See Figure 4-7B.)

<table>
<thead>
<tr>
<th>J0/232</th>
<th>IN</th>
<th>Chan. 0 (Receive): RS-232C/423</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1/232</td>
<td>IN</td>
<td>Chan. 1 (Receive): RS-232C/423</td>
</tr>
<tr>
<td>J2/232</td>
<td>IN</td>
<td>Chan. 2 (Receive): RS-232C/423</td>
</tr>
<tr>
<td>J3/232</td>
<td>IN</td>
<td>Chan. 3 (Receive): RS-232C/423</td>
</tr>
<tr>
<td>J0/X1</td>
<td>IN</td>
<td>Chan. 0 (Transmit): RS-232C/423</td>
</tr>
<tr>
<td>J0/X2</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>J1/X1</td>
<td>IN</td>
<td>Chan. 1 (Transmit): RS-232C/423</td>
</tr>
<tr>
<td>J1/X2</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>J2/X1</td>
<td>IN</td>
<td>Chan. 2 (Transmit): RS-232C/423</td>
</tr>
<tr>
<td>J2/X2</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>J3/X1</td>
<td>IN</td>
<td>Chan. 3 (Transmit): RS-232C/423</td>
</tr>
<tr>
<td>J3/X2</td>
<td>IN</td>
<td></td>
</tr>
</tbody>
</table>

-------------------------------------------
OPTIONS FOR MASTER RESET OF THE UART
-------------------------------------------

<table>
<thead>
<tr>
<th>E3</th>
<th>OUT</th>
<th>If used, Master Reset is DCOKL</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2</td>
<td>IN</td>
<td>Master Reset signal is INITH</td>
</tr>
</tbody>
</table>

SMS 1000 4-56
HARDWARE CONFIGURATION INSTRUCTIONS

SELECTION OF BUS-REQUEST (BR) INTERRUPT-LEVEL OPTIONS

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Selection</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E7 IN</td>
<td>Selects bus request (BR) level 4.</td>
<td></td>
</tr>
<tr>
<td>E10 IN</td>
<td>Jumpers E6, E8, E9 and E11 are OUT.</td>
<td></td>
</tr>
<tr>
<td>E12 IN</td>
<td>This is the SMS as-shipped (default) configuration.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Selection</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E6</td>
<td>Selects bus request (BR) level 5.</td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>(If selected, jumpers E6, E8, E10 and E12 are IN, and E7, E9 and E11 are OUT.)</td>
<td></td>
</tr>
<tr>
<td>E10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Selection</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E6</td>
<td>Selects bus request (BR) level 6.</td>
<td></td>
</tr>
<tr>
<td>E9</td>
<td>(If selected, jumpers E6, E9 and E11 are IN, and E7, E8, E10 and E12 are OUT.)</td>
<td></td>
</tr>
<tr>
<td>E11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LEGEND

IN = Jumper installed
OUT = Jumper removed

IMPORTANT

Unless otherwise specified, above configuration instructions apply to both the first and second DLV11-J.

TABLE 4-17 (DEC and Camintonn)

CSR ADDRESSES AND VECTORS FOR FIRST AND SECOND DLV11-J

<table>
<thead>
<tr>
<th>CSR ADDRESS (FIRST DLV11-J)</th>
<th>CSR ADDRESS (SECOND DLV11-J)</th>
<th>REGISTER</th>
<th>INTERRUPT VECTOR (FIRST DLV11-J)</th>
<th>INTERRUPT VECTOR (SECOND DLV11-J)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CHANNEL 0</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>176500</td>
<td>176540</td>
<td>RCSR</td>
<td>300</td>
<td>340</td>
</tr>
<tr>
<td>176502</td>
<td>176542</td>
<td>RBUF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176504</td>
<td>176544</td>
<td>XCSR</td>
<td>304</td>
<td>344</td>
</tr>
<tr>
<td>176506</td>
<td>176546</td>
<td>XBUF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHANNEL 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>176510</td>
<td>176550</td>
<td>RCSR</td>
<td>310</td>
<td>350</td>
</tr>
<tr>
<td>176512</td>
<td>176552</td>
<td>RBUF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176514</td>
<td>176554</td>
<td>XCSR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMS 1000

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**HARDWARE CONFIGURATION INSTRUCTIONS**

<table>
<thead>
<tr>
<th>176516</th>
<th>176556</th>
<th>XBUF</th>
<th>314</th>
<th>354</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CHANNEL 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>176520</td>
<td>176560</td>
<td>RCSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176522</td>
<td>176562</td>
<td>RBUF</td>
<td>320</td>
<td>360</td>
</tr>
<tr>
<td>176524</td>
<td>176564</td>
<td>XCSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176526</td>
<td>176566</td>
<td>XBUF</td>
<td>324</td>
<td>364</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CHANNEL 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>176530</td>
<td>176570</td>
<td>RCSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176532</td>
<td>176572</td>
<td>RBUF</td>
<td>330</td>
<td>370</td>
</tr>
<tr>
<td>176534</td>
<td>176574</td>
<td>XCSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176536</td>
<td>176576</td>
<td>XBUF</td>
<td>334</td>
<td>374</td>
</tr>
</tbody>
</table>

**TABLE 4-18A (DEC)**

**DLV11-J (DEC)**

**ALTERNATE CHARACTER-FORMAT CONFIGURATIONS**

(See Figure 4-7A)

<table>
<thead>
<tr>
<th>JUMPERS</th>
<th>CHANNEL</th>
<th>RESULT OF X TO 0 CONNECTION</th>
<th>RESULT OF X TO 1 CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E*</td>
<td>Parity</td>
<td>Odd parity expected</td>
<td>Even parity expected</td>
</tr>
<tr>
<td>D</td>
<td>Bits per character</td>
<td>7 bits</td>
<td>8 bits</td>
</tr>
<tr>
<td>S</td>
<td>Number of stop bits</td>
<td>1 bit</td>
<td>2 bits</td>
</tr>
<tr>
<td>P</td>
<td>Parity on/off</td>
<td>Parity on</td>
<td>Parity off</td>
</tr>
</tbody>
</table>

* - The E jumpers must have an X-to-0 or an X-to-1 connection even if parity-off is selected for the P jumpers.

**SMS 1000** 4-58
Fig. 4-7A  Location of jumper pins on DLV11-J (DEC)
Fig. 4-7B  Location of jumper pins on DLV11-J (Camintonn)
TABLE 4-18B (Camintonn)

DLV11-J (Camintonn)

ALTERNATE CHARACTER-FORMAT CONFIGURATIONS
(See Figure 4-7B.)

<table>
<thead>
<tr>
<th>JUMPERS (EACH CHANNEL)</th>
<th>CHANNEL</th>
<th>PARAMETER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>B5 IN</td>
<td></td>
<td>Parity</td>
<td>Odd parity expected</td>
</tr>
<tr>
<td>B1 IN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5 OUT</td>
<td></td>
<td>Parity</td>
<td>Even parity expected</td>
</tr>
<tr>
<td>B1 IN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2 OUT</td>
<td></td>
<td>No. of stop bits</td>
<td>Two stop bits between adjacent characters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3 IN</td>
<td></td>
<td>No. of data bits in a character</td>
<td>Five data bits/char.</td>
</tr>
<tr>
<td>B4 IN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3 IN</td>
<td></td>
<td>No. of data bits in a character</td>
<td>Six data bits/char.</td>
</tr>
<tr>
<td>B4 OUT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3 OUT</td>
<td></td>
<td>No. of data bits in a character</td>
<td>Seven data bits/char.</td>
</tr>
<tr>
<td>B4 IN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E4 IN</td>
<td></td>
<td>Break response</td>
<td>Halt on Break.</td>
</tr>
<tr>
<td>E5 OUT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E4 OUT</td>
<td></td>
<td>Break response</td>
<td>Re-boot on Break.</td>
</tr>
<tr>
<td>E5 IN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 4-19 (DEC only)

DLV11-J (DEC)

BAUD RATE OPTIONS

<table>
<thead>
<tr>
<th>CONNECTION FROM PINS TO PIN:</th>
<th>CORRESPONDING BAUD RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 1, 2, OR 3</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>150</td>
</tr>
<tr>
<td>T</td>
<td>300</td>
</tr>
<tr>
<td>V</td>
<td>600</td>
</tr>
</tbody>
</table>

SMS 1000 4-61
HARDWARE CONFIGURATION INSTRUCTIONS

<table>
<thead>
<tr>
<th>W</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>2400</td>
</tr>
<tr>
<td>L</td>
<td>4800</td>
</tr>
<tr>
<td>N</td>
<td>9600</td>
</tr>
<tr>
<td>K</td>
<td>19,200</td>
</tr>
<tr>
<td>Z</td>
<td>38,400</td>
</tr>
</tbody>
</table>

---

NOTE: The connection of pins 0, 1, 2, and 3 to pin N is the SMS-shipped configuration.

---

TABLE 4-20A (DEC)

DLV11-J (DEC)

ALTERNATE PERIPHERAL-INTERFACE CONFIGURATIONS
(See Figure 4-7A)

<table>
<thead>
<tr>
<th>JUMPER OR COMPONENT</th>
<th>PROTOCOL AND REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS-232C/RS-423</td>
</tr>
<tr>
<td></td>
<td>RS-422</td>
</tr>
<tr>
<td></td>
<td>20 mA CURRENT LOOP</td>
</tr>
<tr>
<td>M0, M1, M2, M3</td>
<td>X TO 3</td>
</tr>
<tr>
<td>NO, N1, N2, N3</td>
<td>X TO 3</td>
</tr>
<tr>
<td></td>
<td>X TO R</td>
</tr>
</tbody>
</table>

TERMINATION (RS-422 ONLY)
RESISTORS
R30: Chan. 0
as shown in Figure 4-7A.
R31: Chan. 1
Each resistor is 100 ohms, 1/4 watt, non-
R32: CHAN. 2
wire wound and fusible.
R33: Chan. 3

SLEW-RATE (RS-232C/RS-423 ONLY)
RESISTORS
R10: Chan. 0
locations shown in
and Fig. 4-7A. Each resistor
Chan. 1 is 22K, 1/4 watt and
R23: Chan. 2
non wire-wound. See
and Table 4-21 for values
Chan. 3 of R10 and R23 that
correspond to various
baud rates. Note that
each resistor sets slew
rate for two channels.
The 22K resistor

SMS 1000 4-62
produces a two-microsecond slew rate at 9600 baud.

FUSE
F1

Fuses 12-volt source for all four 20 mA current-loop channels. Install a 2.0 amp Pico fuse at location shown in Figure 4-7A.

NOTE 1: In conjunction with a converter device such as a DLV11-KA, this interface permits program-controlled data transfers, on a single-character basis, from devices such as paper tape readers.

---

**TABLE 4-20B (CAMINTONN)**

**DLV11-J (Camintonn)**

ALTERNATE PERIPHERAL-INTERFACE CONFIGURATIONS
(see Figure 4-7B)

<table>
<thead>
<tr>
<th>JUMPERS (EACH CHANNEL)</th>
<th>JUMPER CONNECTION</th>
<th>CHANNEL PROTOCOL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>J0/422</td>
<td>IN</td>
<td>RS-422</td>
<td>Receive</td>
</tr>
<tr>
<td>J1/422</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J2/422</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J3/422</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J0/Y1</td>
<td>IN</td>
<td>RS-422</td>
<td>Transmit</td>
</tr>
<tr>
<td>J0/Y2</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J1/Y1</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J1/Y2</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J2/Y1</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J2/Y2</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J3/Y1</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J3/Y2</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J0/T1</td>
<td>IN</td>
<td>20-mA</td>
<td>Enables 20-mA</td>
</tr>
<tr>
<td>J1/T1</td>
<td>IN</td>
<td>current-loop</td>
<td>current-loop</td>
</tr>
<tr>
<td>J2/T1</td>
<td>IN</td>
<td>loop</td>
<td>operation.</td>
</tr>
<tr>
<td>J3/T1</td>
<td>IN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMS 1000 4-63
TABLE 4-21 (DEC only)

DLV11-J (DEC)

SELECTION OF RS-232C/423 SLEW-RATE RESISTOR VALUES

<table>
<thead>
<tr>
<th>BAUD RATE</th>
<th>VALUE OF R10: CHAN. 0 AND 1</th>
<th>VALUE OF R23: CHAN. 2 AND 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 thru 600</td>
<td>1 megohm</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>820K</td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>430K</td>
<td></td>
</tr>
<tr>
<td>4800</td>
<td>200K</td>
<td></td>
</tr>
<tr>
<td>9600</td>
<td>120K</td>
<td></td>
</tr>
<tr>
<td>19,200</td>
<td>51K</td>
<td></td>
</tr>
<tr>
<td>38,400</td>
<td>22K (see note)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SMS-shipped default value is normally 22K. This provides a sufficiently accurate slew rate over a range of at least 9600 through 38,400 baud.

STRAPPING THE DZQ11 FOUR-PORT MUX

The strapping of the DZQ11 module involves the following steps:

1. Setting the ten CSR address switches on E28 (A3 through A12). For the first DZQ11 used in your SMS 1000, refer to Table 4-22. For the second DZQ11 used, the CSR settings are given in Table 4-23. See Figure 4-8.

2. Setting the six interrupt vector switches on E13 sections 1 through 6 (V3 through V8). E13/7 is not used. For the first DZQ11 used in your SMS 1000, the interrupt-vector switch settings are given in Table 4-24. For the second DZQ11 the interrupt-vector switch settings are given in Table 4-25.

3. Setting DIP switch E13, sections 8, 9 and 10. Section 8 is a test switch which can disconnect the DZQ11 oscillator. Sections 9 and 10 control the DZQ11 response to a Break character received on line 3.

HARDWARE CONFIGURATION INSTRUCTIONS

SETTING THE CSR ADDRESS SWITCHES (E28).

The DZQ11 device base address is assigned by making the appropriate settings on ten DIP switches located on the card's base-address switch group E28 (see Figure 4-8). These switch settings affect ten of the sixteen bits of the CSR base address. The three most-significant address bits are preset to 1's and the three least significant bits are preset to 0's. The ten DIP switches control the setting of base address bits 12 through 3.

CSR BASE-ADDRESS SETTING. The E28 DIP switches are set by SMS to produce a CSR base address configuration of 160100 (octal) for the first DZQ11 and 160110 (octal) for the second. Refer to Tables 4-22 and 4-23.

SETTING THE SWITCHES. Note that the DIP switches are numbered 1 through 10 and that these switches control, respectively, base-address bits 12 through 3 of the 16-bit address. To set a switch to ON use a fine-pointed tool, such as the tip of a ball point pen, and press straight down on the dot-like depression on the side of the switch that is numbered, until the switch snaps down. To set the switch to OFF do the same thing on the side of the switch marked "OPEN".

An ON setting of a switch puts a 1 bit into its corresponding position in the base address. An OFF position sets in a 0 bit. The SMS-shipped base-address settings of these switches are as follows:

<table>
<thead>
<tr>
<th>BASE-ADDRESS BIT</th>
<th>SWITCH NUMBER ON E28</th>
<th>SWITCH SETTING</th>
<th>BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 (MSB)</td>
<td>1</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>OFF</td>
<td>0</td>
</tr>
</tbody>
</table>

TABLE 4-22
FIRST DZQ11

SMS-SHIPPED CONFIGURATION
E28 SWITCH SETTINGS TO ASSIGN A CSR BASE-ADDRESS OF 160100

SMS 1000 4-65
TABLE 4-23
SECOND DZQ11

SMS-SHIPPED CONFIGURATION
E28 SWITCH SETTINGS TO ASSIGN A CSR BASE-ADDRESS OF 160110

<table>
<thead>
<tr>
<th>BASE-ADDRESS ON E28</th>
<th>SWITCH NUMBER</th>
<th>SWITCH SETTING</th>
<th>BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 (MSB)</td>
<td>1</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>3 (LSB)</td>
<td>10</td>
<td>ON</td>
<td>1</td>
</tr>
</tbody>
</table>

SETTING THE INTERRUPT-VECTOR ADDRESS SWITCHES (E13).

The DZQ11 device interrupt-vector address is assigned by making the appropriate settings on six of the ten rocker-type DIP switches located on the card's vector-address switch E13 (see Figure 4-8). These switch settings affect six of the sixteen bits of the interrupt-vector address. The seven most-significant interrupt-vector-address bits and the three least significant bits are all preset to 0's. The six DIP switches of E13, numbered 1 through 6, control the setting of interrupt-
HARDWARE CONFIGURATION INSTRUCTIONS

vector address bits 8 through 3, respectively, of the 16-bit address. Note that DIP switch group E13 has ten switches. The settings of switches 7, 8, 9 and 10 are described below.

INTERRUPT-VECTOR ADDRESS SETTING. The switches of E13 are set to produce an SMS-shipped interrupt-vector address of 400 (octal) for the first DZQ11 and 410 (octal) for the second. Refer to Tables 4-23 and 4-24.

SETTING THE SWITCHES. To set a switch to ON, use a fine-pointed tool, such as the tip of a ball point pen, and press straight down on the dot-like depression on the side of the switch that is numbered, until the switch snaps down. To set the switch to OFF do the same thing on the side of the switch marked "OPEN".

An ON setting of a switch puts a 1 bit into its corresponding position in the interrupt-vector address. An OFF position sets in a 0 bit. The SMS-shipped interrupt-vector address settings of these switches are as follows:

<table>
<thead>
<tr>
<th>Table 4-24</th>
<th>FIRST DZQ11</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMS-SHIPPED CONFIGURATION E13 SETTINGS TO ASSIGN INTERRUPT-VECTOR ADDRESS OF 400</td>
<td></td>
</tr>
<tr>
<td>Interrupt-Address Bit</td>
<td>Switch Number ON E13</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>8 (MSB)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 (LSB)</td>
<td>6</td>
</tr>
</tbody>
</table>
TABLE 4-25
SECOND DZQ11
SMS-SHIPPED CONFIGURATION
E13 SETTINGS TO ASSIGN INTERRUPT-VECTOR ADDRESS OF 410

<table>
<thead>
<tr>
<th>INTERRUPT-ADDRESS</th>
<th>SWITCH NUMBER ON E13</th>
<th>SWITCH SETTING</th>
<th>BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (MSB)</td>
<td>1</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>3 (LSB)</td>
<td>6</td>
<td>ON</td>
<td>1</td>
</tr>
</tbody>
</table>

SETTINGS OF DIP SWITCHES E13/7, E13/8, E13/9 AND E13/10

These DIP switches are to be set as follows:

<table>
<thead>
<tr>
<th>SWITCH NUMBER ON E13</th>
<th>SMS AS-SHIPPED SETTING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Either</td>
<td>NOT USED</td>
</tr>
<tr>
<td>8</td>
<td>ON</td>
<td>Test switch. The OFF position disconnects the DZQ11 oscillator.</td>
</tr>
<tr>
<td>9</td>
<td>OFF</td>
<td>With 9 ON and 10 OFF, processor halts when a Break character is received.</td>
</tr>
<tr>
<td>10</td>
<td>OFF</td>
<td>With 9 OFF and 10 ON, processor boots when a Break character is received.</td>
</tr>
</tbody>
</table>
NOTE ON E28 AND E13:
ON = PRESS DOT ON NUMBERED SIDE OF SWITCH
OFF = PRESS DOT ON SIDE OF SWITCH MARKED "OPEN"

Fig. 4-8  Location of jumper pins on DZQ11
HARDWARE CONFIGURATION INSTRUCTIONS

SETTINGS OF JUMPERS W1 THROUGH W16.

The following table describes the settings of the thirteen jumpers on the DZQ11. See Figure 4-8. NOTE: These jumper settings are the same for both a first and a second DZQ11.

**TABLE 4-26**

**DZQ11**

**SETTING UP JUMPERS W1 THROUGH W16**

(For first and second DZQ11)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>JUMPER FUNCTION</th>
<th>SMS-SHIPPED CONFIGURATION</th>
<th>ALTERNATE AND/OR REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODEM-CONTROL JUMPERS W1 THROUGH W8</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W1</td>
<td>Line 3 DTR (Data-Terminal-Ready) to RTS (Request-to-send) connection.</td>
<td>IN</td>
<td>W1 through W4 must be installed to run the external cable and test diagnostic programs.</td>
</tr>
<tr>
<td>W2</td>
<td>Line 2 DTR to RTS connection</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W3</td>
<td>Line 1 DTR to RTS connection</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W4</td>
<td>Line 0 DTR to RTS connection</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W5</td>
<td>Line 3 RTS (Ready-to-Send) to FB (Forced Busy) connection</td>
<td>IN</td>
<td>W5 through W8 are for modem use only</td>
</tr>
<tr>
<td>W6</td>
<td>Line 2 RTS to FB connection</td>
<td>IN</td>
<td>Modem use only</td>
</tr>
<tr>
<td>W7</td>
<td>Line 1 RTS to FB connection</td>
<td>IN</td>
<td>Modem use only</td>
</tr>
<tr>
<td>W8</td>
<td>Line 0 RTS to FB connection</td>
<td>IN</td>
<td>Modem use only</td>
</tr>
<tr>
<td><strong>BAUD-RATE SELECT JUMPERS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HARDWARE CONFIGURATION INSTRUCTIONS

W9 | OUT
---|---
W10 | IN  Baud rate = 9600
---|---
W11 | IN  Baud rate = 9600
---|---
W12 | OUT
---|---
W13 | OUT
---|---

STRAPPING THE DHV11 EIGHT-PORT MUX (MANUFACTURED BY DIGITAL EQUIPMENT CORPORATION OR CAMINTONN CORPORATION)

IMPORTANT

The DHV11 board provided with your SMS 1000 Model 40 may be supplied by two possible manufacturers: Digital Equipment Corporation (DEC) or Camintonn Corporation. These boards, although functionally identical, have somewhat different strapping requirements. The following strapping instructions will present DEC and Camintonn separately, as required for clarity.

STRAPPING THE DEC-MANUFACTURED DHV11

The strapping of the DHV11 eight-port MUX (see Figure 4-9A) involves the following steps:

1. Making device-address selection settings on switch group E58 and on one section of E43. The SMS-shipped setting of these switches gives an address of 160440 (octal).

2. Making vector-address selection settings on switch group E43. The SMS-shipped setting of these switches gives an address of 420 (octal).

SETTING THE DEVICE-ADDRESS SWITCHES (E58 and E43).

The DHV11 device address of 160440 (octal) is assigned by making corresponding settings to the eight sections of DIP switch E58 and to one section of DIP switch E43 (Figure 4-9A). These switches control the values of bits A4 through A12 of the device-address word. Bits A0 through A3 of the device-address word are preset to 0's, and bits A3 through A16 are preset to 1's.

SETTING THE SWITCHES. Note that the DIP switches are numbered 1

SMS 1000 4-71
through 8 (see Figure 4-9A). Switch section 1 of E43 and sections 8 through 1 of E58 control the values of device address bits A4 through A12, respectively. Also, note that to set a switch to ON, use a fine-pointed tool, such as the tip of a ball point pen, and press straight down on the dot-like depression on the side of the switch that is numbered, until the switch snaps down. To set the switch to OFF do the same thing on the side of the switch marked "OPEN". An ON setting of a switch puts a 1 bit into its corresponding position in the device address. An OFF position sets in a 0 bit. The SMS-shipped device-address settings of these switches are as follows:

**TABLE 4-27A**

**DHV11 (DEC)**

**SMS-SHI PPED CONFIGURATION**

**E43 AND E58 SETTINGS TO ASSIGN A DEVICE ADDRESS OF 160440**

* (See Figure 4-9A)*

<table>
<thead>
<tr>
<th>DEVICE-ADDRESS BIT</th>
<th>SWITCH NUMBER</th>
<th>SWITCH SETTING (AS SHIPPED)</th>
<th>CORRESPONDING BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12</td>
<td>E58/1</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A11</td>
<td>E58/2</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A10</td>
<td>E58/3</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A9</td>
<td>E58/4</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A8</td>
<td>E58/5</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td>A7</td>
<td>E58/6</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A6</td>
<td>E58/7</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>A5</td>
<td>E58/8</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td>A4</td>
<td>E43/1</td>
<td>OFF</td>
<td>0</td>
</tr>
</tbody>
</table>

SETTING THE VECTOR-ADDRESS SWITCHES (E43)

The DHV11 vector-address of 420 (octal) is assigned by making corresponding setting to sections 3 through 8 of DIP switch group E43. These switches control the value of bits V8 through V3 respectively of the DHV11 vector-address word.
HARDWARE CONFIGURATION INSTRUCTIONS

SETTING THE SWITCHES. Note that the vector-address DIP switches (E43) are numbered 1 through 8 (see Figure 4-9A). Switch section 1 of E43 is used in the setting of the device address (above). Switch section 2 of E43 is not used. In general, to set a switch to ON, use a fine-pointed tool, such as the tip of a ball point pen, and press straight down on the dot-like depression on the side of the switch that is numbered, until the switch snaps down. To set the switch to OFF do the same thing on the side of the switch marked "OPEN". An ON setting of a switch puts a 1 bit into its corresponding position in the vector address. An OFF position sets in a 0 bit. The SMS-shipped vector-address settings of these switches are as follows:

<table>
<thead>
<tr>
<th>VECTOR-ADDRESS BIT</th>
<th>SWITCH NUMBER</th>
<th>SWITCH SETTING (AS SHIPPED)</th>
<th>CORRESPONDING BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>V8</td>
<td>E43/3</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td>V7</td>
<td>E43/4</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>V6</td>
<td>E43/5</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>V5</td>
<td>E43/6</td>
<td>OFF</td>
<td>0</td>
</tr>
<tr>
<td>V4</td>
<td>E43/7</td>
<td>ON</td>
<td>1</td>
</tr>
<tr>
<td>V3</td>
<td>E43/8</td>
<td>OFF</td>
<td>0</td>
</tr>
</tbody>
</table>

TABLE 4-28A

DHV11 (DEC)
SMS-SHIPPED CONFIGURATION
E43 SETTINGS TO ASSIGN A VECTOR ADDRESS OF 420
(See Figure 4-9A)

STRAPPING THE CAMINTONN-MANUFACTURED DHV11

The strapping of the Camintonn-manufactured DHV11 eight-port MUX (see Figure 4-9B) involves the following steps:

1. Making device-address selection settings on jumpers A12 through A4. The SMS-shipped setting of these jumpers gives an address of 160440 (octal).
2. Making vector-address selection settings on jumpers V8 through V3. The SMS-shipped setting of these jumpers gives a vector address of 420 (octal).

SETTING THE DEVICE-ADDRESS JUMPERS.

The DHV11 device address of 160440 (octal) is assigned by making corresponding strappings to the nine jumpers A12 through A4 (Figure 4-9B). These jumpers control the values of bits 12 through 4 of the device-address word. See Table 4-27B.

**TABLE 4-27B**

<table>
<thead>
<tr>
<th>DEVICE-ADDRESS BIT</th>
<th>JUMPER DESIGNATION</th>
<th>JUMPER SETTING (AS SHIPPED)</th>
<th>CORRESPONDING BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12</td>
<td>A12</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A11</td>
<td>A10</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A10</td>
<td>A10</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A9</td>
<td>A9</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A8</td>
<td>A8</td>
<td>IN</td>
<td>1</td>
</tr>
<tr>
<td>A7</td>
<td>A7</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A6</td>
<td>A6</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>A5</td>
<td>A5</td>
<td>IN</td>
<td>1</td>
</tr>
<tr>
<td>A4</td>
<td>A4</td>
<td>OUT</td>
<td>0</td>
</tr>
</tbody>
</table>

**NOTE:** Remaining address jumpers are not used.
HARDWARE CONFIGURATION INSTRUCTIONS

SETTING THE VECTOR-ADDRESS JUMPERS

The DHV11 vector-address of 420 (octal) is assigned by making corresponding setting to jumpers V8 through V3 (Figure 4-9B). These jumpers control the value of bits V8 through V3 respectively of the DHV11 vector-address word. See Table 4-28B.

TABLE 4-28B

<table>
<thead>
<tr>
<th>VECTOR-ADDRESS BIT</th>
<th>JUMPER DESIGNATION</th>
<th>JUMPER SETTING (AS SHIPPED)</th>
<th>CORRESPONDING BIT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>V8</td>
<td>V8</td>
<td>IN</td>
<td>1</td>
</tr>
<tr>
<td>V7</td>
<td>V7</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>V6</td>
<td>V6</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>V5</td>
<td>V5</td>
<td>OUT</td>
<td>0</td>
</tr>
<tr>
<td>V4</td>
<td>V4</td>
<td>IN</td>
<td>1</td>
</tr>
<tr>
<td>V3</td>
<td>V3</td>
<td>OUT</td>
<td>0</td>
</tr>
</tbody>
</table>

NOTE: Remaining vector jumpers are not used.

SYSTEM FOUNDATION MODULE

All the jumpers on the System Foundation Module are for factory use only. The System Foundation Module has no user-configurable jumpers and must always be used in its as-received configuration.

STRAPPING PERIPHERAL DEVICES

GENERAL. The following paragraphs identify and describe the jumper connections (strapping) on the disk and tape drives that are part of the SMS 1000 system. Each description is supported by a table that lists the as-shipped (default) configuration of the user-configurable jumpers and by a diagram that shows the locations of the jumpers on the drive's printed circuit board (PCB).
Fig. 4-9A  Location of jumper pins on DHVll (DEC)
NOTE:
The as-shipped (default) strapping shown here is:
Vector address = 420 (octal)
Device address = 160440 (octal)

Fig. 4-9B  Location of jumper pins on DHV11 (Camintonn)
HARDWARE CONFIGURATION INSTRUCTIONS

There are generally two types of jumper connections on the PC boards. One type uses a pair of jumper pins onto which the user can place a jumper plug or a wire wrap to short the pins. The other type uses an IC-type "shunt block" with exposed shorting leads. The shunt block plugs into a standard 14-pin or 16-pin IC socket and the exposed shorting leads are cut as required.

In the tables that follow, when the CONNECTION column contains the word IN, it means that either a jumper has been placed between a pair of pins or a shunt has NOT been broken. The word OUT means that there is NO jumper on the pins or that the jumper on a shunt block has been cut.

TERMINATING THE DRIVES

All input data and control lines to the drives require terminating resistors. When there are two or more drives daisy-chained together, only the drive at the end of the cable is terminated. For reference, the diagram for each drive shows, when possible, the location of the terminating resistor pack.

IMPORTANT

If you replace a drive in the field, be certain that the new drive has the same jumper connections and termination as the drive it replaced.

STRAPPING THE TANDON TM848-2E DISK DRIVE

The TM848-2E is an eight-inch, floppy disk drive with two read-write heads for double-sided diskettes. Table 4-29 describes the configurable jumpers, and Figure 4-10 shows their locations. For any drive, only one of the drive-select jumpers (DS1 through DS4) should be in. Jumper pins TR, HL, and M4 must be shorted. No other jumper pins on the board should be connected.

Table 4-29 shows that the drive-select jumper DS1 is plugged in, and the other drive-select jumpers (i.e. DS1, DS3 AND DS4) are open. This means that the drive is selected as drive one (i.e. F0).

Figure 4-10 also shows the location of the terminating resistor pack. The resistor pack must always be plugged in if the system is a single-drive system. In any multiple-drive system, the resistor pack must be plugged in only on the last drive.
HARDWARE CONFIGURATION INSTRUCTIONS

TABLE 4-29

TANDON TM848-2E
JUMPER CONNECTIONS
(See Figure 4-10)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIG-</td>
<td>FACTORY-</td>
<td>Drive Select 1: When this</td>
</tr>
<tr>
<td>NATION/</td>
<td>SHIPPED</td>
<td>jumper is in and the other three DS</td>
</tr>
<tr>
<td>PIN NO.</td>
<td>CONNECTION</td>
<td>jumpers are out, the drive is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>selectable as floppy drive 1 (F0).</td>
</tr>
</tbody>
</table>

NOTE: The SMS 1000 can be configured to include a single 8" floppy drive. Hence, the DS1 jumper pair is the only one used.

| TR    | IN         | True Ready: When this jumper is in, the true-ready line                  |
|       |            | indicates that the diskette is rotating at normal speed.                |

| HL    | IN         | Head Load: When this jumper is in, the head-load line controls power for |
|       |            | the stepper motor.                                                      |

| M4    | IN         | Motor Control: When this jumper is in, the head-load line turns on the   |
|       |            | spindle motor.                                                          |

STRAPPING THE PANASONIC JU465 DISK DRIVE

The JU465 is a 5 1/4-inch, double-headed, 96 TPI, floppy disk drive. As many as two drives can be daisy-chained together in your SMS 1000 system. Jumper connections enable the user to select various options. Table 4-30 describes the jumpers, and Figure 4-11 shows the locations of the jumpers and the connections made by the factory.

Figure 4-11 also shows the location of the terminating resistor pack, RPl. In a single-drive system, the resistor pack must be plugged into the circuit board of the drive; in a multiple-drive system, the resistor pack must be plugged into the circuit board of the last drive. No other drive in the string should be terminated.
<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1</td>
<td>IN</td>
<td>Drive Select 1: When this jumper is in and the other three are out, the drive is selected as floppy drive 1 (F0).</td>
</tr>
<tr>
<td>DS2</td>
<td>OUT</td>
<td>Drive Select 2: When this jumper is in and the other three are out, the drive is selected as floppy drive 2 (F1).</td>
</tr>
</tbody>
</table>

**NOTE:** The SMS 1000 is configurable to include up to two 5 1/4" floppy drives. Hence, jumper pairs DS3 and DS4 are always open.

<table>
<thead>
<tr>
<th>MX</th>
<th>OUT</th>
<th>Drive Select Enabled: When this jumper is in, it allows any of the four drive-select lines to activate the drive. In the SMS 1000, this jumper is always out.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS</td>
<td>IN</td>
<td>The DS jumper allows only a selected drive-select line to activate the drive.</td>
</tr>
<tr>
<td>+WP</td>
<td>IN</td>
<td>Enables write-protect mode in which diskettes with their write-protect notch COVERED are write protected. This is the standard convention for 5 1/4&quot; diskettes.</td>
</tr>
<tr>
<td>-WP</td>
<td>OUT</td>
<td>Drive is shipped with this jumper OUT. If these jumper pins are connected, it enables the write-protect mode in which diskettes with their write-protect notch OPEN (NOT COVERED) are write protected. This connection gives 5 1/4&quot; diskettes the same write-protect convention as 8&quot; diskettes.</td>
</tr>
</tbody>
</table>
CAUTION: Be sure that your JU465 has its +WP/-WP strapping done in accordance with the conventions adopted by your installation. If it has the opposite strapping, data meant to be protected could easily be written over.

MM,HS IN Factory installed: Always in.
MS,HM OUT Not used: Always out.
HL,IIU

STRAPPING THE SEAGATE ST412 AND ST419 WINCHESTER DRIVES

The ST412 is a 5 1/4-inch Winchester disk drive with two platters and four read-write heads. The ST419 has three platters and six read-write heads. A shunt block on the drive's circuit board permits the user to select the options described in Table 4-31. Figure 4-12 shows the location of the shunt block.

Also, next to the shunt block is the terminating resistor pack. The resistor pack terminates the drive's signal lines, and it must be plugged in the circuit board of the drive in a single-drive system. In a multiple drive system, the resistor pack must be plugged in only on the last drive. All other drives in the string must not be terminated.

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIG- FACTORY- NATION/ SHIPPED PIN NO. CONNECTION</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| DS1 IN (8,9) | Drive Select 1: When this jumper is in and the other three are out, the drive is selected as drive 1 (W0). |
| DS2 OUT (7,10) | Drive Select 2: When this jumper is in and the other three are out, the drive is selected as drive 2 (W1). |
Fig. 4-10  Location of jumpers on Tandon TM848-2E
NOTES:
1. Soldered-in jumpers are for factory use only. Do not change.
2. + WP = Write protect when notch on diskette is covered. This is the SMS-shipped strapping.
3. − WP = Write protect when notch on diskette is open.
4. Jumpers are shown in their default configurations.

Fig. 4-11 Location of jumpers on Panasonic JUA465
HARDWARE CONFIGURATION INSTRUCTIONS

NOTE: Since the SMS 1000 is configurable to include up to two Winchester drives, DS3 and DS4 are always open.

R OUT  Radial Option: When this jumper is in all output signals of the drive are active, even if the drive has not been selected.
(1,16)

D IN  Defeat Recal: When this jumper is in, the automatic recal operation is defeated. When this jumper is out, the drive heads are automatically re-positioned to track 0 during a power-up sequence. This is called "recal."
(2,15)

(3,14) IN Not used.

H IN  Half Step: When this jumper is in, the half-step option is defeated. The ST412 and ST419 do not use the half-step option.
(4,13)

STRAPPING THE SEAGATE ST212 WINCHESTER DRIVE

The Seagate ST212 is a single-disk half-height Winchester drive with a 12-megabyte unformatted capacity. Drive-selection strapping is accomplished by adding jumper plugs to pins of a 16-pin connector located at the Pl/P2 end of the drive's printed circuit board. The last drive in a chain has chained signals terminated by a resistor pack located at the connector end of the circuit board. The following paragraphs describe the strapping procedure for the ST212.

JUMPER PINS. All jumper pins are located on connector J9, which can be found between the circuit board's connectors J1 and J2. Viewed from the connector-end of the drive with J1 on the left, the pins of J9 are numbered as follows (pins 13 and 14 are not used):

15 13 11 9 7 5 3 1
16 14 12 10 8 6 4 2

DRIVE-SELECT JUMPERS

(1). CONFIGURING AS DRIVE 0. To configure this drive as Drive 0,
HARDWARE CONFIGURATION INSTRUCTIONS

place a jumper between pins 1 and 2. Remove jumpers from pins 3, 4, 5, 6, 7 and 8.

(2). CONFIGURING AS DRIVE 1. To configure this drive as Drive 1, place a jumper between pins 3 and 4. Remove jumpers from pins 1, 2, 5, 6, 7 and 8.

RADIAL OPTION

To configure the drive for radial instead of daisy-chain operation, place a jumper between pins 15 and 16. The as-shipped (default) option is NO jumper. Each radial drive must have its termination-resistance pack in place.

WRITE FAULT OPTION

To permit the Drive Select signal to reset the Write Fault latch, place a jumper between pins 11 and 12. The as-shipped (default) option is NO jumper.

LIFE TEST OPTION

This option is for manufacturing use only. The as-shipped (default) option is NO jumper between pins 9 and 10.

TERMINATION OF DAISY CHAINED SIGNALS

The last drive in a chain must include a 220/330-ohm termination-resistance IC pack in the green 16-pin socket located near the P1/P2 connectors on the circuit board. This pack must be removed from the other drives in the chain.

STRAPPING THE SEAGATE ST213 AND ST225 WINCHESTER DRIVES

Drive-selection strapping of both the ST213 and ST225 is done by adding jumper plugs to pins of a 16-pin connector (J7) at the P1/P2 end of the drive's printed circuit board. The last drive in a chain must have chained signals terminated by a resistor pack whose socket is located at the connector end of the circuit board.

JUMPER PINS. All jumper pins are located on connector J7, which can be found between the circuit board's connectors J1 and J2. Viewed from the connector-end of the drive with J1 on the left, the pins of J7 are numbered as follows:

\[
\begin{align*}
1 & \quad 3 & \quad 5 & \quad 7 & \quad 9 & \quad 11 & \quad 13 & \quad 15 \\
2 & \quad 4 & \quad 6 & \quad 8 & \quad 10 & \quad 12 & \quad 14 & \quad 16
\end{align*}
\]
HARDWARE CONFIGURATION INSTRUCTIONS

DRIVE-SELECT JUMPERS

(1). CONFIGURING AS DRIVE 0. To configure this drive as Drive 0, place a jumper between pins 15 and 16. Remove jumpers from pins 9, 10, 11, 12, 13 and 14.

(2). CONFIGURING AS DRIVE 1. To configure this drive as Drive 1, place a jumper between pins 13 and 14. Remove jumpers from pins 9, 10, 11, 12, 15 and 16.

RADIAL OPTION

To configure the drive for radial instead of daisy-chain operation, place a jumper between pins 1 and 2. The as-shipped (default) option is NO jumper. Each radial drive must have its termination-resistor pack in place.

WRITE FAULT OPTION

To permit the Drive Select signal to reset the Write Fault latch, place a jumper between pins 5 and 6. The as-shipped (default) option is NO jumper.

LIFE TEST OPTION

This option is for manufacturing use only. The as-shipped (default) option is NO jumper between pins 7 and 8.

RECOVERY MODE OPTION

This option permits the read/write heads to microstep. To select this option, connect a jumper between pins 3 and 4. The as-shipped (default) option is NO jumper between pins 3 and 4.

TERMINATION OF DAISY CHAINED SIGNALS

The last drive in a chain must include a 220/330-ohm termination-resistance IC pack in the green 16-pin socket located near the P1/P2 connectors on the circuit board. This pack must be removed from the other drives in the chain.

STRAPPING THE CMI CM5412 AND CM5619 DRIVES

The CMI CM5412 is a 5 1/4-inch Winchester disk drive with two disks and four read-write heads. The CM5619 has three disks and 6 read-write heads. A shunt block that plugs into a socket on the circuit board allows the user to change the drive-select number (DS1 through DS4). This is the only option available to the user. Table 4-32 describes the shunt block, and Figure 4-13 shows its location.
HARDWARE CONFIGURATION INSTRUCTIONS

Also, next to the shunt block is the terminating resistor pack. The resistor pack terminates the drive's signal lines, and it must be plugged into the drive's circuit board in a single-drive system. In a multiple drive system, the resistor pack must be plugged into only the last drive. All other drives in the string must not be terminated.

TABLE 4-32
COMPUTER MEMORIES, INC.
CM5412 AND CM5619
JUMPER CONNECTIONS
(See Figure 4-13)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIG-FACTORY-NATION/SHIPPED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIN NO. CONNECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>DS0 (1,2) IN</td>
<td></td>
<td>Drive Select 0: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).</td>
</tr>
<tr>
<td>DS1 (3,4) OUT</td>
<td></td>
<td>Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).</td>
</tr>
</tbody>
</table>

NOTE: Since the SMS 1000 is configurable to include up to two Winchester drives, DS3 and DS4 are always open.

9-10 OUT Not used.
11-12 OUT Not used.

STRAPPING THE QUANTUM Q540 WINCHESTER DRIVE

The Q540 is a 5 1/4-inch Winchester disk drive with 4 disks and 8 read-write heads. Five pairs of jumper pins on the circuit board provide the only user options. Table 4-33 describes the options, and Figure 4-14 shows the locations of the jumper pins on the circuit board.

Near the group of jumper pins is the terminating resistor pack. The resistor pack must be plugged in the circuit board of the...
Fig. 4-12  Location of jumpers on Seagate ST412 and ST419
Fig. 4-13 Location of jumpers on CMI CM5412 and CM5619
HARDWARE CONFIGURATION INSTRUCTIONS

drive in a single-drive system. In a multiple-drive system, the resistor pack must be plugged in the circuit board of the last drive and the other drives in the string must not be terminated.

TABLE 4-33

QUANTUM Q540
JUMPER CONNECTIONS
(See Figure 4-14)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIG- FACTORY-</td>
<td>NATION/ SHIPPED</td>
<td>PIN NO. CONNECTION</td>
</tr>
<tr>
<td>DS1 IN</td>
<td></td>
<td>Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).</td>
</tr>
<tr>
<td>DS2 OUT</td>
<td></td>
<td>Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).</td>
</tr>
</tbody>
</table>

NOTE: Since the SMS 1000 is configurable to include up to two Winchester drives, DS3 and DS4 are always open.

A OUT | Drive Select Enabled: When this jumper is in, drive select is always enabled.

STRAPPING THE VERTEX V170 WINCHESTER DRIVE

The V170 is a 5 1/4-inch Winchester disk drive with four disks, seven read-write heads, and one servo head. A shunt block provides the user options. Table 4-34 describes the options, and Figure 4-15 shows the location of the shunt block on the circuit board.

A terminating resistor pack, RP1, is located near the shunt block. The resistor pack must be plugged in the circuit board of the drive in a single-drive system. In a multiple-drive system, the resistor pack must be plugged in the circuit board of the last drive. The other drives must not be terminated.
TABLE 4-34

VERTEX V170
JUMPER CONNECTIONS
(See Figure 4-15)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIG-</td>
<td>FACTORY-</td>
<td>(8,9)</td>
</tr>
<tr>
<td>NATION/</td>
<td>SHIPPED</td>
<td></td>
</tr>
<tr>
<td>PIN NO.</td>
<td>CONNECTION</td>
<td></td>
</tr>
<tr>
<td>DS1 IN</td>
<td>Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).</td>
<td></td>
</tr>
<tr>
<td>DS2 OUT</td>
<td>Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Since the SMS 1000 is configurable to include up to two Winchester drives, DS3 and DS4 are always open.

<table>
<thead>
<tr>
<th>RADIAL</th>
<th>OUT</th>
<th>(1,16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO ACCESS</td>
<td>OUT</td>
<td>(2,15)</td>
</tr>
<tr>
<td>CAPACITY ID</td>
<td>(3,14)</td>
<td>OUT</td>
</tr>
<tr>
<td>CAPACITY: Manufacturer uses these to indicate the number of heads and disks on the drive.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not change these jumpers.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMS 1000 4-91
HARDWARE CONFIGURATION INSTRUCTIONS

Fig. 4-14  Location of jumpers on Quantum Q540
Fig. 4-15  Location of jumpers on Vertex VL70
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE MAXTOR XT-1140 AND XT1085 WINCHESTER DRIVES

The XT-1140 is a 5 1/4-inch Winchester disk drive with 8 disks, 15 read-write heads, and one servo head. The XT-1085 is a 5 1/4-inch Winchester drive with 5 platters, 8 read-write heads, and one servo head. Jumper pins enable the user to select either drive as one of four in a system. Table 4-35 describes the jumpers, and Figure 4-16 shows the locations of the jumper pins on the circuit board.

Above the jumper pins is the terminating resistor pack. The resistor pack must be plugged into the circuit board of the drive in a single-drive system. When multiple drives are in the system, the resistor pack must be plugged into the circuit board of only the last drive.

TABLE 4-35
MAXTOR XT-1140 AND XT-1085
JUMPER CONNECTIONS
(See Figure 4-16)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS0 (5,6) IN</td>
<td>Drive Select 0: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).</td>
</tr>
<tr>
<td>DS1 (4,5) OUT</td>
<td>Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).</td>
</tr>
</tbody>
</table>

NOTE: Since the SMS 1000 is configurable to include up to two Winchester drives, DS2 and DS3 are always open.

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS2 (2,3) OUT</td>
<td>Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 3.</td>
</tr>
<tr>
<td>DS3 (1,2) OUT</td>
<td>Drive Select 3: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 4.</td>
</tr>
</tbody>
</table>

SMS 1000 4-94
Fig. 4-16 Location of jumpers on Maxtor XT-1140 and XT-1085
STRAPPING THE DMA 360 REMOVABLE-CARTRIDGE WINCHESTER DRIVE

The DMA 360 is a 5 1/4-inch, half-height Winchester drive that uses a removable hard-disk cartridge. The cartridge contains a hard disk with two recording surfaces; the two read-write heads are inside the drive. As shipped from the SMS factory, the DMA 360 has no user re-configurable options. The drive must always be the first hard-disk drive in the system (i.e. C0). Table 4-36 describes the jumper connections; Figure 4-17, view A, shows the locations of the connections. The jumper wire at DS0 is soldered in place.

View B of Figure 4-17 shows the line terminators. The terminators are soldered in place; in the SMS 1000 system, they are not to be removed.

**TABLE 4-36**

DMA 360 JUMPER CONNECTIONS

(See Figure 4-17)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS0</td>
<td>Drive Select 0: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (C0). NOTE: In the SMS 1000 system, this jumper is always connected, and the other three DS jumpers are always disconnected (OUT).</td>
</tr>
<tr>
<td>DS1</td>
<td>Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1.</td>
</tr>
<tr>
<td>DS2</td>
<td>Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2.</td>
</tr>
</tbody>
</table>

SMS 1000 4-96
HARDWARE CONFIGURATION INSTRUCTIONS

DS3 OUT  Drive Select 3: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 3.

---------------------------------------------

STRAPPING THE TANDBERG TDC 3309 STREAMING TAPE DRIVE AND THE TDC 3350 MK. II FORMATTER BOARD

The TDC 3309 is a half-height 1/4-inch, streaming, cartridge-tape drive. The basic drive is the TDC 3309. The drive's separate formatter board is the TDC 3350 Mk. II. Two hook-type connectors, JP1 and JP2, on the rear of the drive's internal circuit board, allow the user to select the drive-select number (see Figure 4-18). In the SMS 1000 system the TDC 3309 is always set as drive 1 (T0). Table 4-37 describes the use of these hook-type connectors JP1 and JP2, and Figure 4-18 shows their locations. Table 4-37 also includes information on jumpering the TDC 3350 Mk. II formatter board. The TDC 3350 Mk. II jumpers are shown in Figure 4-19.

In Table 4-37, with regard to the hook-type connectors used on the TDC 3309, the term OUT means that the long part of the connector is NOT hooked to the stationary part of the connector. The term IN means that the long part of the connector IS hooked to the stationary part of the connector. Figure 4-18 shows both connectors in their default, or unhooked (OUT), position.

TERMINATORS. The terminating resistor pack (Figure 4-18) is located behind the d-c power connector J2. This pack must be plugged in its socket in all single-drive systems.

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN-FACTORY-NATION/SHIPPED</td>
<td></td>
</tr>
<tr>
<td>PIN NO. CONNECTION (DEFAULT)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDC 3309 DRIVE (see Figure 4-18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP1 OUT When both JP1 and JP2 are unhooked (OUT)</td>
</tr>
<tr>
<td>JP2 OUT the drive is selected as drive 1 (T0).</td>
</tr>
</tbody>
</table>

NOTE: The following alternate connections are NOT used on the SMS

SMS 1000  4-97
1000 and are included here for reference only: When JP1 is unhooked (OUT) and JP2 is hooked (IN), the drive is selected as drive 2. When JP1 is hooked (IN) and JP2 is unhooked (OUT), the drive is selected as drive 3. When both JP1 and JP2 are hooked (IN), the drive is selected as drive 4.

---

**JP3 OUT**  
While these jumper pins are shorted, the drive runs repeated self-test cycles.  
CAUTION: These pins should never be shorted for more than a few self-test cycles. To operate in this mode for long periods may destroy the tape and injure the capstan motor.

---

**TDC 3350 MK. II FORMATTER BOARD (see Figure 4-19)**

---

**JP1 IN**  
Pins 1 and 2 ("+5V CON")  
When this jumper is IN, +5 volts is supplied to pin 2 of connector J3 for use by special test circuits drawing a maximum of 300 ma.

---

**JP2 OUT**  
Pins 17 and 18 ("SELF")  
While this jumper is IN, The drive runs repeated self-test cycles.  
CAUTION: These pins should never be shorted for more than a few self-test cycles. To operate in this mode for long periods may destroy the tape and injure the capstan motor.

---

**JP2 OUT**  
Pins 19 and 20 ("WRTT")  
When this jumper is IN, and a self-test of the drive has also been commanded, the self test then includes a write operation.

---

**JP3 OUT**  
Pins 1 and 2 ("PAR")  
With this jumper OUT, parity checking is not performed. With the jumper IN, the drive's parity circuits check for odd parity.

---

**JP3 OUT**  
Pins 3 and 4 ("OPT 1")  
Automatically seeks tape edge for head positioning before writing. With the jumper IN, the mechanical head switch is used for head positioning before writing.
**HARDWARE CONFIGURATION INSTRUCTIONS**

**JP3 IN** pins 5 and 6 ("8K RAM")

Enables a buffer size of 8K. This requires that an 8K RAM chip be inserted in socket U52 with U51 left open. An 8K buffer size is the default (as-shipped) value. The default jumper connections given in this table permit expansion to 16K by the simple addition of an extra 8K RAM chip in the U51 socket; i.e. with no further jumper strapping needed.

**JP5 IN** pins 1 and 2 ("RAM SEL")

Also, when JP3/5,6 are open, JP5/2,3 are shorted, and JP6/1,2 are shorted, the formatter is configured to operate with a 4K buffer. This requires 2K RAM chips in both U51 and U52.

**JP4 OUT** pins 9 and 10 ("OPT 2")

A status byte of A2H is sent out by drive at EORA (End Of Recorded Area). With jumper IN, EORA status byte = A0H.

**JP4 OUT** pins 11 and 12 ("OPT 3")

In the default mode, i.e. NO jumper, the formatter operates in QIC-11/QIC-24 mode. With the jumper IN, the formatter operates in QIC-11 mode only.

**JP4 OUT** pins 13 and 14 ("OPT 4")

Drive looks for physical BOT (Beginning Of Tape). With jumper IN, drive looks for logical BOT indication.

**JP4 OUT** pins 15 and 16 ("OPT 5")

Selects "hard" parity-error handling. With jumper IN, "soft" parity-error handling is selected. NOTE: "Soft" parity-error handling is available only in the "Dual Format Extended Command Set" firmware version.

**FILE TAPE INTERFACE BOARD:** Strapping of the file tape interface board used with the TDC 3309/3350 Mk. II is described in Appendix H as part of the general discussion of how to configure and use the file tape facility.
Fig. 4-17  Location of jumpers on DMA Model 360
Fig. 4-18 Location of jumpers on Tandberg TDC 3309 control board
Fig. 4-19 Location of jumpers on Tandberg TDC 3350 Mk. II formatter board.
HARDWARE CONFIGURATION INSTRUCTIONS

STRAPPING THE SYQUEST SQ312RD CARTRIDGE-TYPE WINCHESTER DRIVE

The default (as shipped) jumper strapping for the SyQuest SQ312RD cartridge-type Winchester drive is given in the following table (Table 4-38). See Figure 4-20.

TABLE 4-38
SYQUEST SQ312RD
JUMPER CONNECTIONS
(See Figure 4-20)

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>SMS DESIGNATION/PIN NO.</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>IN</td>
<td>Write-data termination</td>
</tr>
<tr>
<td>W2</td>
<td>IN</td>
<td>Read-data termination</td>
</tr>
<tr>
<td>W3</td>
<td>IN</td>
<td>Change-cartridge option</td>
</tr>
<tr>
<td>W4</td>
<td>IN</td>
<td>Fault-latch option</td>
</tr>
<tr>
<td>W5-W</td>
<td>OUT</td>
<td>Factory use only</td>
</tr>
<tr>
<td>W6-W</td>
<td>OUT</td>
<td>Factory use only</td>
</tr>
<tr>
<td>W7-W</td>
<td>OUT</td>
<td>Factory use only</td>
</tr>
<tr>
<td>W8</td>
<td>IN</td>
<td>Recovery option</td>
</tr>
<tr>
<td>W9</td>
<td>IN</td>
<td>Recalibrate option</td>
</tr>
<tr>
<td>W10</td>
<td>OUT</td>
<td>De-select auto-recovery mode</td>
</tr>
</tbody>
</table>

DRIVE-SELECT JUMPERS (DEFAULT CONNECTION): The drive is shipped from SMS with a jumper across drive-select pins 1 and 2. This selects the drive as DS1. All other drive-select pins are without jumpers (see Figure 4-20). To select the drive as DS2, jumper drive-select pins 2 and 3 only; for DS3, short pins 4 and 5 only; for DS4, short pins 5 and 6 only.

TERMINATION-RESISTOR PACK: The SQ312RD drives are shipped from SMS with a termination-resistor IC plugged into the drive's termination-resistance socket. Do not remove this IC unless two or more chained drives are used, in which case the IC is to be plugged only into the last drive in the chain.
NOTE:
Jumpers shown in default (as-shipped) positions.

Fig. 4-20  Location of jumpers on SyQuest SQ312RD
SECTION 5

SMS 1000 SYSTEM OPERATION
AND
THE SENSE MONITOR

INTRODUCTION

MODES OF OPERATION

The SMS 1000 has two fundamental modes of operation:

1. HOST OPERATION. In this mode the SMS 1000 system runs only host programs. Communication with the host is via a user-selected terminal. Booting from initial power-up, Restart, Run/halt, and write protection of Winchester drives must be initiated using the SMS 1000 front-panel display and controls.

2. SENSE MONITOR OPERATION. The SENSE menu system can run either in the foreground, using your video data terminal, or in the background (i.e. while the host is operating) using the SMS 1000 front-panel display and controls. Not all SENSE functions can be performed while the host is running.

THE SENSE MONITOR

The SENSE Monitor (or "SENSE", as it will usually be called) is a group of utility, operational, system-configuration and analytical programs residing in ROM on the System Foundation Module and organized, for user purposes, as a set of menus and sub-menus. These programs interact with the system's peripherals as well as with the CPU and memory so as to permit you to configure system parameters, check system status, run system diagnostics, do backups, format disks, and identify component failures.

SENSE readouts can appear either on the 16-character front-panel display or on any console device. Also, seven pushbutton controls on the SMS 1000 front panel permit rapid movement through the SENSE menus; operator-initiated system-restart commands; operator-initiated run/halt commands; and write protection of fixed-disk Winchester drives. These controls and indicators are shown in Figure 5-1.
SYSTEM OPERATION AND THE SENSE MONITOR

16-CHAR DISPLAY

MENU  ←  ▶  *  
RE START  RUN HALT  WRT PROT

DC ON/OFF SWITCH

FLOPPY DRIVE

FRONT PANEL

Fig. 5-1 Front panel switches and display window
SYSTEM OPERATION AND THE SENSE MONITOR

SENSE is designed so that even with no modules in the backplane, its processor (see Figure 1-8) allows the user to perform diagnostics and self tests of the basic SMS 1000 system. Thus, the system can be fully checked out prior to installing modules in the backplane, and then, as each board is added to the backplane, further diagnostics and self tests can be performed. In this way, as your system is built up, it can be tested and checked out at each step of the system-integration process.

FRONT PANEL CONTROLS AND INDICATORS

The front panel controls and indicators include the DC power switch (located behind the front panel door), the 16-character readout and the seven pushbutton switches. These are described in Table 5-1.

IMPORTANT

If you are accessing SENSE from a video display terminal, remember that the front panel controls (except for the DC POWER switch and the RESTART, RUN/HALT and WRT PROT buttons) are locked out once video display terminal operation begins.

<table>
<thead>
<tr>
<th>TABLE 5-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRONT PANEL CONTROL AND INDICATOR FUNCTIONS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTROL OR INDICATOR</th>
<th>FUNCTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC POWER SWITCH</td>
<td>Located behind door on front panel. Controls application of DC power to backplane, fans, and all integral peripherals.</td>
</tr>
<tr>
<td>16-CHARACTER FRONT-PANEL DISPLAY</td>
<td>Displays readouts of system status; environmental or operational conditions; evaluation test results; and system configuration parameters. The names of menus and menu contents are displayed as each level in the menu-selection process is reached.</td>
</tr>
<tr>
<td>MENU button</td>
<td>1. At system turn-on or reset, pressing MENU removes the &quot;SMS 1000&quot; logo display,</td>
</tr>
</tbody>
</table>
starts the menu-selection process, and the first menu is then displayed.
2. Returns to start of current menu, if within a menu.
3. Aborts current command, if one is pending.

---

**left arrow**
1. Steps back to previous menu entry.
2. Can shift from units to tens to hundreds positions when entering decimal data.

---

**right arrow**
1. Steps to next menu entry.
2. Can step through digits 0 to 9 when entering decimal data.

---

**button**
1. Selects the current entry being displayed by the 16-character front panel readout.
2. Enables the RESTART button when both are being pressed at the same time.

---

**RESTART**
Stopes all current host activity and reboots the system. NOTE: This button is inter-
locked with the "*" button. For RESTART to operate, it must be pressed at the same
time as the "*" button. The RESTART button controls the restart function in both front-panel and external-terminal operation.

---

**RUN/HALT**
Pressing this button makes the RUN/HALT menu appear on the 16-character front-panel display. This menu can then be used to either run or halt the CPU. RUN/HALT button can be used at any time, regardless of current system state. The RUN/HALT button controls the run/halt function in both front-panel and external-terminal operation. The RUN/HALT menu does not appear on your video terminal.

---

**WRT PROT**
Enables the write protection of either Winchester fixed-disk drive. This button must be used for write protection both in external-terminal and front-panel operation. Pressing the WRT PROT button causes a menu of write-protect options to appear on the 16-character front-panel display. The WRT
SYSTEM OPERATION AND THE SENSE MONITOR

PROT button can be used at any time, regardless of current system state. Note that the write-protection menu does not appear on your video display terminal.

BASIC OPERATION OF THE SENSE MONITOR

The basic operating procedure for SENSE is very simple: Read through the list of commands in a SENSE menu until you find the one you want, then select that command by using controls on the Front Panel or your terminal. Because the basic operation is so simple, you can run SENSE, if desired, using only the 16-character display window and the front panel buttons. Therefore, even systems that have no terminal available for use as a console can use SENSE. Operating from a console is, of course, more convenient since the terminal can display more information and provides a keyboard for data input.

THE SENSE MENU SYSTEM

As mentioned previously, the basic operating principle of SENSE is to select a desired command from a list, or menu, of commands. Because a single menu of all possible commands would be too long, the SENSE commands are divided up into four basic groups:

STATUS. The status commands check and report on the system's operating status.

OPERATION. The operation commands duplicate some functions available in your operating system such as booting, restarting, copying disks, etc. These commands are provided as a convenience feature for use when the operating system is not available. Because the operation commands run in the independent support processor on the System Foundation Module, these utilities are available even when the backplane is empty.

EVALUATION. Evaluation commands test and report the status of peripheral devices controlled by the system foundation module (i.e., Winchester and floppy disks, and cartridge tape). These commands help you isolate problems quickly and easily. Isolating a problem often allows you to correct it yourself. For example, read/write errors on cartridge tape or floppy disk may occur simply because the heads need to be cleaned. Problems that require repair service can be handled more efficiently if you can identify the faulty component when requesting help.

CONFIGURATION. Configuration commands enable you to define various parameters that affect the system's operation. For example, the system must know a terminal's baud rate before it can communicate
with the terminal. The configuration commands allow you to enter this information directly and rapidly into the SMS 1000 controller's EEPROM. The information is then stored, and the controller communicates at the baud rate you entered.

LEVELS WITHIN MENUS

The concept of levels within menus is important because the system allows you to view only one level at a time. In the following example, taken from the STATUS menus, the system presents the TEMPERATURE and POWER SUPPLY menus (Level 2) when you select the ENVIRONMENT menu (Level 1) within the STATUS menu (level 0, or top level). If you try to position the cursor beyond the end of the POWER SUPPLY commands (Level 3), the system simply wraps back around to the TEMPERATURE subcommand.

This manual uses the convention of indentation to designate levels within menus, as shown in the following sample listing of the STATUS menu:

```
Level 3:
  Level 2:
    Level 0:
      STATUS
          ↓
          ↓
      SYSTEM
          <compact status>
          IDENTIFY
            <banner>
            FIRMWARE V<n.n>
            SPM S/N <nnnn>
            SHIP <mm/dd/yy>
          ENVIRONMENT
            TEMPERATURE
              DRIVES: <fff>F/<cc>C
              CARDS: <fff>F/<cc>C
              POWER SUPPLY
                +5V:  <d.d>V
                +12PV: <dd.d>V
                +12CV: <dd.d>V
                -12V:  <-dd.d>V
                +24V:  <dd.d>V
```

COMMAND FUNCTIONS

As seen in the example of the POWER SUPPLY command (above), some commands display information. Other commands, such as FORMAT, initiate disk-controller functions. Still other com-
SYSTEM OPERATION AND THE SENSE MONITOR

Commands display a parameter list and give you an opportunity to modify that parameter. For example the BAUD RATE command displays a list of the possible baud rates and allows you to change the current setting. The command always displays the currently configured setting first. Therefore, you can use this type of dual-purpose command to determine the current baud rate setting and/or to change the setting.

CONCURRENT OPERATION VERSUS OFF-LINE OPERATION

Concurrent operation allows SENSE to run certain commands while application programs are also running on the host CPU. Notice that concurrent operation applies only to SENSE commands run from the front panel. The console is always reserved for use by applications when the host CPU is running.

Although some commands can run concurrently, to accomplish certain other tasks it is often necessary to stop all applications and run SENSE in an off-line mode. For example, some evaluation tests write over data on the disks and cannot run concurrently with any application. If you attempt to carry out such tasks concurrent with host operation, the system issues the error message

    HOST IS RUNNING

and aborts the task.

As a general guide, STATUS information is always available. EVALUATION, CONFIGURATION, and most OPERATION commands should be run in the off-line mode. The system will not allow you to perform SENSE tasks that would interfere with programs running on the host CPU.

COMMAND USER LEVELS

SENSE provides three levels of user access into the menu system: user, system manager or technician. The user access level includes all the commands required for normal system operation. The system manager level adds commands used to configure or change the system. The technician level allows access to all SENSE commands in order to permit the diagnosis of problems. See Appendix A for a complete list of SENSE menus and corresponding access levels.

By use of the ACCESS LEVEL commands in the CONFIGURATION menus of SENSE, you can assign passwords that control access at the Technician (abbreviated TECH) and System Manager (SYS MGR) levels. The USER level provides maximum convenience because
commands that you don't need are not displayed in the menus.

The TECH access level may be useful for isolating problems. The SYS MGR access level is typically used only for the initial system set up or for periods of system maintenance.

CONVENIENCE FEATURES

MOVING THROUGH THE MENUS. In moving through the menus, the system allows you to step backward in a list as well as forward. From the front panel, press the "<-" button (this is the move-backward key). From a smart terminal, use the "<" (less-than) key. Dumb terminals do not require this feature since you select commands by their number.

When running from a console (smart or dumb terminal) you can step back one level in the menu system by pressing the backspace key. For example, if your current choices are TEMPERATURE and POWER SUPPLY, press the backspace key to backup to the level that offers the choice of IDENTIFY or ENVIRONMENT. The backspace key has no effect if you are already at the beginning of a menu.

The ^R (control R) key combination jumps back to the beginning of a menu. For example, in the STATUS menus, if you have accessed the TEMPERATURE and POWER SUPPLY commands and want to return to the top of the menus, press the ^R key combination to return to the beginning of the STATUS menu.

READY MENU. When you select a command that requires operator intervention, the system displays the READY? NOT READY? menu. This gives you time to perform actions such as inserting a diskette into the drive. Select READY? when you are ready for the command to begin. Select NOT READY? (or simply wait before selecting READY?) if further operator intervention is required.

IN-PROGRESS MESSAGES. When a time-consuming command is running, the system displays appropriate messages to let you know what is happening. During flaw map installation, for example, the system displays messages when it sorts the new map, and when it writes the map.

A few commands, formatting a Winchester disk in particular, are so lengthy that the system concentrates its resources on the task rather than displaying messages. Be sure to wait for the format command to complete, even though the system may appear to be inactive for several minutes.
SYSTEM OPERATION AND THE SENSE MONITOR

HOW TO OPERATE THE SYSTEM

INTRODUCTION

There are three basic modes of system operation. These are:

1. HOST OPERATION ALONE. In this mode the host runs applications, and communication with programs is via the terminal.

2. SENSE ALONE. In this mode, only SENSE is running. Communication with SENSE can take place via either the terminal or the SMS 1000 front-panel display.

3. CONCURRENT OPERATION OF THE HOST AND SENSE. In this mode, the host runs programs while, at the same time, certain portions of SENSE can be run in a background mode. Communication with the host is via the terminal. Communication with SENSE is via the SMS 1000 front-panel display.

The following paragraphs provide you with a complete step-by-step procedure for system operation. This procedure covers the three modes of system operation described above. See Figure 5-1 for the identification of controls referred to in these examples.

COMPLETE SYSTEM OPERATING PROCEDURE

1. APPLYING POWER. Apply a-c power by pressing the "1" side of the switch at the rear of the system enclosure (see Figure 1-3). A light on the a-c switch will glow as long as a-c power is applied. Next, apply d-c power to the system by opening the door on the front panel and pressing the d-c power switch to its "1" position.

2. VIDEO DISPLAY TERMINAL. Apply a-c power to your video display terminal, if used (refer to the terminal-connection and interfacing instructions given in Section 3). Note that the following procedure for checking out initial system operation is based on use of a video display terminal. (Although it is possible to configure the system in such a way that booting in the absence of a terminal (i.e. from the front panel alone) is possible, it is not recommended because the front-panel controls are only set up for such things as restart, run/halt and write protect, but not for any other type of communication with
a running program).

3. SELF TEST: GENERAL. For a short period after d-c power is applied, the front panel display flashes:

   POWER-ON/RESTART

and the system performs a multi-step automatic self-test sequence. Note that during the self test procedure, an LED on the front edge of the System Foundation Module (see Figure 1-4) will turn on for the duration of the tests (about a second). If the system fails any part of the self test, the LED will remain on. For diagnostic purposes, the system can be operated with the front panel removed and hanging by its safety wires so that you can observe the state of the LED during self test.

The self-test sequence includes steps 4, 5, and 6 of this procedure.

4. EPROM VERSION TEST. The first thing the system does is to compare the current controller firmware version number stored in the Foundation Module EPROM with the corresponding version number read from the EEPROM (i.e. the electrically erasable and reprogrammable read-only memory in which various configurable system characteristics are stored). If the numbers match, the test goes to its next step (Step 5 of this procedure).

If the numbers do not match, it means that the EEPROM must be reloaded from the EPROM and the following two front-panel messages are displayed in sequence:

   EEPROM mismatch!
   Re-load EEPROM?

You must press the "*" button on the front panel to initiate the EEPROM reload sequence. During the reload the front panel will display the message:

   Changing EEPROM!

Once the EEPROM has been reloaded from the EPROM the following messages are displayed on the front panel:

   Please reconfig!
   Please RESTART!

These messages remind the operator that when EEPROM is reloaded from EPROM, all configuration parameters are returned to the default values stored on the EPROM and, thus, previously configured (i.e. non-default) values that were entered by means of
the CONFIGURATION menus of SENSE are lost. Therefore, to start
the re-configuration process, you must first press the RESTART
and "*" buttons simultaneously and then enter SENSE (as de-
scribed in step 19 of this procedure). Next, reconfigure by
means of the CONFIGURATION menus, as described in Section 9 of
this manual. After reconfiguring, you must again restart the
system by pressing the front-panel "*" and RESTART buttons sim-
ultaneously.

NOTE

At any time during the complete start-up
process, as well as when the system is run-
ing applications, you can restart from the
beginning of the self-test sequence by simul-
taneously pressing the RESTART and "*"
buttons on the front panel.

5. HARDWARE SELF-TEST. After performing its test of firmware
version-number compatibility (see previous step), the system
then performs a self test of major hardware components. If
this test runs to completion without detecting any failures,
the following message is displayed, only if the system has
been restarted from a power-off condition:

Self Test OK

and the test goes on to Step 6 of this procedure. This mes-
 sage is not displayed if the self test took place during a
restart, i.e. as the result of simultaneously pressing the
RESTART and "*" buttons.

If an error is detected, the following error message is dis-
played:

Self Test Err <nn>

where nn is the decimal number of the self-test
error that was detected. The self-test error numbers and a
description of the corresponding errors are listed in Appen-
dix E. Note that some types of error are sufficiently severe
that even the front-panel error display cannot appear. In
the case of all displayable errors, however, the operator has
the option of continuing processing by pressing the "*"
button on the front panel.

6. CHECKSUM SELF-TEST. In this test, a checksum test is
performed on the contents of the EEPROM on the system Found-
ation Module. If there is no checksum error as the result of
this test, the system goes to Step 7 of this procedure.
If a self-test checksum error is reported, the following message is displayed on the front panel:

Self Test Err256

See Table E-1 of Appendix E for descriptions of this and other self-test error messages. The above message means that if processing continues, correct results cannot be assured. The system now waits for your response. In this case, pressing the "*" button produces the message:

Re-load EEPROM?

To reload the EEPROM from the EPROM you must again press the "*" button. This starts the reload process during which the following message is displayed:

Changing EEPROM!

At the completion of the reload the following two messages are flashed in sequence:

Please reconfg!
Please RESTART!

These messages remind the operator that when EEPROM is reloaded from EPROM, all configuration parameters are returned to the default values stored in the EPROM and, thus, previously configured (i.e. non-default) values that were entered by means of the CONFIGURATION menus of SENSE are lost. Therefore, to start the re-configuration process, you must first press the RESTART and "*" buttons simultaneously and then enter SENSE (as described in step 19 of this procedure). Next, reconfigure by means of the CONFIGURATION menus, as described in Section 9 of this manual. After reconfiguring, you must again re-enter the system by simultaneously pressing the front-panel "*" and RESTART buttons.

7. MEMORY SIZING. At the completion of self test the host memory size is measured, during which the message:

MEM sizing

is flashed on the front panel display. At the completion of the measurement, the memory size in K words (KW) is added to the end of the "MEM sizing" message.

NOTE

In performing tests on Winchester drives during the power-up sequence (see following
steps), the system tests access to each drive. The order followed is: Winchester 0, Winchester 1, cartridge-Winchester 0. The following steps apply only to those systems that are configured to include one or more Winchester drives.

8. WINCHESTER SPINUP. As soon as d-c power is applied, any Winchester drives in your system are energized and start to come up to their normal rotational speed. Note that, starting with the application of power, there is a fixed time delay before the system can load and run programs. This delay, which is configurable in the WINCHESTR SPINUP portion of the CONFIGURATION menus (see Section 9 of this manual), has a default value of 20 seconds. This corresponds to the spinup delay of most fixed-disk Winchester drives. Cartridge-type Winchester require a delay of at least 45 seconds. During the delay period, the message

Winchestr spinup

is displayed on the front panel. When each Winchester drive is up to speed and initialized, the following message is displayed:

xx ONLINE OK

where xx can be W0, W1 or C0, depending upon how your system is configured. The abbreviations W0, W1, etc. are defined as follows:

W0 = Fixed-disk Winchester 0
W1 = Fixed-disk Winchester 1
C0 = Removable-cartridge Winchester 0

9. WINCHESTER FLAW TABLES. After spinup, the system looks for the flaw table stored on each Winchester drive in order to read it into controller RAM. If this is done successfully, the following message is displayed and the system then goes on to Step 10 of this procedure:

xx FlaTbl OK

where xx can be W0, W1 or C0, depending upon how your system is configured.

If the flaw table cannot be successfully loaded, one of the following two messages is displayed:

xx FlaTbl Err nn
xx FlaTbl Bad
SYSTEM OPERATION AND THE SENSE MONITOR

where xx can be W0, W1 or C0, depending upon how your system is configured; and nn is the decimal number assigned to the error as listed in Appendix E.

NOTE

If the EEPROM was reloaded prior to this step and you have not yet reconfigured the system, then a flaw-table error is always generated.

The first message indicates that, for the reason listed in Appendix E, the flaw table cannot be read from disk. The second message will appear in place of the first if the table can be read but the contents are invalid. If either message is issued, you can escape by pressing the "*" button on the front panel. This causes a so-called "null" flaw table (i.e. an empty flaw table) to be built, and the following message to be displayed:

xx Entries = 0

where xx can be W0, W1 or C0, depending upon how your system is configured. CAUTION: with a null flaw table, you must be aware that hard disk flaws are no longer known and automatically passed over and that data already stored on spare sectors is not accessed until the flaw table is fully restored. This means that continued processing has a high degree of risk of data being corrupted. Hence, it is advisable to contact your service organization in order to restore the flaw table. See Section 7 of this manual.

If the flaw-table error message was issued for C0, then the following additional message appears:

C0 Ready?

This message is issued to cover the situation in which the only problem with C0 is that you may have forgotten to insert a cartridge or to close the drive door. If this is the problem, insert the cartridge or close the door and press the front-panel "*" button. The system will now repeat the last sequence of steps, starting with Winchester spinup.

Another possible cause of the error may be that the spinup delay configured into the system is too short for a cartridge-type Winchester. This type of drive requires a spinup delay of at least 45 seconds. If this is the problem, reconfigure, using the WINCHESTR SPINUP portion of the POWER-ON/RESTART menus, as described in Section 9 of this manual.

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SYSTEM OPERATION AND THE SENSE MONITOR

If you deliberately did not load a cartridge into the cartridge Winchester, then press the "->" button (right arrow, indicating a "no" response to the "C0 Ready?" query). The system then displays the message:

Not Ready?

Press the front-panel "**" button (i.e. a "yes" response). This tells the system that the absence of a cartridge in C0 is deliberate and to continue with power-on/restart processing.

10. WINCHESTER ACCESS TEST. An access test is now performed on each Winchester. This test attempts to read a sector from the first track on the last configured cylinder. If the access is successful, the following message is displayed and the system goes to Step 11 of this procedure:

xx Access OK

where xx can be W0, W1 or C0, depending upon how your system is configured.

If the track cannot be accessed, for example, because the actual number of cylinders does not agree with the configured value stored in EEPROM, the system returns the message:

xx Access Err nn

where xx can be W0, W1 or C0, depending upon how your system is configured, and nn is the error number as listed in Table E-3 of Appendix E. Proceed by pressing the "**" button on the front panel. The system then sends the following message, which warns that there may be a conflict between the actual hardware and how the system is configured:

Check config!

Also, any time the Winchester under test is write protected, the system sends the following message:

xx Writ Prot

where xx can be W0, W1 or C0, depending upon how your system is configured.

11. A row of stars ("****") is now scrolled across the front panel display. This signifies that the system is now ready to branch to the next phase of the power-up sequence: that is, either booting the host or calling SENSE.
12. OPTIONS FOR OPERATION AT THE CONCLUSION OF INITIAL TESTS. Depending upon how your system is configured, (see STARTUP MODE portion of the CONFIGURATION menus in Section 9 of this manual) there are three possible modes of going into full operation. These are:

(1) The usual as shipped (i.e. default) option is for the system to go automatically into bootstrapping the host at the completion of the initial tests described in this procedure.

(2) A second option is for the system to automatically call the SENSE menus.

(3) The third option involves testing and exercising the system and is of interest primarily to system engineers (see LOOP UNTIL ERR option under STARTUP MODE in Section 9).

NOTE

If you wish to run SENSE either in stand-alone mode or concurrently with the host, go to Step 19 of this procedure.

13. BOOTING THE HOST. After the system passes all steps of the preceding tests, it then goes directly to the start of bootstrap mode. The booting process is indicated on the front panel by the rapid flashing of the message:

Booting host

The system then boots in the manner described in Step 14 of this procedure.

If any kind of hardware failure prevents booting, the following front-panel message is displayed:

Boot failure

This message could be caused by such types of failure as a bad or missing CPU card, an incorrectly strapped CPU or memory card, bad or missing memory cards, or a bad Foundation Module. If the system detects a bad or missing CPU, the "Boot failure" message is replaced by the message:

Bad CPU?

If the system detects bad or missing memory cards, the "Boot failure" message is replaced by the message:
SYSTEM OPERATION AND THE SENSE MONITOR

No memory?

If any of these three messages appears, the booting process goes no further and your support organization should be informed. NOTE: In this case, it is still possible to enter the SENSE menus by pressing the "*" button on the front panel.

14. AUTOBOOT TIMEOUT DELAY. After the display of the message "Booting host", there are three possible modes of booting the system, depending upon the configured autoboot delay. This delay period is configurable using the AUTOBOOT TIMEOUT portion of the BOOTSTRAP commands (see CONFIGURATION menus in Section 9). The three delay modes are:

(1) ZERO DELAY. System immediately searches for first valid boot block among configured devices (see Section 9) in order to load and run bootstrap.

(2) CONFIGURED DELAY. During configured delay period you enter the logical name and unit number of the boot device and the system searches it for a valid boot block. See Step 16 of this procedure for a discussion of logical-device names and unit numbers.

(3) DELAY TIMEOUT. If no boot device is entered before the end of the configured delay period, the autoboot sequence automatically searches for the first valid boot block among the drives configured in the BOOTSTRAP portion of the CONFIGURATION menus.

MODE (1). In the first mode, autobooting is immediate, that is, the timeout delay is zero. The user is informed of this mode by the message:

AUTO - BOOT

The configurable autoboot drive sequence (see BOOTSTRAP portion of CONFIGURATION menus) is used to load the first valid boot block.

MODE (2). In the second mode, the boot device name and unit number is entered manually and the time allotted for this purpose is configurable. The time can range from zero to an indefinite period. The as-shipped default value supplied with the system is 10 seconds. The following typical display (see sample screen below) appears on your video display terminal screen if the delay is non-zero. The sample screen shows typical responses of the RT-11 operating system and includes operator responses to the prompt:
SYSTEM OPERATION AND THE SENSE MONITOR

ENTER DEVICE NAME AND UNIT NUMBER:

The purpose of this prompt is to allow you to choose an alternate drive for booting when special circumstances require it. For example, the stand-alone add-on tape unit (device name MS) is not part of the autoboot sequence and must be specified manually in order to be used as a boot device. The response "DUL" (see sample screen) means that a DU device with a unit number of 1 is being selected. In the sample screen, the operator responses are underlined.

MODE (3). The third mode occurs automatically if a valid device name and unit number is not entered within the autoboot timeout period. At the end of that period the response:

AUTO - BOOT

appears at the end of the "ENTER DEVICE NAME AND UNIT NUMBER" prompt on your terminal. The autoboot sequence then finds the first valid boot block among the configured devices, booting takes place, and the logical-device unit number containing the boot block is displayed in the following format:

BOOTING FROM DEVICE <unit No.> [Displayed in autoboot only]

IMPORTANT

In order to boot from a peripheral device such as a floppy-disk drive it must contain a DU-bootable diskette. Similarly, to boot from a Winchester drive, it must have been created as a DU-bootable device.
SAMPLE SCREEN WHEN BOOTING SYSTEM
(EXAMPLE SHOWS RT-11 SYSTEM RESPONSES)

<table>
<thead>
<tr>
<th>SMS 1000</th>
<th>BOOTSTRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>256KW MEMORY</td>
<td>11/73 CPU</td>
</tr>
</tbody>
</table>

BOOTABLE DEVICES:

<table>
<thead>
<tr>
<th>DEVICE NAME</th>
<th>DEVICE TYPE</th>
<th>UNIT NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DU</td>
<td>DSA</td>
<td>0-3</td>
</tr>
<tr>
<td>MS</td>
<td>TS</td>
<td>0</td>
</tr>
</tbody>
</table>

ENTER DEVICE NAME AND UNIT NUMBER: DU1 [Entry consists of two parts: Device name ("DU"), and Unit No. ("1"). Operator then presses Return.]

BOOTING FROM DEVICE 1 [Appears in autoboost only]

RT-11SJ V05.01

.SET TT SCOPE

.SET KMON IND

.SET EDIT KED

. [The RT-11 dot prompt shown at left means that the operating system is now ready for commands]

LEGEND

DU - Disk device
MS - External Tape device
DSA - Digital Storage Architecture
TS - Tape system
15. BOOTSTRAP ERROR MESSAGES. If the specified boot device does not exist or is not recognized (for any reason) the following message appears on your terminal:

***DEVICE NOT IN SYSTEM***

If the response was misspelled, the following message is displayed and the prompt is repeated:

***ILLEGAL DEVICE***
ENTER DEVICE NAME AND UNIT NUMBER:

If no boot block is found, the following message is displayed:

***NOT A BOOTABLE DEVICE***

If the specified unit is not online, the system returns the following message:

***UNIT OFF LINE***

If you are attempting to boot from an external tape device (device name MS) and a bad or blank tape is detected, the following message is displayed:

***TAPE READ ERROR***

If a valid boot block is not found on any of the devices searched in the autoboot sequence, the following message is displayed:

***NO BOOTABLE DEVICE IN SYSTEM***

At the conclusion of this message, the standard bootstrap screen (see sample screen above) is again displayed.

16. DESIGNATION OF LOGICAL DEVICE NAMES. Floppy and Winchester drives are designated with the prefix DU followed by a number. The numbers are assigned according to the following rules:

(1) Fixed-disk Winchester drives are assigned the lowest DU numbers (starting with DU0).

(2) Floppy drives are assigned the next higher DU numbers.

(3) Removable-cartridge Winchester drives are assigned the highest DU numbers.

(4) No more than four devices can be specified.
NOTE

At present, no logical (i.e. DU) device name for host-type access exists for the integral image-oriented streaming tape drive that may be part of your SMS 1000 system. That is, booting cannot take place from an image-oriented streaming tape drive. Booting can, however, take place from a streaming tape drive operating in conjunction with a TSV05 file-oriented tape interface module (see Appendix H), or from an external TSV05-equivalent tape unit such as the SMS FWT01180.

For example, in a system with two fixed-disk Winchesters and two floppy drives, the device numbering would be as follows:

- Winchester 0 = DU0
- Winchester 1 = DU1
- Floppy 0 = DU2
- Floppy 1 = DU3

A second example might be a system with a cartridge Winchester drive, one fixed-disk Winchester drive, and one floppy drive. In this case the device designations would be:

- Winchester 0 = DU0
- Floppy 0 = DU1
- Cartridge Winchester = DU2

In the sample screen shown above, the "DU" portion of the operator response (i.e. in response to the query "ENTER DEVICE NAME") designates a Winchester of either type or a floppy drive. Similarly, the response "MS" designates an external tape unit. The logical unit numbers 0 to 3 (for DU devices) and 0 (for an MS device) are designated in response to the query: "AND UNIT NUMBER".

17. CONVENTIONS WHEN SPECIFYING A BOOT DEVICE. When responding to the prompt "ENTER DEVICE NAME AND UNIT NUMBER", type the selected boot-device name and unit number (see previous steps) without a space (e.g. DU3), followed by a carriage return.

18. SYSTEM RESPONSE AFTER BOOTING. If you have successfully bootstrapped from the designated unit, an operating-system message such as: "RT-1lSj" and a version number (as in the current example) now appears. In the operating-system example shown here, these messages are also followed by a command string and the RT-1l operating system's normal prompt of a single dot, i.e. ".", at the completion of the command string. The system is now in its normal operating mode and is ready to run your applications, accept commands, etc.
19. RUNNING SENSE IN STAND-ALONE MODE. Referring back to Step 12 of this procedure, if you wish to operate SENSE at the conclusion of the initial system tests, press the front panel MENU button any time between the start of initial self tests (see Step 3) and the display of the group of stars scrolling across the front-panel display (see Step 11). This tells the system to display SENSE menus rather than boot the operating system. After the MENU button has been pressed and the group of stars moving across the front-panel display goes away, the next message:

VDU prompting

tells you to look at your video terminal (i.e. "VDU") for the message:

*HIT ANY KEY WITHIN TIME LIMIT*

You have a (configurable) time delay period in which to press any key on your terminal in order to select terminal display of SENSE menus. If you wish to select front-panel operation of SENSE, simply allow the delay to expire or press the front-panel MENU button before the expiration of the delay. See the following steps.

20. SELECTING SENSE OPERATION FROM THE TERMINAL. When the message "*HIT ANY KEY WITHIN TIME LIMIT*" is displayed on your terminal you have about ten seconds in which to press a key on the keyboard. (NOTE: The delay period is configurable by means of the VDU ONLINE DELAY portion of the CONFIGURATION menus. The default value is ten seconds.) Pressing a key transfers control to the console. The system now indicates that you are at the start of the SENSE menus by displaying and highlighting the first word of the menus:

STATUS

on the video display. The front panel then displays a user-selected logo (entered from the SPECIAL section of the CONFIGURATION menus) or the "SMS 1000" default logo. Note that the RESTART, RUN/HALT, and WRT PROT buttons on the front panel can still be used during console operation.

NOTE

At any time during the complete start-up process, as well as when the system is running applications, you can restart from the beginning of the self-test sequence by simultaneously pressing the RESTART and "*" buttons on the front panel.
21. SELECTING SENSE OPERATION FROM THE FRONT PANEL. During the (configurable) time delay period (the default is ten seconds) during which you can select either the front panel or the terminal, the message "VDU prompting" is displayed on the front panel. By allowing the time delay to elapse without hitting a key on the terminal keyboard (or by simply pressing the MENU button before the end of the delay), control of SENSE is given to the front panel, from which its menus can be accessed. The system now indicates that you are at the start of the SENSE menus by displaying the word

STATUS

on the front-panel display. A full description of how to interact with the SENSE menus is given later in this section.

22. RUNNING SENSE CONCURRENTLY WITH THE HOST. Once the host is booted and running applications, you can still run certain areas of SENSE at the same time as the host. To do this, after the host is running and a logo appears on the SMS 1000 front panel, press the front-panel MENU button. This will call SENSE and, after a brief delay, the word STATUS will appear on the front-panel display to indicate that you are at the start of the SENSE menu system. While in the menu system, if you attempt to perform a task that interferes with the host, the error message:

HOST IS RUNNING

is issued and the task is aborted.

AN EXAMPLE OF INTERACTION WITH THE SENSE MENUS

The following paragraphs provide instructions for running the SENSE menus. This will be done by using the example of the SENSE Monitor's POWER SUPPLY command (part of the STATUS menu system), which reads and displays the backplane voltage levels currently being produced by the power supply. You can run this example from the front panel even when there are other applications running in the system. Proceed as follows:

1. CALLING SENSE. Call SENSE as described in Step 19 of the complete system operation procedure (above).

2. SELECTING FRONT-PANEL OPERATION. Select front-panel operation of SENSE as described in Step 21 of the complete system operation procedure (above).

3. ENTERING SENSE MENUS. When the word
SYSTEM OPERATION AND THE SENSE MONITOR

STATUS

appears on the front-panel display, it indicates that you are at the top of the SENSE menus. This is the entry point of the complete menu system. Note that pressing the MENU button repeatedly always returns you to the top level of whatever section of SENSE you happen to be in, i.e. CONFIGURATION, OPERATION, etc. You must then use the right or left arrow keys to get back to STATUS.

4. The following example displays system status information. First, press the "*" button to select the STATUS commands. The word SYSTEM now appears in the display window. That is, by selecting STATUS, you now go to the top of the next menu level under STATUS. This is the basic principle for moving between the various levels of SENSE menus. See panels 1 and 2 of the following group of front-panel displays. Note that pressing the "*" button, as shown in panel 1, produces the display shown in panel 2. This sequence applies to all the panels shown in this example.

5. Use the front panel "->" button to step through the list of STATUS commands. The first time you press the button, the word IDENTIFY appears in the display window; the second time, the word ENVIRONMENT appears, etc. See panels 2, 3, and 4.

6. This example displays status information about the system's electrical environment, so press the "*" button to select the list of environment commands (panel 4). The word TEMPERATURE now appears in the display window (panel 5).

7. Use the "->" button to step through the ENVIRONMENT commands until the words POWER SUPPLY appear (panel 6).

8. Press the "*" button (panel 6) to select the POWER SUPPLY command. The first value in the list of voltages appears in the display window as "+5V: 4.9", for example (panel 7), meaning that the currently measured value of the +5 volt supply is actually 4.9 volts.

9. Use the "->" button to step through the sequence of power supply voltages (panels 7 through 11). If you press the "->" button one more time after the last voltage in the list has been displayed, SENSE jumps back to the beginning of the list and displays the words "POWER SUPPLY" (panel 12). (To see a complete listing that shows how the STATUS commands are organized, refer to Chapter 6.)

10. Press the MENU button to return to the beginning of the STATUS menus. The front panel now displays the word STATUS (see panel 13).
The operating sequence for this example is illustrated in the following 13 panels for the sake of readers who do not have a system readily available. Shading over a button indicates that the button has been pressed.
5. **TEMPERATURE**

MENU ▲ ▶ *

RE START RUN HALT WRT PROT

6. **POWER SUPPLY**

MENU ▲ ▶ *

RE START RUN HALT WRT PROT

7. **+5V: 4.9**

8. **+12 PV: 11.8**

9. **+12 CV: 11.9**

10. **-12 V: -12.0**
SYSTEM OPERATION AND THE SENSE MONITOR

11. +24V: 24.0

12. POWER SUPPLY

13. STATUS

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SMART TERMINAL OPERATION

TRANSFERRING CONTROL TO A TERMINAL. You can use a video display terminal to run SENSE only in the off-line mode (i.e. host not running). To transfer control from the front panel to a terminal refer to Step 20 of the complete operating procedure (above).

KEYBOARD CONTROLS. The following controls on your smart terminal have special meanings when interacting with the SENSE menus.

<table>
<thead>
<tr>
<th>KEY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space bar or letter N or n</td>
<td>Step to next menu entry.</td>
</tr>
<tr>
<td>Return or letter Y or y</td>
<td>Select current entry.</td>
</tr>
<tr>
<td>^C</td>
<td>Abort current command.</td>
</tr>
<tr>
<td>^R</td>
<td>Go to top of current menu.</td>
</tr>
<tr>
<td>Backspace</td>
<td>Jump back one menu level.</td>
</tr>
<tr>
<td>&quot;&gt;&quot; (greater than)</td>
<td>Step to next menu entry. Same as space bar.</td>
</tr>
<tr>
<td>&quot;&lt;&quot; (less-than)</td>
<td>Step back to previous menu entry.</td>
</tr>
</tbody>
</table>

SENSE OPERATION FROM A SMART TERMINAL

NOTE

The terminal-type default in the SMS 1000 is "dumb". This means that your terminal, whether smart or dumb, will interact with the system as though it were dumb until you change the TERMINAL TYPE option in the SENSE CONFIGURATION menus. If you have a smart terminal and want to change TERMINAL TYPE to SMART, set your smart terminal to VT100 emulation mode. Note that a dumb terminal will not operate properly with TERMINAL TYPE set to SMART.
Operating from the console differs significantly from front-panel operation. Note the following:

1. The terminal screen can display and accept a great deal more information than the front panel.

2. You enter commands and data through the keyboard rather than the front panel buttons. Notice that only the space bar and return key are needed for most SENSE operations with a smart terminal. NOTE: Remember that when using your terminal for running host programs only, the keyboard functions normally; that is, there are no special key functions other than those peculiar to your selected keyboard or to the operating system or application you are running. Note the following:

<table>
<thead>
<tr>
<th>CONTROL LOCATION</th>
<th>RUN MENUS/</th>
<th>STEP TO</th>
<th>STEP TO</th>
<th>SELECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOP OF</td>
<td>NEXT</td>
<td>PREVIOUS</td>
<td>CURRENT</td>
</tr>
<tr>
<td></td>
<td>MENUS</td>
<td>LIST</td>
<td>LIST</td>
<td>ENTRY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FRONT PANEL BUTTON</th>
<th>RUN MENUS/</th>
<th>STEP TO</th>
<th>STEP TO</th>
<th>SELECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU</td>
<td>&quot;-&gt;&quot;</td>
<td>&quot;&lt;-&quot;</td>
<td>&quot;*&quot;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SMART-TERMINAL EQUIVALENT</th>
<th>RUN MENUS/</th>
<th>STEP TO</th>
<th>STEP TO</th>
<th>SELECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>^R</td>
<td>Space bar,</td>
<td>&quot;&lt;&quot;</td>
<td>RETURN key or letter N/n</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;-&gt;&quot; or letter N/n</td>
<td></td>
<td>or letter Y/y</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: "N/n" and "Y/y" means that either the upper or lower case letter can be used.
SYSTEM OPERATION AND THE SENSE MONITOR

Notice, also, that the display on a smart terminal is divided into three sections. These sections are used for the following functions:

**Your configurable banner goes here**

- command selection
- data entry
- status display

Certain commands such as the configuration commands for Winchester disks request input by issuing a prompt in the data entry section of the screen. If the Winchester has already been formatted, the command also displays the current format parameters in the status display section.

***WARNING***

Be certain that commands that both display and modify data terminate normally (i.e. the system displays a "TASK COMPLETE" status message) before you select another command, restart, or power down. Exiting the command before the completion message has the effect of altering configuration parameters.

3. The following examples show you how to move through the STATUS menus when operating from a smart terminal. The word STATUS is highlighted on the terminal when you initially enter the menu system. (At the same time, the front panel displays either your logo or a system status readout.)
NOTE

The screen images shown in the following examples are compressed to save space.

4. Tap the space bar until the cursor is positioned over the word IDENTIFY. If you step past a desired entry, just keep tapping the space bar; the cursor will eventually wrap around the end of the list and return to the desired item. This example displays status information, so press the carriage return key to select these commands. The system then sends the following list of the available status commands to the console (remember that the SYSTEM command is available only at the Front Panel display):

**SMS 1000**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>OPERATION</th>
<th>EVALUATION</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENTIFY</td>
<td>ENVIRONMENT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Use the space bar to step through the list of STATUS commands. The first time you press the space bar, the cursor moves to the word ENVIRONMENT. Remember, if you space too far, just keep tapping the space bar until the cursor returns to the desired item.
6. This example displays status information about the system's electrical environment, so type a carriage return to select the list of ENVIRONMENT commands:

```
**SMS 1000**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>OPERATION</th>
<th>EVALUATION</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENTIFY</td>
<td>ENVIRONMENT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

7. Use the space bar to step through the ENVIRONMENT commands until the cursor is positioned over the words POWER SUPPLY, and then type a carriage return to select that entry. Notice that the console can display all of the system's power levels at once. Notice also that each previous selection remains highlighted to provide a visual audit trail of how you arrived at this particular command.

```
**SMS 1000**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>OPERATION</th>
<th>EVALUATION</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENTIFY</td>
<td>ENVIRONMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>POWER SUPPLY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
**SYSTEM OPERATION AND THE SENSE MONITOR**

**SMS 1000**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>OPERATION</th>
<th>EVALUATION</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENTIFY</td>
<td>ENVIRONMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>POWER SUPPLY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+5V: 4.9  +12PV: 12.0  +12CV: 11.9  -12V: -12.0  
+24V: 23.8

**DUMB TERMINAL OPERATION**

**KEYBOARD CONTROLS ON DUMB TERMINAALS**

In SENSE operation, a dumb terminal displays a list of the available menu entries. Each entry in the list has a number. You select entries by typing the number of the desired command. The keyboard controls with special meaning for dumb terminals are defined as follows:

<table>
<thead>
<tr>
<th>KEY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 7</td>
<td>Select menu entry.</td>
</tr>
<tr>
<td>^C</td>
<td>Abort current command.</td>
</tr>
<tr>
<td>^R or 8</td>
<td>Go to top of current menu.</td>
</tr>
<tr>
<td>Backspace or 0</td>
<td>Jump back one menu level.</td>
</tr>
</tbody>
</table>

**SENSE OPERATION FROM A DUMB TERMINAL**

A smart terminal has circuits that tells SENSE where the cursor is located. Dumb terminals lack these circuits and communicate with SENSE only when you enter information from the keyboard.

When a dumb terminal is used for the console, SENSE displays a numbered list of the options that are available. You select an option by typing in its number as described in the following
steps. NOTE: Remember that when using your terminal for running host programs only, the keyboard functions normally; that is, there are no special key functions other than those peculiar to your selected keyboard or to the operating system or application you are running.

1. TRANSFERRING CONTROL TO A TERMINAL. You can use a video display terminal to run SENSE only in the off-line mode (i.e. host not running). To transfer control from the front panel to a terminal refer to Step 20 of the complete operating procedure (above).

2. The following examples show you how to move through the STATUS menus when operating from a dumb terminal. The word STATUS is highlighted by an arrow on the terminal screen when you initially enter the menu system. (At the same time, the front panel displays either your logo or a system status readout.)

```
**SMS 1000**

1  STATUS     <--
2  OPERATION
3  EVALUATION
4  CONFIGURATION

ENTER NUMBER -
```

3. Type the number 1 and a carriage return to select the status commands. SENSE now displays a numbered list of the STATUS command types:

```
**STATUS**

1  IDENTIFY     <--
2  ENVIRONMENT

ENTER NUMBER - 2 [carriage return]
```
4. Type the number 2 and a carriage return to select the ENVIRONMENT commands. The screen now changes to:

```
**ENVIRONMENT**

1  TEMPERATURE  <--
2  POWER SUPPLY

ENTER NUMBER - 2 [carriage return]
```

5. Type the number 2 and a carriage return to select the POWER SUPPLY command. SENSE responds by displaying the system's current power supply levels:

```
**ENVIRONMENT**

1  TEMPERATURE
2  POWER SUPPLY  <--

ENTER NUMBER - 2 [carriage return]
+5V:  5.0V
+12PV: 12.1V
+12CV: 12.3V
-12V: -12.1V
+24V:  23.7V
```

COMMAND TERMINATION (Abort)

If you have successfully run the example described above from both the front panel and console, you can perform all necessary SENSE functions except for terminating commands by use of the abort menu.

ABORT MENU

To abort a command when running from the front panel, press the MENU switch.
SYSTEM OPERATION AND THE SENSE MONITOR

To abort a command when running from a console, type `C by holding down the control key (CTRL on most terminals) while you type the letter C.

Aborting a command invokes the abort menu, which has only two possible options:

       MENU?
       RESUME?

Select the MENU option to return to the menu system; select RESUME to continue with the current command.

Proper command termination is critical with commands that display information and provide the option of changing that information. It is possible to reset command parameters to zero by terminating a command incorrectly. After you initiate the abort sequence, be certain to WAIT FOR THE ABORT MENU PROMPT.

Some commands have a lengthy termination sequence, so it may take several seconds for the abort menu prompt to appear. If you are running from a console, do not type a carriage return before the prompt appears, as the system may take the carriage return as a response to a data prompt.

ENTERING NUMERIC DATA

SENSE requires you to specify the number base to be used if you enter other than decimal numbers. When you enter a number that is not decimal, the number must include an upper-case letter suffix to indicate its base. Use the upper-case letter Q to indicate OCTAL values, or the upper-case letter H to indicate HEXADECIMAL values. Do not forget the letter if it is needed. If you forget, the value is interpreted as decimal. Remember that the following numbers represent very different values:

    17776500
    17776500Q
    17776500H

ENTERING NUMBERS FROM FRONT PANEL

Although the front panel does not have numeric keys, it is possible to enter DECIMAL values from the front panel when a command prompt requests numeric input. Note the following steps:

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SYSTEM OPERATION AND THE SENSE MONITOR

1. To select the least significant digit of the desired number, press the "->" (right arrow) button repeatedly to display a digit in the range 0 - 9. When you reach the desired digit, use the "*" button to enter it.

2. To enter the next most significant digit, press the "<-" (left arrow) button once to move one space to the left of the displayed digit. Again use the "->" button to select the desired digit value and then enter it, using the "*" button.

3. Repeat this process until all desired digits have been entered.

4. When all digits have been entered and are seen to be correct, enter the complete number by pressing the "*" button.

5. If at any point you notice that you have made an error in any of the preceding digit positions, you must clear the entire number by pressing the MENU button. Then reenter the complete number.

6. For a table of equivalent decimal, octal and hexadecimal values refer to the Appendix.

WRITE PROTECTION OF FIXED-DISK WINCHESTER DRIVES

The WRT PROT button on the front panel is used to change the current write-protection status of Winchester drives. Note the following:

1. You can change the write-protection status of Winchester drives at any time regardless of where you are in the menu system. After making changes to the write-protection status, the system automatically returns you to your last position in the menu system before the WRT PROT button was pressed.

2. Write-protection status changing cannot be done from an external terminal. It must always be done from the front panel.

The following two examples illustrate the write-protection procedure for (a) systems with a single Winchester drive and (b) systems with two Winchester drives.

HOW TO CHANGE THE WRITE PROTECTION STATUS OF A SINGLE WINCHESTER DRIVE.
SYSTEM OPERATION AND THE SENSE MONITOR

Proceed as follows:

1. Press the front panel WRT PROT button whenever it is desired to change write protection status.

2. Assume that your drive (i.e. W0) is currently write protected and that you wish to remove its write protection. Pressing WRT PROT produces the following front-panel display:

   W0#

The symbol # means that Winchester W0 is currently write protected. The symbol 1 means that the data on that line is a report of current status. Thus, each time WRT PROT is pressed, the first thing the system displays is a report of current write-protection status.

3. Press the "->" (right arrow) button. The following now appears on the front-panel display:

   W0?

The system is here asking if you wish to change write-protection status to not-protected, as shown by the W0 and the absence of the "#" symbol. Therefore, to change status to not-protected, press the "*" (select) button. The status change is now in effect and the system automatically returns to your last position in the menu system.

4. If at any time you wish to abort the status-change process, press the MENU button.

HOW TO CHANGE WRITE PROTECTION STATUS IN SYSTEMS WITH TWO WINCHESTER DRIVES

Proceed as follows:

1. Press the WRT PROT button when it is desired to change the write-protection status of either Winchester drive. In this example, assume that both of your Winchester drives (i.e. W0 and W1) are currently write protected and that you want to remove the write protection from W0.

2. The following now appears on the front panel display:

   W0# W1# 1

As discussed in the previous example, this current-status display indicates that both drives are write protected.
SYSTEM OPERATION AND THE SENSE MONITOR

3. This step and the following steps will show you how to move through the three menu entries associated with the write-protection status of the two Winchester drives. Press the "->" (right arrow) button. The following now appears on the front panel display:

WO W1 ?

Selecting this menu permits removal of write protection for both drives.

4. Again press the "->" button. The following appears:

WO# W1 ?

Selecting this menu permits write protecting W0 and not write protecting W1.

5. Again press the "->" button. The following appears:

WO W1# ?

This menu permits selecting the write-protection conditions assumed in Step 1 of this example, i.e. write protection for W1 and none for W0. To make this selection, press the "#" (i.e. select) button. The menu system now returns to the state it was in before the WRT PROT button was pressed.

6. If at any time you wish to abort the write-protect menu, press the MENU button.

USING THE TANDBERG TDC 3309 CARTRIDGE TAPE DRIVE

HOW TO INSERT AND REMOVE CARTRIDGES

Proceed as follows:

1. If the front door of the drive is not already open, press the rectangular black button at the upper right side of the front panel. The cartridge can now be removed by pulling it directly out of the drive. CAUTION: If you wish, while the drive is running, a cartridge can be removed without physical damage to the cartridge or drive. However, doing so may terminate the program then in progress or cause a loss of data.

2. To insert a cartridge, open the front door of the drive and then orient the cartridge so that its aluminum base plate is down and the two base-plate notches are to the right. Then push in the cartridge until it hits a stop at the rear of the drive. Closing the door will now push the cartridge all the
SYSTEM OPERATION AND THE SENSE MONITOR

way in. Continue to press the door until it latches.

HOW TO WRITE PROTECT TAPE CARTRIDGES

Along one edge of the cartridge there is a two-position rotary cam that can be operated by a screwdriver. When this cam is turned so that the arrow molded into it faces the word "SAFE" that is molded into the cartridge itself, the cartridge is in the write-protected condition. When the arrow on the cam is turned 180 degrees away from the word "SAFE", both reading and writing can take place with that cartridge.

USING THE DMA 360 REMOVABLE-CARTRIDGE WINCHESTER DRIVE

HOW TO INSERT AND REMOVE CARTRIDGES

To insert and remove cartridges from the DMA 360, proceed as follows:

1. DEENERGIZING DRIVE. If your DMA 360 is in operation, as shown by the steady illumination of the green front panel lamp, then press the RUN/STOP switch at the right side of the front panel. When this switch is pressed, the green lamp will start flashing at a rate of about 2 Hz. This indicates that the spindle is coming to a stop, and should last for about 10 seconds.

   IMPORTANT

   The DMA 360 can neither be opened nor closed unless the d-c power is turned on in your SMS 1000. Therefore, before cartridge removal or insertion both the a-c and d-c power switches must be in their ON (i.e. "1") positions.

2. UNLATCHING THE DOOR. When the spindle comes to a stop, the green lamp will go out. Then, unlatch the drive door by rotating the door latch lever, at the left side of the front panel, by rotating it 90 degrees clockwise.

3. EXTENDING THE DRIVE. Grasp the drive between its center top and bottom grip areas and carefully slide it out until a stop is felt. The drive now extends approximately 5 1/4 inches out from the front panel.

4. PIVOTING DOOR DOWN. Now carefully pivot the drive door downward. Doing this raises the cartridge holder slides about a quarter of an inch and provides clearance for the removal and
SYSTEM OPERATION AND THE SENSE MONITOR

insertion of the cartridge. The door rotation must be slightly more than 90 degrees in order to raise the holder slides and unlock the cartridge.

5. REMOVING THE CARTRIDGE. The cartridge can now be removed by simply grasping it and sliding it out on its slides.

6. INSERTING A CARTRIDGE. Before inserting a new cartridge, be sure to remove the strip of plastic tape that is applied for shipping purposes to the round armature plate on the underside of the cartridge. Note that the cartridge must be inserted with the rectangular write-protect notch facing out, i.e. toward the door of the drive, and with its armature plate facing down.

7. CLOSING DOOR. After inserting the cartridge in its slides, rotate the door to its full up position. Then carefully rotate the drawer latch lever counterclockwise 90 degrees to its fully vertical position. The door is now locked.

8. RETURNING DRIVE INTO HOUSING. Carefully slide the drive back into its housing. Press the drive in securely until a click is heard, indicating that the drive is properly locked in place.

9. RESTARTING THE DRIVE. Restart the drive by pressing the RUN/START switch on the right side of the front panel. As the spindle comes up to speed the green front panel light flashes at a frequency of about 1 Hz. When the drive is up to speed the light glows steadily. The drive is now ready for operation.

10. If, at any time, the green front-panel light flashes at a frequency of about 4 Hz, this means that the embedded servo tracks on the cartridge cannot be found by the drive's circuits. The cartridge must then be reformatted.

WRITE PROTECTION OF DMA 360 CARTRIDGES

Changing the write protection status of DMA 360 cartridges is accomplished by adding or removing a plastic tab approximately 9/16-inch square covering the write-protect cavity at one corner of the cartridge. Note the following:

1. ADDING WRITE-PROTECTION. To write protect a cartridge, REMOVE the red plastic tab covering the write-protect cavity of the cartridge. The tab is easily slid out from its location over the cavity.
SYSTEM OPERATION AND THE SENSE MONITOR

2. REMOVING WRITE PROTECTION. To stop write protection of a cartridge, slide the special DMA-supplied red plastic tab over the cartridge's write-protect cavity. These plastic tabs are supplied with each cartridge.

USING THE SYQUEST SQ312RD CARTRIDGE WINCHESTER DRIVE

HOW TO INSERT AND REMOVE CARTRIDGES

To insert and remove cartridges from the SyQuest SQ312RD, proceed as follows:

1. CARTRIDGE. The cartridge used with this drive is the SyQuest SQ200. Keep the cartridge in its protective sleeve when not in use. Before use, a cartridge must be allowed to stabilize for at least an hour at the temperature of the room in which it is to be used. In other words, if possible, store cartridges in the same room as the drive. Do not attach labels to the bottom of the cartridge (the bottom is where the round armature plate can be seen).

2. POWERING-DOWN THE DRIVE. Assume that the drive is operating and that the front panel light is glowing a steady green, indicating that the drive is up to speed and is not currently being accessed. To power down the drive, press the button on the front panel of the drive. The light changes from green to flashing red.

3. OPENING FRONT-PANEL DOOR. The flashing red light means that the drive motor is spinning down. When the motor stops, the light stops flashing and stays off. The front-panel door can now be opened by pressing the front-panel button and swinging the door down.

4. REMOVING THE CARTRIDGE. Press the door to its full horizontal position and the cartridge will partially eject. Place your hand in front of the door as you open it so that the cartridge does not accidentally drop out as it ejects. The cartridge can now be removed.

5. CARTRIDGE-LOADING PROCEDURE. Open the front-panel door by pressing the front-panel button. Swing the door down to its full horizontal position.

6. INSERTING THE CARTRIDGE. Position cartridge to be loaded so that the following two conditions are met:
SYSTEM OPERATION AND THE SENSE MONITOR

(1) The round metal armature plate on the bottom of the cartridge faces the door, i.e. down.

(2) The sliding black locking mechanism at one end of the cartridge is inserted into the drive first.

Gently slide the cartridge in until you encounter resistance (it should, at first, slide in easily). Then push the cartridge in a little bit further until it snaps in place.

7. CLOSING DOOR. After inserting the cartridge, rotate the door back to its full up position. It should snap and lock when fully closed. If the drive is energized, the front-panel light should now glow a constant red, indicating that the motor is in the process of spinning up. When the motor is up to speed, the lamp will again glow green, indicating that the drive is ready for use.

WRITE PROTECTION OF CARTRIDGES FOR THE SQ312RD

Changing the write protection status of the Type SQ200 cartridges used with the SQ312RD drive is accomplished by adding or removing a red plastic clip approximately 1/2-inch square to or from the write-protect cavity at one corner of the cartridge. Note the following:

1. ADDING WRITE-PROTECTION. To write protect a cartridge, INSERT the red plastic clip over the write-protect cavity of the cartridge. To insert the clip, slide it over the two protruding edges at each side of the cavity. These plastic clips are supplied with each cartridge.

2. REMOVING WRITE PROTECTION. To end write protection so as to permit both reading and writing of a cartridge, use a small screwdriver (or even your thumb nail) to slide the red clip from the write-protect cavity. The write-protect cavity will now be OPEN.

USING FLOPPY DISKETTES

INSERTING DISKETTES.

Open the large door in the front panel (see Figure 5-2) in order to gain access to floppy-disk drive(s). This door protects the diskette drive(s) from dust and should normally remain closed.

The system can access a diskette only when it is inserted into the drive correctly. First, notice that the diskette has an
oblong opening to admit the read/write heads, as shown in Figure 5-2. Next, insert the diskette with the oblong opening first, making sure that the side of the diskette with the label faces toward the door-latch handle of the drive. If the label faces the wrong way the diskette or the drive could be injured.

WRITE PROTECTION OF DISKETTES

GENERAL. Refer to Figure 5-2. Notice that diskettes have a large notch on the front edge (eight inch diskettes) or on one side (5-1/4 inch diskettes). This notch provides write protection for the diskette. When write protection is in effect, the system can only read from the diskette. Write protection prevents accidental erasure of information. Diskettes containing purchased software should usually be protected.

8" DISKETTES. With eight inch diskettes, write protection is obtained when the notch is uncovered. Covering the notch allows the system to both read and write on the diskette.

5 1/4" DISKETTES. Most 5-1/4 inch diskettes follow the opposite procedure: covering the notch provides write protection; leaving the notch uncovered allows the system to read and write on the diskette.

IMPORTANT: If you cover the notch, use the self-sticking tabs provided by the diskette manufacturer.
Fig. 5-2 Inserting diskettes
SECTION 6

SENSE MONITOR:

STATUS MENU COMMANDS

INTRODUCTION

The STATUS menu commands of SENSE check and report on the system's operating status. Status information includes operating information such as which disk drives are write-protected, and also hardware information such as the current voltages being supplied to the backplane.

When SENSE is positioned at the beginning of the STATUS menu, the STATUS entry appears in the display window. This entry is the starting point of the complete menu system. All STATUS menu commands can be run concurrently with host CPU operation.

Table 6-1 provides a summary of the STATUS menu commands.

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM</td>
<td>Displays a 16-character system status message (known as the &quot;compact status display&quot;) on the front-panel display. The compact status display is not available from a video display terminal.</td>
</tr>
<tr>
<td>IDENTIFY</td>
<td>Displays a user-configurable &quot;banner&quot;, or logotype, of up to 16 characters; firmware version number; system serial number and shipment date.</td>
</tr>
<tr>
<td>ENVIRONMENT</td>
<td>Displays the current values of system temperatures and voltage levels.</td>
</tr>
</tbody>
</table>

LEGEND

C0 = Removable-Cartridge Winchester Drive 0
F0 = Floppy Drive 0
F1 = Floppy Drive 1
T0 = Tape Drive 0
W0 = Fixed-Disk Winchester Drive 0
W1 = Fixed-Disk Winchester Drive 1
SENSE MONITOR: STATUS MENU COMMANDS

SYSTEM command

The SYSTEM command displays a compact status line, i.e., a brief summary of the current status of various system units, which appears in the front panel 16-character display window. The STATUS display does not appear on a video display terminal.

MENU STRUCTURE

SYSTEM
  <compact status>

REMARKS

This command is not available when using a console device and must be run from the front panel.

The following is a typical <compact status> display:

  R*W0#W1#F0 F1

where:

R (or H)  R indicates that the CPU is running. This value is replaced by an H if the processor is halted.

*  Blinks to indicate that SENSE is active. If this field is blank or the asterisk fails to blink, SENSE is not operating, which may indicate a serious hardware or software error. Contact your service representative if a RESTART fails to restart SENSE.

The remainder of the display identifies the peripherals configured into the system (as follows):

WO  Represents fixed-disk Winchester 0; W1 represents fixed-disk Winchester 1. Note that the system cannot be configured with more than two Winchester-type devices of any kind.

F0  Represents floppy drive 0; F1 represents floppy 1.

T0  Represents tape drive 0.

C0  Represents cartridge-type Winchester drive 0. Note that the system cannot be configured with more than two Winchester-type devices of any kind.

#  Indicates that a fixed-disk Winchester drive is write-
SENSE MONITOR: STATUS MENU COMMANDS

protected. In the example above, all disk drives except F0 and F1 are write protected. Write protection can be accomplished through the controller firmware, the front panel WRT PROT button (Winchester disks only), the write-protect notch on a diskette, the write-protect cavity on the cartridge used with the cartridge-type Winchester drive, or some combination of the above. SENSE flags a disk as write-protected if one or more of these write protection techniques is in effect.

Only devices actually configured into your system appear in the list. Thus, for example, W1 would not appear in the status display for systems that have a single Winchester disk drive configured as W0. Note, however, that a system could also be configured in which W0 is absent and W1 is present. Remember that the status of your system as displayed here is determined by the configuration of Winchester, floppy and tape devices entered into the DISK DEVICES portion of the CONFIGURATION menus.

IDENTIFY command

The IDENTIFY command reports system characteristics such as firmware version number, System Foundation Module serial number, and system shipping date.

MENU STRUCTURE

IDENTIFY
   <banner>
   Firmware V<n.n>
   Sfm S/N <nnnnnnnn>
   Ship <mm/dd/yyyy>

REMARKS

BANNER. In the SPECIAL section of the CONFIGURATION menus you can create a message of up to 16 characters (known as the "banner") that can be displayed at the top of your video-terminal screen and also, as a default instead of the compact status, on the front-panel display.

FIRMWARE VERSION. The firmware version number (Firmware V) is a manufacturer-controlled value stored in the EPROM on the system foundation module that contains the SMS 1000 firmware programs.
SENSE MONITOR: STATUS MENU COMMANDS

SFM S/N and SHIP. The serial number of the System Foundation Module in your SMS 1000 (SFM S/N) and the shipment date of the system from SMS (SHIP) are configurable parameters that can be entered through the SPECIAL portion of the CONFIGURATION menus. Your system is shipped with these values already entered. The user does not need to alter these values except in the event of installation of a new System Foundation Module, etc.

ENVIRONMENT command

The ENVIRONMENT command supplies information about the temperatures and voltage levels within the system.

MENU STRUCTURE

ENVIRONMENT
  TEMPERATURE
    DRIVES: <fff>P/<cc>C
    CARDS: <fff>P/<cc>C
  POWER SUPPLY
    +5V: <d.d>V
    +12PV: <dd.d>V
    +12CV: <dd.d>V
    -12V: <dd.d>V
    +24V: <dd.d>V

REMARKS

The system reads internal sensors and supplies appropriate temperatures and voltages each time this command is executed.

TEMPERATURE

Temperature is displayed for two different areas of your SMS 1000: the area containing the peripherals and the cardcage area. Temperatures at either location should not exceed 140F (60C). If the ambient air is too hot to permit adequate cooling, turn the system off until the temperature drops. Overheating when the ambient temperature is reasonably cool, however, indicates a problem. Make sure that both fans are operating properly. If the condition persists, turn off the AC power switch and call for service.

POWER SUPPLY
SENSE MONITOR: STATUS MENU COMMANDS

The +12PV entry displays the +12V voltage level supplied to the peripherals; the +12CV entry displays the +12V voltage level supplied to the card cage.

These voltages are read as follows:

1. Call the STATUS menus as described in Section 5 of this manual. Repeatedly press the "->" button until the word ENVIRONMENT is displayed.

2. Press the "*" button to select ENVIRONMENT. Then press the "->" button. The word POWER SUPPLY is now displayed. Again press the "*" button to select POWER SUPPLY and start the display of its voltages.

3. The present level of the +5 volt power supply is now displayed. Each time the "->" button is pressed, the next power supply voltage in turn is displayed, i.e. +12 volts (P), +12 volts (C), -12 volts, and +24 volts. After the last voltage is displayed, you are returned to the POWER SUPPLY display the next time the "->" button is pressed.

The power-supply displays show the current voltage level for each of the system's power supplies. These displays are subject to minor sampling errors, but are accurate enough for all but the most critical applications. For absolute accuracy, measure voltages at the test points provided on the backplane. Voltages should remain within the following limits:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5</td>
<td>4.7 to 5.3</td>
</tr>
<tr>
<td>+24</td>
<td>21.6 to 26.4</td>
</tr>
<tr>
<td>+12</td>
<td>11.4 to 12.6</td>
</tr>
</tbody>
</table>
SECTION 7

SENSE MONITOR:

OPERATION MENU COMMANDS

OPERATION MENUS

Most OPERATION menu commands of the SENSE Monitor duplicate operating-system functions such as, for example, backup, restore, and format commands. These commands are provided for your convenience since many test procedures are performed when the CPU is off-line and the operating system is not available.

The WINCHESTR MGT commands, for example, perform essential but infrequently used functions such as building the tables that allow the Winchester disks to skip flawed disk sectors efficiently.

Note that all SENSE menus reflect the actual device configuration of your system. This means that if, for example, your system has only one floppy drive (i.e. F0), then the menus do not display any F1 options.
Table 7-1 provides a summary of the OPERATION menu commands:

Table 7-1. OPERATION MENU COMMAND SUMMARY

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACKUP WINCHESTR</td>
<td>Copies the contents of a selected Winchester disk to a cartridge tape drive.</td>
</tr>
<tr>
<td>RESTOR WINCHESTR</td>
<td>Restores the data that has been copied to a cartridge tape drive, as the result of a previous BACKUP WINCHESTR command, back to a specified Winchester disk.</td>
</tr>
<tr>
<td>IDENTIFY</td>
<td>Displays the format (sector size, recording density, etc.) of the specified disk.</td>
</tr>
<tr>
<td>FORMAT FLOPPY</td>
<td>Formats the diskette in a specified floppy drive.</td>
</tr>
<tr>
<td>WINCHESTR MGT</td>
<td>Invokes a submenu of infrequently used commands. These subcommands enable you to format Winchester disks and enter flaw management information for Winchester disks.</td>
</tr>
<tr>
<td>BOOT HOST CPU</td>
<td>Runs the bootstrap program, which loads bootcode and starts the host CPU.</td>
</tr>
</tbody>
</table>

LEGEND

C0 = Removable-Cartridge Winchester Drive 0
F0 = Floppy Drive 0
F1 = Floppy Drive 1
T0 = Tape Drive 0
W0 = Fixed-Disk Winchester Drive 0
W1 = Fixed-Disk Winchester Drive 1

IMPORTANT

The commands in this section regarding tape involve only image-oriented streaming tape. If your SMS 1000 includes the file-oriented streaming-tape option, see Appendix H for full description, installation data and operating instructions.
SENSE MONITOR: OPERATION MENU COMMANDS

BACKUP WINCHESTER COMMAND

The BACKUP WINCHESTR command copies a duplicate image of the selected Winchester disk to cartridge tape.

MENU STRUCTURE

BACKUP WINCHESTR
  BACKUP W0
    BACKUP W0->T0
    READY?
  BACKUP W1
    BACKUP W1->T0
    READY?

REMARKS

GENERAL. Back up Winchester disks whenever there is a possibility that the integrity of the data on the disk might be compromised. For example, certain tests from the EVALUATION menu write on the disk. Also, a disk is always at risk when a system is moved from one site to another. Backup is recommended at such times.

TAPE. Backup to tape is independent of the amount of tape in a cartridge. Thus, for example, a combination of 450- and 600-foot tape cartridges can be used as part of the same backup process. Remember that backup always starts the transfer of data at the first normal data sector on the source disk.

EXAMPLES OF BACKUP TO TAPE. The following are some examples of the process of backup to tape. They include examples of how the system deals with disk errors and tape errors.

EXAMPLE 1: NORMAL COMPLETION. To back up from W0 to T0, proceed as follows:

1. Move through the OPERATION menus until you get to the command

   BACKUP W0->T0

Select this command by pressing the front panel "*" button or the carriage-return/line-feed key (hereafter designated as the "Return" key) if you are operating from your terminal. NOTE: These examples will assume that you are operating from your terminal.
2. The system responds with the message:

   Insert next vol.

In response to this message the user must insert a cartridge into the tape drive. After a fixed period the following message appears:

   T0 ready?

If a cartridge has been inserted, press the Return key. The system then responds with the message:

   Retension+Rewind

NOTE: If you press Return before inserting a cartridge, the system responds with an error message indicating that no cartridge is present.

The "Retension+Rewind" message indicates that the tape cartridge is being wound to one end and then fully rewound so as to initialize tape position. This could take as much as several minutes to complete.

3. At the completion of the "Retension+Rewind" process, the following messages are displayed in sequence:

   LBN= 0
   Vol#=1

These messages indicate that the backup starts from logical block number 0 in the source device and that the backup is taking place on the first volume (i.e. cartridge) in the sequence. NOTE: If, for example, you have inserted a write-protected cartridge in the tape drive, the following error message is displayed:

   Error logging...
   Drive write prot
   e88 T0:90HC8H
   Action?

The field e88 indicates that error 88 has been detected (see Appendix E). T0: indicates that the error involves the tape drive. The remaining field is a QIC-02 status message. At this point, the operator has three possible options. If you press Return in response to the prompt "Action?" the system produces the first option:

   Restart?
This means that the system returns to the last major prompt, in this case the prompt: "Insert next vol.". To choose this option, press Return. This is the option that you would normally select in order to remove a write-protected cartridge from the drive, insert one that is not write-protected, and proceed with the backup. To move to the second option, press the space bar (or the "->" button on the front panel). The second option is 

Menu?

Choosing "Menu" returns you to your original menu option, i.e. "BACKUP W0->T0". To choose it, again press Return. The third option is obtained by pressing the space bar again. The third-option prompt is:

Resume?

Choosing this option (by pressing Return) allows you to resume the backup from its stopping point. In the case of a write-protected cartridge, choosing this option prevents the copy process from taking place, and the error message "Done (error)" is issued.

4. After the successful completion of the previous step, the backup is now in process and the system displays the message:

Backing up W0

When the end of the tape is reached, the following two messages appear, as in Step 2 (above):

Insert next vol.
T0 ready?

The user then removes the first cartridge, inserts the second and presses the Return key. The system again responds with the message:

Retension+Rewind

Next, the following two messages are displayed:

LBN= 7775
Vol#=2

In this example, backup resumes at logical block number 7775 octal (note that, starting with firmware version V1.2, this value is expressed in decimal). The second message confirms that the second cartridge is being used. As the backup proceeds, the following message is displayed:
SENSE MONITOR: OPERATION MENU COMMANDS

Backing up W0

Assuming for this example that backup runs to completion within the second volume, the following two messages now appear:

#Vols=2
Done (errs)

The "Done" message marks the completion of the backup process.

NOTE: You will remember that in this example, a write-protected cartridge was used in the tape drive, causing an error to be generated. Remember that after the cartridge was then replaced with one not protected, the above error report "(errs)" was still generated, even though the backup completed normally. In other words, errors of all types, fatal or benign, occurring in the course of the backup, will be reported.

EXAMPLE 2. BACKUP INTERRUPTED BY DISK ERROR. In the following example, backup is interrupted by a flaw detected in the source disk. The corresponding sector on the backup cartridge is filled with a characteristic data pattern. The backup proceeds as in Example 1 until the flaw is detected. Then, the message

Bad sector data
e76W0c123h12s17
Action?

is received. The message indicates that error 76 (decimal) has been detected (see Appendix E), that the error is on unit W0, and that the flaw is located at cylinder 123, surface 12 (i.e. "h" represents head), and sector 17. At this point, the operator has three possible options. If you press Return in response to the prompt "Action?" the system produces the first option:

Restart?

This means that the system returns to the last major prompt, in this case the prompt: "Insert next vol.". To choose this option, press Return. To move to the second option, press the space bar (or the "->" button on the control panel). The second option is

Menu?

Choosing "Menu" returns you to your original menu option, i.e. "BACKUP W0->T0". To choose it, again press return on your keyboard. The third option is obtained by pressing the space bar again. The response is:
SENSE MONITOR: OPERATION MENU COMMANDS

Resume?

Choosing this option (by pressing Return) allows you to resume the backup from its stopping point. Most often, the operator will want to resume a backup after being informed of a disk error.

EXAMPLE 3. BACKUP INTERRUPTED BY TAPE ERROR. This example shows the opposite situation from Example 2: the backup process stops when a tape flaw is detected. The backup process proceeds as in Examples 1 and 2 until the error is discovered. Then the system displays the message:

Tape Error
e128t0:12h12h
Action?

The field e128 indicates that error 128 (see Appendix E) has occurred. T0: indicates that the error is in the tape unit. The remaining fields are a QIC-02 status message that indicate the nature of the problem. You now have the same three options as in Example 2. Most often, after a tape error, the operator will want to restart on a new cartridge, especially when several cartridges have already been written. Restarting at this point will cause the backup to resume at its current position.

RESTORE WINCHESTER COMMAND

The RESTOR WINCHESTR command restores data saved by a previous BACKUP command (to cartridge tape) to a Winchester disk.

MENU STRUCTURE

RESTOR WINCHESTR
  RESTOR W0
    RESTOR W0<-T0
      Are you sure?
  RESTOR W1
    RESTOR W1<-T0
      Are you sure?

REMARKS

When carrying out a restore operation, you can insert tape cartridges in any order, except that, because the last cartridge (i.e. the one with the highest Logical Block Number (LBN)) con-
tains the double end-of-volume mark that terminates the restore operation, it must be inserted last.

Write protection status of the target disk drive used in a restore operation is checked before the restore operation can take place.

In carrying out a restore operation, any combination of cartridges can be used; e.g. intermixing 450 and 600 foot cartridges is acceptable.

IDENTIFY COMMAND

The IDENTIFY command displays information about how your disks are formatted.

MENU STRUCTURE

IDENTIFY
 IDENTIFY F0
   <Disk-format parameters>
 IDENTIFY F1
   <Disk-format parameters>
 IDENTIFY W0
   <Disk-format parameters>
 IDENTIFY W1
   <Disk-format parameters>
 IDENTIFY C0
   <Disk-format parameters>

REMARKS

The IDENTIFY command displays the following parameter list for the specified disk. The example given here is for an 8-inch double-sided floppy disk:

#Cyls=77
#Heads=2
CylOff=1
HeadOff=4
Cyl#=53
Head#=0
Format=RX02
Byt/Sct=256
SENSE MONITOR: OPERATION MENU COMMANDS

NOTE: In the above example the information on the fifth and sixth lines represents the current cylinder and head numbers being looked at. Head and cylinder numberings begin at 0.

Fixed disk formats are fully defined under the DEVICE PARAMETERS command in the CONFIGURATION menu.

FORMAT FLOPPY COMMAND

The FORMAT FLOPPY command prepares a diskette for use in a system.

MENU STRUCTURE

FORMAT FLOPPY
   FORMAT FLOPPY F0
   <Parameter list>
   READY?
   FORMAT FLOPPY F1
   <Parameter list>
   READY?

REMARKS

The FORMAT FLOPPY command formats diskettes according to the specifications entered through the FLOPPY FORMATS command of the CONFIGURATION menus. The format specifications must be verified, using the CONFIGURATION menu commands, before you use the FORMAT FLOPPY command. The default is RX02. Once entered, the specifications remain in effect until altered by a subsequent FLOPPY FORMATS command. Thus, most users need to specify diskette formats only once.

A new diskette is just a raw recording medium until it is formatted. The format determines a diskette's storage capacity by establishing the number of bytes per sector, number of sectors per track, and the data encoding technique.

Systems with two diskette drives can be configured so that each drive formats diskettes according to different specifications.

EXAMPLE: If "FORMAT FLOPPY F0" is selected, the following list of formatting parameters and responses could appear (this example assumes a 5 1/4" drive):
SENSE MONITOR: OPERATION MENU COMMANDS

Format=DEC PC
Intrlv=1
Byt/sct=512
#Cyls=80
#Heads=2
F0 Ready? [press Return for "yes" response]
Formatting F0
Done (no errs).

NOTE: For 8" drives "$Heads" is determined dynamically by the
system if its value has been set to 0 in the DEVICE PARAMETERS
portion of the CONFIGURATION menus.

Note that Intrlv means physical interleaving, not logical inter-
leaving. Also, note that the previously defined parameter set is
displayed before the READY? prompt is given.

WINCHESTER MGT COMMAND

The WINCHESTER MGT command prepares a Winchester drive for use in
a system by formatting its disks in accordance with a previously
selected format pattern; and by examining its disk surfaces and
preparing a flaw map that enables defective areas to be passed
over without loss of data.

MENU STRUCTURE

WINCHESTR MGT

FORMAT W0?
  <Parameter list>
  Are you sure?
  Save flaw tbl?
  Clear flaw tbl?
  Formatting W0.
  <Flaw management message sequence>

FORMAT W1?
  <Parameter list>
  Are you sure?
  Save flaw tbl?
  Clear flaw tbl?
  Formatting W1.
  <Flaw management message sequence>

FORMAT C0
  <Parameter list>
  Are you sure?
  Save flaw tbl?
  Clear flaw tbl?
  Formatting C0.
SENSE MONITOR: OPERATION MENU COMMANDS

<Flaw management message sequence>

REMARKS

The FORMAT W0, FORMAT W1, or FORMAT C0 commands format disks according to the specifications entered through the DEVICE PARAMETERS command of the CONFIGURATION menu. The format specifications must be verified before you use the FORMAT commands. When you start a format operation, the system displays a list of the previously entered formatting parameters before the actual formatting takes place.

EXAMPLE: If, for example, you select "FORMAT W0", the following typical list of previously selected parameters, messages and responses would be displayed:

Format=FMF
Intrvl=1
Byte/Scr=512
CylOff=1
HeadOff=4
#Cyls=512
#Heads=8
Are you sure? (enter Return for yes)
Save flaw tbl?
Clear flaw tbl?
Formatting W0
<Flaw management message sequence, as follows:>
Phase #1 [Sort raw flaw table]
Phase #2 [Construct sector flaw records]
Phase #3 [Sort revectoring table]
Phase #4 [Allocate primary replacement blocks]
Phase #5 [Allocate secondary replacement blocks]
#Groups=xx [Calculate number of replacement blocks]
#RawFla=xx [Calculate number of raw flaw records]
#SctFla=xx [Calculate number of sector flaw records]
Update tbls [Write updated support tables to disk]
Reload FlaTbls [Reload all revectoring tables]
Done (no errs).

If the disk has never been formatted, the operator should always elect not to save existing flaw information, since the SMS 1000 does not access flaw maps that may be preinstalled directly on the disk by the drive manufacturer.

Remember that formatting a Winchester disk modifies all data recorded on the disk except for the flaw table, which is saved if you answered the query SAVE FLAW TABLE? in the affirmative. Be sure to back up any data on the disk before performing a FORMAT command. Because formatting is destructive of data, the system
issues the ARE YOU SURE? prompt when you select this command.

Most Winchester disks require formatting only once, and that is when they are first installed. Disks shipped installed in the SMS 1000 system are already formatted and have the flaw map installed.

For the initial installation of a new Winchester disk, format the disk and then enter the flaw table information.

CAUTION

Reformatting a Winchester disk is a radical procedure that destroys all data stored on the disk except the flaw table. Do not reformat a disk unless there is some compelling reason to do so.

CAUTION

The flaw tables will be destroyed if the system is restarted or powered down during a Winchester formatting operation or during a flaw-table build sequence. If this should happen, reformat the Winchester using the CLEAR FLAW TABLE option. Then, reenter the flaw table entries and scan the disk (see DISK EXERCISE commands in EVALUATION menus) a number of times to further update the flaw tables.

FLAW MGT WO SUBCOMMAND

The FLAW MGT command is used to enter, maintain, and examine the flaw map for the Winchester disk. Winchester disks that are SMS-installed in the SMS 1000 system are shipped with the flaw map already installed. Therefore, users seldom need to use this command.

FLAW MAP INFORMATION. All Winchester disks are subject to minor manufacturing imperfections in the recording surface. These imperfections make a small portion of the surface unsuitable for recording data. The SMS 1000 system provides a flaw mapping facility that prevents errors by automatically mapping around flawed sectors.
SENSE MONITOR: OPERATION MENU COMMANDS

The system stores a primary and a backup copy of a disk's flaw map on the disk. The flaw map is simply a list of the disk's known flaws. When power is applied, the disk controller reads the flaw map and then automatically excludes flawed sectors from any read or write operations to the disk.

The disk address of a flaw can be specified in three different formats:

- Raw flaw data
- Sector address
- Logical block number (LBN)

Most disk manufacturers provide raw flaw data because the raw data is independent from the disk format. Raw data identifies a flaw by cylinder number, head number, its displacement from the index ("starting point") in bytes, and its length in bits.

Sector addresses identify a flaw by cylinder number, head number, and sector number. This is the format used by the disk controller. The flaw mapping facility converts flaw data to this format, regardless of the format used for entering the flaw data.

MENU STRUCTURE

FLAW MGT W0
   RAW FLAW MGT
   Entries= <system displays current number of entries in flaw table, unless number is zero, in which case this line is replaced by the message: "Tbl empty">  
   NEXT?
      Cyl#= xxxx
      Head#= xxxx
      BytDsp= xxxx
      BitCnt= xxxx
      Entry#= xxxx
   PREVIOUS?
      Cyl#= xxxx
      Head#= xxxx
      BytDsp= xxxx
      BitCnt= xxxx
      Entry#= xxxx
   NEW?
      Cyl#=
      Head#=
      BytDsp=
      BitCnt=(see note)
      Cyl#= xxxx
SENSE MONITOR: OPERATION MENU COMMANDS

Head#= xxxx
BytDsp= xxxx
BitCnt= xxxx
Are you sure?
BadSct#=xxxx
[BadSct#=xxxx]
LBN#=xxxxxxx
[LBN#=xxxxxxxx]
Entry#= xxxx
DONE/BLD TBL?

<Flaw management message sequence. System goes through the following steps in building the flaw table:>
Phase #1 [System sorts raw flaw table]
Phase #2 [Construct sector flaw records]
Phase #3 [Sort revectoring table]
Phase #4 [Allocate primary replacement blocks]
Phase #5 [Allocate secondary replacement blocks]
#Groups=xx [Calculate number of replacement blocks]
#RawFla=xx [Calculate number of raw flaw records]
#SctFla=xx [Calculate number of sect flaw records]
Update tbls [Write updated support tables to disk]
Reload FlatBls [Reload all revectoring tables]

REMOVE?
Cy1#= xxxx
Head#= xxxx
BytDsp= xxxx
BitCnt= xxxx
Entry#= xxxx
Are you sure?

CLEAR?
Are you sure?

NOTE: If drive does not specify a bit count (BitCnt=), enter a default of 1. If bit count given is 255 then that raw flaw entry was generated either by the autoflaw manager or by manually entering a sector or logical block flaw entry. The maximum bit count that can be entered manually is 254.

SECTOR FLAW MGT
Entries= <system displays current number of entries in flaw table, unless number is zero, in which case this line is replaced by the message: "Tbl empty">

NEXT?
Cy1#= xxxx
Head#= xxxx
Sector#= xxxx
Entry#= xxxx
GrpDsp=+xxxx
PREVIOUS?  -
SENSE MONITOR: OPERATION MENU COMMANDS

Cyl# = xxxx
Head# = xxxx
Sector# = xxxx
Entry# = xxxx
GrpDsp = +xxxx

NEW?
Cyl# =
Head# =
Sector# =
Cyl# = xxxx
Head# = xxxx
Sector = xxxx
Are you sure?
GrpDsp = +xxxx
LBN# = xxxxxxxx
BytDsp = xxxx
Entry# = xxxx

DONE/BLD TBL?
System displays the following in-process messages when updating the vectoring table
during SECTOR FLAW MGT:

Sorting [Sort vectoring table]
Update tbls [Write updated support tables to disk]
Reload tbls [Reload all vectoring tables]

REMOVE?
Cyl# = xxxx
Head# = xxxx
Sector = xxxx
Entry# = xxxx
Are you sure?
Done (no errors).

CLEAR?
Are you sure?

BLOCK FLAW MGT

NEXT?
LBN# = xxxxxxxxxx
Entry# = xxxx

PREVIOUS?
LBN# = xxxxxxxxxx
Entry# = xxxx

NEW?
LBN# =
Are you sure?
Cyl# = xxxx
Head# = xxxx
BytDsp = xxxx
BitCnt = xxxx
BadSct# = xxxx
GrpDsp = +xxxx

SMS 1000  7-15
ENTRY#=xxxx
DONE/BLD TBL?
Are you sure?
REMOVE?
   LBN#=xxxxxxxxxx
   ENTRY#=xxxx
   Are you sure?
CLEAR?
   Are you sure?
FLAW MGT W1
   (Same as for W0)
FLAW MGT C0
   C0 READY?
   (Otherwise same as for W0)

REMARKS

GENERAL. The basic sequence of steps by which you can inspect individual entries in a flaw table or add entries to a flaw table are:

1. NEXT? Selecting this command permits you to view sequentially each entry in the raw-flaw table or the sector-flaw revectoring table. It also permits sequential viewing of flaw entries expressed in logical block number (LBN) format.

2. PREVIOUS? This command permits you to examine flaw-table entries preceding the current entry. If this command is selected when you are at the start of the table, wrap-around takes place and entries are viewed from the end of the table back; i.e. last entry, next-to-last entry, etc.

3. NEW? Use the NEW? command when you want to enter or add either new raw-flaw data or new sector-flaw data into their corresponding tables. Use this command, also, to enter flaw data using logical block numbers (LBN). After all data pertaining to a flaw is entered, it is echoed back to show what has been entered.

4. DONE/BLD TBL? After all new flaw data has been entered, a new flaw revectoring table must be constructed. This is done by selecting the DONE/BLD TBL command. The various steps in the process of table construction are displayed. Note that this option constructs a best-case mapping when selected within the RAW FLAW MGT menu.

5. CLEAR? Selecting this command clears all entries from the tables in any of the three flaw management modes.

FLAW MANAGEMENT MODES. Three flaw management modes are supported. These are:

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SENSE MONITOR: OPERATION MENU COMMANDS

1. Raw-flaw address mode.
2. Sector-flaw address mode.
3. Logical-block flaw address mode.

RAW-FLAW MODE. A raw flaw is defined by four components that specify a starting address and a length. These are:

1. Cylinder number
2. Head number
3. Byte displacement from index
4. Bit count (length)

SECTOR-FLAW MODE. A sector flaw is defined by three address components:

1. Cylinder number
2. Head number
3. Logical sector number

LOGICAL-BLOCK MODE. A logical-block flaw is defined by a single decimal address known as the logical block number (LBN). The value of this address has as its upper limit the storage size of the device. Mapping in terms of logical block numbers represents an alternative way of describing the locations of defects and their replacements.

During power-on processing the revectoring tables for each configured Winchester are loaded into controller ram. Each revectoring table contains two types of data: (1) a sorted list containing the cylinder-, head- and sector number of each flaw on the disk, and (2) for each flaw address the address of a reserve sector that is used instead of the flawed sector. The entry "Grp Dsp" (group displacement) is the address of the sector or block that replaces the defective sector. Thus, the revectoring table contains all the data necessary to map from a flawed sector to its replacement sector.

When the FLAW MGT menu is entered, the support tables pertaining to the corresponding Winchester are loaded into controller ram. These tables include a replacement-block bit map and the raw flaw table.

CAUTION

Note that when the raw-flaw table is rebuilt, an optimal replacement mapping is used in constructing the corresponding revectoring table. This ignores all previous mappings and, hence, could destroy data entered under previous mappings. Therefore, always back up data before rebuilding a revectoring table.
NOTE

The NEW commands accept and temporarily store flaw map information. The flaw map is not updated until you select the DONE/BLD TBL command. The latter is also true for the REMOVE and CLEAR commands.

The NEW commands request you to enter flaw data using the raw data format or the sector format.

The NEXT and PREVIOUS commands display the contents of an existing flaw map. New flaw data that you have just entered is also displayed even though the new data is not added to the flaw map until you request DONE/BLD TBL and exit from the FLAW MGT command.

The REMOVE command removes the current entry from an existing flaw map. Use the NEXT and PREVIOUS commands to display the desired entry, then remove it with the REMOVE command. Use this command to remove faulty entries caused by typing errors. You should never remove valid entries from the flaw map.

DONE/BLD TBL updates the flaw map if any new entries have been made with a NEW command and terminates the FLAW MGT command. This process may take up to several minutes to complete; do not interrupt it while it is in progress. Remember that when this command is used with the SECTOR FLAW MGT or BLOCK FLAW menus a revectoring table is rebuilt using a non-optimal replacement block mapping. That is, the mapping allocates the nearest available replacement blocks for newly added sector flaw records. Existing mappings are left unchanged.

The maximum number of raw flaws that can be managed is 200 per disk. The maximum number of sector flaws, i.e. the size of each revectoring table, is 250. Attempting to add to a table that contains the maximum allowed number of entries will cause the following message to be displayed:

Tbl full

FLAW MGT FOR W1 SUBCOMMAND

This command provides flaw-map management for Winchester drive W1. This command is identical to FLAW MGT for W0, except it applies to W1. This menu entry appears only if your system is configured with two Winchester drives and W1 is enabled.
SENSE MONITOR: OPERATION MENU COMMANDS

FLAW MGT FOR C0 SUBCOMMAND

This command provides flaw-map management for cartridge-type Winchester drive C0. This command is identical to FLAW MGT W0 except that it applies to C0. The menu only appears if your system is configured to include C0.

BOOT HOST CPU COMMAND

The BOOT HOST command terminates menu processing and runs the boot program.

MENU STRUCTURE

BOOT HOST CPU
  Are you sure?

REMARKS

The BOOT HOST command runs the bootstrap program, which invokes the LSI-11 CPU. In systems configured for AUTO BOOT, the BOOT HOST command and the RESTART switch have similar effects. The BOOT HOST command may be somewhat faster than a RESTART because it bypasses any optional start-up self-test routines.

IMPORTANT

The BOOT HOST command reassigns the console device from SENSE to the LSI-11 CPU. After the BOOT HOST command is executed, SENSE commands must be entered using the front panel pushbuttons and 16-character display. Not all SENSE commands can be executed while the host is running. If a SENSE command would interfere with the host, an error message is issued and the command is aborted. SENSE issues an ARE YOU SURE? message before executing the BOOT HOST command.

CAUTION

If you have made configuration changes to the system (see Section 9) and want them to be stored, DO NOT restart the system by means of the
BOOT HOST CPU command. While this will restart the system it will not store configuration changes. Instead, to store such changes, restart by simultaneously pressing the front-panel RESTART and "*" buttons.
SECTION 8

SENSE MONITOR:
EVALUATION MENU COMMANDS

INTRODUCTION

The EVALUATION menu commands of the SENSE Monitor are used to exercise the circuits, mechanism and recording media of peripherals integral to the system, and to set limits on these tests.

One of the most used EVALUATION exercises is READ-ONLY SCAN. This exercise scans the surface of a diskette or Winchester disk and reports any imperfections on the media. Since it is unwise to use diskettes with known flaws, this test should be performed on each diskette after it is formatted, but before it is used for recording data.

EVALUATION tests that write to memory or to the system peripherals must run in the stand-alone mode since they could interfere with application programs. Tests that do not write to memory or the peripherals can run concurrently with your applications.

The following table provides a summary of the commands supported by the EVALUATION menu:

Table 8-1. EVALUATION MENU COMMAND SUMMARY

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFY CONTROLS</td>
<td>Specifies the devices to be tested and the number of times an evaluation test is to be repeated.</td>
</tr>
<tr>
<td>SYSTEM EXERCISES</td>
<td>Enables or disables tests to write on storage devices.</td>
</tr>
<tr>
<td>DISK EXERCISES</td>
<td>Performs random I/O tests on groups of sectors. Reserved areas are avoided.</td>
</tr>
<tr>
<td>TAPE EXERCISES</td>
<td>Includes block write/read tests of tape drive alone as well as tape/disk tests that verify backup and restore capabilities.</td>
</tr>
<tr>
<td>LOGS</td>
<td>Lists Winchester and tape error events generated during various evaluation activities.</td>
</tr>
</tbody>
</table>
SENSE MONITOR: EVALUATION MENU COMMANDS

SPECIAL

Provides facilities for displaying the contents of a sector. Also includes an option enabling you to run a demonstration of the capabilities of the total SENSE menu system.

LEGEND

C0 = Removable-Cartridge Winchester Drive 0
F0 = Floppy Drive 0
F1 = Floppy Drive 1
T0 = Tape Drive 0
W0 = Fixed-Disk Winchester Drive 0
W1 = Fixed-Disk Winchester Drive 1
SENSE MONITOR: EVALUATION MENU COMMANDS

SPECIFY CONTROLS COMMAND

The SPECIFY CONTROLS command specifies the number of times a test is to be performed, the extent of the test and the devices to be tested. This command can also be used to limit the testing of Winchester disks and/or memory to a specific range of physical addresses.

The SPECIFY CONTROLS command includes the following subcommands:

SPECIFY LIMITS
This command specifies the number of times a specific test is to be performed. Within the overall pass limit, you can also specify the number of soft and hard errors that may occur before the system pauses to display an error message.

SPECIFY DRIVES
This command specifies which of the configured peripherals are to be included in the test.

DISK RANGES
These commands set starting and ending track limits to establish a cylinder and head range used in calculating sector addresses for disk tests.

DATA PATTERNS
Permits configuring data patterns for use in disk evaluation tests.

MODES
Permits selection of various evaluation modes.

SPECIFY LIMITS SUBCOMMAND

The SET PASS LIMIT subcommand controls the number of times a test is performed.

MENU STRUCTURE

SPECIFY CONTROLS
  SPECIFY LIMITS
    PASS LIMIT
      Limit=
    HARD ERR LIM
      Limit=
    SOFT ERR LIM
      Limit=
REMARKS

One pass equals one complete execution of a test. If the test comprises subtests, one pass equals completing each subtest one time. For the random tests, one pass equals one seek followed by the specified test.

LIMITS. "No limit" is communicated to SENSE by setting LIMIT = 0. NOTE: The system default for PASS LIMIT, HARD ERR LIM, and SOFT ERR LIM is 0. "No limit" is useful for long-duration tests such as, for example, where burn-in of components may be necessary.

HARD AND SOFT ERRORS. Within the PASS limit, you can specify the number of hard and soft errors that may occur before the system terminates the test. A soft error is a correctable read or write error on a disk. A hard error is a read or write error with more incorrect bits than the error correcting circuitry can handle. Both soft and hard errors could also be caused by hardware malfunctions.

TEST TERMINATION. A test terminates when the PASS LIMIT is reached, when either the SOFT or HARD ERROR limit is reached, or when the operator aborts the test (presses the front panel MENU switch or types "^C (control C) at the terminal keyboard).

WHEN ERRORS OCCUR. Notice that the error counter indicates only the raw total of soft and hard errors without indicating the type or source of the errors. See later commands in this section for a description of how errors are reported during tests. In a properly functioning system, the error count should be very low, usually zero. A significant error count indicates the need for further testing to determine the cause of the errors. The following guides may be helpful:

- Media problems, such as a damaged diskette, are the most common cause of errors. However, you should not swap diskettes until you have isolated the problem.

- Isolate the problem drive by testing only one drive at a time. The READ-ONLY SCAN, rather than one of the random tests, is useful for finding faulty media. The disk tests are described under "DISK EXERCISES," later in this section.

- If a particular floppy drive is causing the errors, the problem is very likely a bad diskette. If so, there should be no errors when the drive is retested.
with a diskette known to be good. Notice, however, that diskettes stored together are all subject to damage if they have been exposed to excess heat, humidity, dust, strong magnetic fields, or physical abuse.

- If a floppy drive continues to generate errors even with a good diskette, the problem may be dirty read/write heads. Clean the heads in accordance with the manufacturer's instructions and retest the drive. If the problem still persists, contact your service representative.

- After the flaw map is correctly installed, Winchester disks seldom generate large numbers of errors, particularly when error correction and auto retry are in effect (see the SPECIAL commands of the CONFIGURATION menu). Use the FLAW MGT command of the OPERATION menu to enter the flaw map if it isn't already installed, then perform a scan test on the disk. Contact your service representative if the scan generates errors.

**SPECIFY DRIVES SUBCOMMAND**

**SPECIFY DRIVES** names the peripheral device to be included in any of the tests described under **SYSTEM EXERCISES** (see below).

**MENU STRUCTURE**

**SPECIFY DRIVES**

- W0
  - Disable?
  - Enable?
- W1
  - Disable?
  - Enable?
- C0
  - Disable?
  - Enable?
- F0
  - Disable?
  - Enable?
- FL
  - Disable?
  - Enable?
- T0
  - Disable?
  - Enable?
REMARKS

Only those drives configured into your system appear in this menu. For example, W1 does not appear in the menu for systems that do not have W1 enabled in the CONFIGURATION menus.

Use this command when you want to select a drive or drives to be tested using the SYSTEM EXERCISES commands. Remember, first of all, that the default option for this command is ENABLE. Assume, for example, that you want to scan the diskette in drive F1. This requires you to DISABLE drives W0, W1, C0, F0, and T0 from the test. Then, drive F1 will be selected by default. It is only necessary to select the menu option ENABLE? if a drive has been previously excluded by use of the DISABLE? menu option.

DISK RANGES SUBCOMMAND

The DISK RANGES commands limit a test on a Winchester disk to a specific range of physical addresses. This allows you to test only a specific portion of the disk.

MENU STRUCTURE

DISK RANGES

SET W0 RANGE
  MIN CYL
    Min cyl#= 
  MAX CYL
    Max cyl#= 
  MIN HEAD
    Min head#= 
  MAX HEAD
    Max head#= 

SET W1 RANGE
  MIN CYL
    Min cyl#= 
  MAX CYL
    Max cyl#= 
  MIN HEAD
    Min head#= 
  MAX HEAD
    Max head#= 

SET C0 RANGE
  (same as above)

SET F0 RANGE
SENSE MONITOR: EVALUATION MENU COMMANDS

(same as above)
SET FL RANGE
(same as above)

REMARKS

The SET W0 RANGE (and the similar SET W1 RANGE, etc) command allows you to specify the starting-track and ending-track range to be included in the test of a Winchester drive. These physical addresses are in the cylinder and head number format.

The default setting for these commands is a range from the first normal track to the last.

The minimum and maximum disk addresses specify an area of the disk where the disk exercises can have unrestricted access. The disk exercises are prevented by the system from accessing the flaw table or any tracks reserved for diagnostic purposes. IMPORTANT: Note that MAX CYL# must be equal to or less than the total number of cylinders - 1; and that MIN CYL# must be equal to or less than MAX CYL#.

In cases where the system itself senses such parameters as number of heads, the measured value takes precedence over the value entered by the user. Thus, for example, if a value of two were entered for the number of heads with a single-sided diskette in the drive, the system's measured value of one would be the value actually used.

DATA PATTERNS SUBCOMMAND

This command is used to establish the data patterns that are written to disks when undergoing various evaluation tests.

MENU STRUCTURE

DATA PATTERNS
PATTERN 1
Byte#1=
Byte#2=
Byte#3=
PATTERN 2
Byte#1=
Byte#2=
Byte#3=
REMARKS

Note the following rules for entering the three bytes of each data pattern:

1. Enter all bytes in hexadecimal.
2. Enter each byte as two hex characters. If you attempt to enter more than two hex characters for each byte, the system will truncate all characters after the second.
3. DEFAULT SETTINGS. If you make no entry for these patterns, the system automatically supplies the following worst-case patterns as defaults:

Pattern 1:
- Byte#1 = 6D
- Byte#2 = B6
- Byte#3 = DB

Pattern 2:
- Byte#1 = B6
- Byte#2 = DB
- Byte#3 = 6D

When performing a disk test, the system alternates patterns with each pass. That is, on the first pass Pattern 1 is used, on the second Pattern 2, on the third Pattern 1, etc. Also, when formatting disks using the OPERATION menus, Pattern 1 is always used.

MODES SUBCOMMAND

The MODES subcommand permits the user to enable or disable various features pertaining to auto-flaw management, error correction and error logging.

MENU STRUCTURE

MODES
- AUTO FLAW MODE
- DISABLE?
- ENABLE?
  - VrfyLim=
- ERROR LOGGING
- DISABLE?
- ENABLE?
- ERROR LOG WRAP
- DISABLE?
- ENABLE?
ERROR RECOVERY
ECC CORRECTION
DISABLE?
ENABLE? [This is the default setting]
AUTO RETRY
DISABLE?
ENABLE? [This is the default setting]

REMARKS

AUTO FLAW MODE. If AUTO FLAW MODE is disabled, flaw management
must be done manually, as described in the OPERATION menus (see FLAW MGT commands). If AUTO FLAW MODE is enabled, then during
an evaluation exercise, errors occurring as a result of defec-
tive sectors or tracks are processed automatically by the
flaw-management facility. In this process, the defective sec-
tors or tracks that are found are added to an existing flaw map.
A new revectoring table is then created so that on succeeding
tests these flaws are avoided. The system's default mode for
this command is DISABLE. If you enable auto flaw management,
controller event codes 70, 71, 75 or 76 (decimal) will trigger
the automatic revectoring process. See Appendix E for event
codes. Note that soft errors do not cause an auto-flaw-
management response.

During the auto-flaw-management process, the system displays the
following in-progress messages:

Autoflaw Manager [Sign-on message]
Load AuxTbls [Build auxiliary tables for device read]
Phase 1 [Sort newly appended auxiliary revectoring table]
Phase 2 [Allocate replacement blocks]
Update tbls [Write updated auxiliary tables to disk]
Reload tbls [Reload revectoring tables for all disks]

The autoflaw manager is called during evaluation exercises when
the autoflaw mode is enabled. The autoflaw manager is automati-
cally called by the error handler when ECC errors cannot be
corrected. The auxiliary tables are loaded and flawed sectors
are cataloged in the same manner as in manual flaw management
(see FLAW MGT portion of OPERATION menus). Note that if a
defective sector is mapped to a sector that is itself defective,
a further mapping will be performed after the first verify pass.

CAUTION

If AUTO FLAW mode is enabled, and a flawed sector
is detected, data in the flawed sector could be
lost when the new revectoring table is construc-
ted. Therefore, data should be backed up before
entering the AUTO FLAW mode.
SETTING SCAN LIMIT FOR FLAW VERIFICATION. As part of the auto-flaw-management process the system can be configured to repeatedly scan the cylinder within which a flaw occurred before the pass counter is again incremented. By repeatedly scanning the cylinder, all possible flaws in that area can be detected and mapped. To configure the number of times a flaw area is scanned, supply a decimal number from 0 to 64,000 in response to the prompt "VrfyLim=". If no value is supplied, the system default is 10 (decimal).

ERROR LOGGING. If you select ENABLE in response to the command ERROR LOGGING, the system keeps a log of the two most recent flaws that have been detected by the auto-flaw facility. A separate log is kept for each configured Winchester drive. These logs can then be accessed by the commands in the LOGS menus (see below). The default for the ERROR LOGGING command is ENABLE.

ERROR LOG WRAP. If this command is disabled, error logging will stop when the error log is full. If the command is enabled, "wrap around" of the error log takes place; that is, the next error detected after the log is full displaces the first entry in the log. Then, every subsequent error displaces the oldest entry in the log. In this manner, the log stores only the most recent entries. The default setting for this command is ENABLE.

ERROR RECOVERY. The SMS 1000 supports ECC error correction for Winchester disks. This technique can detect an error up to sixteen bits in length and correct errors up to six bits in length. The ECC CORRECTION command enables error correction or limits the system to error detection only. If ECC CORRECTION is disabled, the controller detects but does not correct ECC events. The default setting for this parameter is ENABLE. The use of error correction is recommended for normal system operation. Error correction should be disabled when testing the Winchester disks since the purpose of the test is to find errors, correctable or otherwise.

When enabled, AUTO RETRY attempts to correct a read or write error up to ten times before reporting the error. AUTO RETRY is recommended for normal system operation, but should be disabled when testing the disk. The default setting for this parameter is ENABLE.

CAUTION

Disabling ECC CORRECTION and AUTO RETRY is not recommended for normal system usage.
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since higher error rates are likely to occur

SYSTEM EXERCISES COMMAND

The SYSTEM EXERCISES commands test the reading and writing capabilities of the storage devices configured in your system. A write-on-Winchester test performs multiple read-after-write exercises. A read-only test performs multiple random-read exercises. Tape tests are also performed.

MENU STRUCTURE

SYSTEM EXERCISES
WRITE ON WINCH?
<evaluation parameter list appears here>
Are you sure?
READ-ONLY WINCH?
<evaluation parameter list appears here>
Are you sure?

REMARKS

GENERAL. Command parameters for these exercises allow you to select a read-only Winchester test or a test that both reads and writes on the disks. The write test must be run in the stand-alone mode. Note that the read-only Winchester test also writes to the tape unit (if so configured). Because the write test affects data on the Winchester disk, you should back up your Winchester disk before running the test.

CAUTION

Before using this command, be sure to back up data on the disks to be tested. If data is not backed up, it will be lost when disk is written over.

WRITE ON WINCH. This exercise consists of a group of repetitive tests that write on the Winchesters configured into your system, read what has been written, and then check that the two match. The number of complete passes in a test is set by the PASS LIMIT command in the SPECIFY LIMITS menus. When you give an affirmative response to the WRITE ON WINCH? menu item, a list of parameters governing the test appears. Its format is as follows:
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A list of drives selected for test by the SPECIFY DRIVES command; i.e. W0, W1, etc.

VrfyLim= xxxx [will appear only if AUTO FLAW MODE is enabled]
PassLim= xxxx [value set under SPECIFY LIMITS]
HErrLim= xxxx [value set under SPECIFY LIMITS]
SErrLim= xxxx [value set under SPECIFY LIMITS]
Autoflaw [either "Enabled" or "Disabled" appears]
ECC [either "Enabled" or "Disabled" appears]
Retries [either "Enabled" or "Disabled" appears]
Err Log [either "Enabled" or "Disabled" appears]
Soft Err [either "Enabled" or "Disabled" appears]
In-prog [either "Enabled" or "Disabled" appears]

Ready?
[Not ready?]
[Are you sure?]
[Not ready?]

Thus, a typical parameter list for a test might appear as follows:

W0 C0
VrfyLim= 10
PassLim= 0
HErrLim= 0
SErrLim= 0
Autoflaw Disabled
ECC Enabled
Retries Enabled
Err Log Enabled
Soft Err Enabled
In-prog Enabled
Ready? [User types: Return]
Are you sure? [User types: Return]

After the appearance of the parameter list, the WRITE ON WINCH test begins. Each complete pass of the WRITE ON WINCH test includes the following steps:

1. Pass-count appears. Controller self-test begins. (Note that one pass represents a complete sequence of disk tests. The number of passes to be performed is set by use of the PASS LIMIT command.)

2. The random-write exercise is repeated 2000 times on each disk. (See below for a description of the steps involved in the random-write exercise.) As the exercise is performed, the following is displayed:

<repetition-sequence number (from 1 to 2000)>
and <disk address>
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where <disk address> is defined as device designation (i.e. W0, W1, C0, F0 or F1); cylinder number; head number; and sector number.

3. The random-read exercise is repeated 2000 times on each disk. (See below for a description of the steps involved in the random-read exercise.) As the exercise is performed, the following is displayed:

   <repetition-sequence number (from 1 to 2000)>
   and <disk address>

where <disk address> is defined as device designation (i.e. W0, W1, C0, F0 or F1); cylinder number; head number; and sector number.

4. If the drives selected for evaluation include a tape and at least one Winchester, the disk-to-tape exercise and the tape-to-disk exercise are performed on each Winchester.

If an error is found in any of the above steps, then the system displays the following messages:

   Error logging... [appears only if ERROR LOGGING command has been enabled]
   <name of error>
   <event code> [refer to Appendix E for descriptions]

If the number of hard and soft errors measured as a result of the test equals the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then the system will issue the message:

   Action?

If you now press Return (or "*" if using the front panel controls) the system gives you the three options: Restart?, Menu?, or Resume?. Selecting "Restart?" begins the sub-test again and resets the error counter. Selecting "Menu?" takes you back to the WRITE ON WINCH menu option again. Selecting "Resume?" resets the error counter and allows you to resume the test from its stopping point.

READ-ONLY WINCH. This exercise performs a series of reads on the Winchester under test. The test is successful if data is read on each seek. This test can exercise any configured peripheral. After selecting the READ-ONLY WINCH command, the system displays a parameter list showing the current values of the parameters involved in the test. This list is in the same format as that displayed in the WRITE ON WINCH test.
After the appearance of the parameter list, the READ-ONLY WINCH test begins. Each complete pass of the READ-ONLY WINCH test includes the following steps:

1. Pass-count appears. Controller self test begins. (Note that one pass represents a complete sequence of disk tests. The number of passes to be performed is set by use of the PASS LIMIT command.)

2. The random-read exercise is repeated 2000 times on each disk. (See below for a description of the steps involved in the RANDOM-READ exercise.) As the exercise is performed, an in-progress message is displayed. It has the following format:

   <repetition-sequence number (from 1 to 2000)>
   and <disk address>

   where <disk address> is defined as device designation (i.e. W0, W1, C0, F0 or F1); cylinder number; head number; and sector number.

3. If the drives selected for evaluation include a tape and at least one Winchester, the disk-to-tape exercise is performed on each Winchester.

If an error is found in any of the above steps, then the system displays the following messages:

   Error logging... [appears only if ERROR LOGGING command has been enabled]
   <name of error>
   <event code> [refer to Appendix E for descriptions]

If the number of hard and soft errors measured as a result of the test equals the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then the system will issue the message:

   Action?

If you now press Return (or "*" if using the front panel controls) the system gives you the three options: Restart?, Menu?, or Resume?. Selecting "Restart?" begins the test again. Selecting "Menu?" takes you back to the READ-ONLY WINCH menu option again. Selecting "Resume?" resets the error counter and allows you to resume the test from its stopping point.

DISK EXERCISES COMMAND

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DISK EXERCISES presents a submenu of five commands that test the disk drives selected by the SPECIFY DISKS command described above.

MENU STRUCTURE

DISK EXERCISES
RANDOM WRITE?
  <evaluation parameter list is displayed>
  Are you sure?
RANDOM READ?
  <evaluation parameter list is displayed>
RANDOM SEEK?
  <evaluation parameter list is displayed>
READ-ONLY SCAN?
  <evaluation parameter list is displayed>
WRITE/SCAN?
  <evaluation parameter list is displayed>
  Are you sure?

REMARKS

The RANDOM READ and READ-ONLY SCAN commands can be run concurrently with host processing. However, you should be aware that these commands, because they share disk accesses with the host, have the potential to slow down some applications.

Disk exercises terminate when the pass count is exceeded, when the hard or soft error limit is exceeded, or when the operator aborts the command.

One pass implies access to each disk selected in the SPECIFY DRIVES command.

The RANDOM tests generate a cylinder, head, and starting sector number using a random-number generation technique, and then perform a seek to that cylinder. These random seeks provide an effective test of the disk's head-positioning hardware. When a seek fails, the controller attempts to bring the heads back into registration by performing a seek to cylinder zero, then repeating the original seek (if RETRY is enabled). A persistent seek error indicates a need for service.

RANDOM WRITE. The RANDOM WRITE command generates a series of random disk addresses, then reads a sector, writes it back, reads it again, and compares the results of these operations. Any change in the data indicates an error.

CAUTION
The RANDOM WRITE command is destructive; that is, it can destroy data that was previously written to a disk. Therefore, be sure to back up your disk before starting this exercise.

After the RANDOM WRITE command is selected, the system displays a list of the parameters involved in the test. This list has the same format as the parameter list described in the WRITE ON WINCH command (see above).

A complete cycle of the RANDOM WRITE test consists of the following steps:

1. The system generates a random disk address and displays an in-progress message that has the following format:
   
   <pass number><disk address>

   where: <pass number> is a decimal number less than or equal to the value set using the PASS LIMIT command (see SPECIFY LIMITS menu); and <disk address> is defined as device designation (i.e. W0, W1, C0, P0 or P1); cylinder number; head number; and sector number.

2. Read a group of logically consecutive sectors. Each group consists of two sectors (1K bytes). This step determines that the sectors are readable.

3. Write a bit pattern back to each sector. This pattern is configurable using the DATA PATTERNS command (see SPECIFY CONTROLS above).

4. Re-read the sectors just written and verify the accuracy of what was read by comparing it against the known pattern.

5. If an error is found in any of these steps, then the system displays the following messages:

   Error logging... [appears only if ERROR LOGGING command has been enabled]
   name of error
   event code [refer to Appendix E for descriptions]

If the number of hard and soft errors measured as a result of the test equals the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then the system will issue the message:
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Action?

If you now press Return (or "*" if using the front panel controls) the system gives you the three options: Restart?, Menu?, or Resume?. Selecting "Restart?" begins the test again. Selecting "Menu?" takes you back to the RANDOM WRITE menu option again. Selecting "Resume?" resets the error counter and allows you to resume the test from its stopping point.

RANDOM READ. After selecting the RANDOM READ command, the system displays a parameter list showing the current values of the parameters involved in the test. This list is in the same format as that described for the WRITE ON WINCH test (see above).

The RANDOM READ command performs the following steps on each disk previously selected using the SPECIFY DRIVES command:

1. The system generates a random disk address and displays an in-progress message that has the following format:

   <pass number><disk address>

   where: <pass number> is a decimal number less than or equal to the value set using the PASS LIMIT command (see SPECIFY LIMITS menu); and <disk address> is defined as device designation (i.e. W0, W1, C0, P0 or P1); cylinder number; head number; and sector number.

2. Read a group of logically consecutive sectors.

3. If an error is found in the read operation, then the system displays the following messages:

   Error logging... [appears only if ERROR LOGGING command has been enabled]
   <name of error>
   <event code> [refer to Appendix E for descriptions]

If the number of hard and soft errors measured as a result of the test equals the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then the system will issue the message:

Action?

If you now press Return (or "*" if using the front panel controls) the system gives you the three options: Restart?, Menu?, or Resume?. Selecting "Restart?" begins the test again. Selecting "Menu?" takes you back to the RANDOM READ menu option again. Selecting "Resume?" resets the error counter and allows you to resume the test from its stopping point.
RANDOM SEEK. The RANDOM SEEK command performs a seek, then verifies that it reached the correct cylinder. After selecting the RANDOM SEEK command, the system displays a parameter list showing the current values of the parameters involved in the test. This list is in the same format as that displayed in the WRITE ON WINCH test (above). The RANDOM SEEK command performs the following steps on each disk previously selected using the SPECIFY DRIVES command:

1. The system generates a random disk address and displays an in-progress message that has the following format:

   `<pass number><disk address>`

   where: `<pass number>` is a decimal number less than or equal to the value set using the PASS LIMIT command (see SPECIFY LIMITS menu); and `<disk address>` is defined as device designation (i.e. W0, W1, C0, F0 or F1); cylinder number; head number; and sector number.

2. The system then does a seek to the sector determined in Step 1. No data is transferred.

3. The number of the sector found is compared with that of the sector determined in Step 1.

4. If an error (i.e. a miscompare) is found, then the system displays the following messages:

   Error logging... [appears only if ERROR LOGGING command has been enabled]
   `<name of error>`
   `<event code>` [refer to Appendix E for descriptions]

If the number of hard and soft errors measured as a result of the test equals or exceeds the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then the system will issue the message:

**Action?**

If you now press Return (or "*" if using the front panel controls) the system gives you the three options: Restart?, Menu?, or Resume?. Selecting "Restart?" begins the test again. Selecting "Menu?" takes you back to the RANDOM SEEK menu option again. Selecting "Resume?" resets the error counter and allows you to resume the test from its stopping point.

READ-ONLY SCAN. The READ-ONLY SCAN command reads the entire contents of a disk within the evaluation range defined by the
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DISK RANGES command (see SPECIFY CONTROLS above), and reports any read errors. In addition to its function as a test of Winchester drives, this command is useful for detecting flawed diskettes. To avoid the inconvenience of using a flawed diskette in your system, use this test on each newly formatted diskette.

After the READ-ONLY SCAN command is selected, the system displays a list of the parameters involved in the test. This list has the same format as the parameter list described in the WRITE ON WINCH command (above).

After you select the READ-ONLY SCAN command, the following steps are performed:

1. Before starting a READ-ONLY scan test be sure that you have confirmed the numbers of the minimum and maximum cylinders to be scanned by use of the DISK RANGES command (see SPECIFY CONTROLS above).

2. The system starts the scan at the beginning of the configured or default cylinder/head range. The system reads every sector within the specified range of cylinders.

3. Assuming that the autoflaw mode is enabled (see MODES command under SPECIFY CONTROLS) and a hard error is found, mapping to an alternate sector will automatically take place. The cylinder with the defective sector is rescanned (or "verified") a number of times determined by the setting of the "VrfyLim=" parameter (see MODES) before the next cylinder is scanned.

4. For each device being scanned, a scan report is displayed at the conclusion of the test (if autoflaw mode is enabled). This report has the following format:

   G<total number of good passes> <device designation>
   g<number of passes in last string of passes unbroken
   by an error>f<new flaw count>

   where <device designation> indicates W0, W1, etc, depending upon the actual configuration of your system; and <new flaw count> is the actual number of flaws detected since the last time the flaw table was constructed. NOTE: G, g, and f are prefixes designating values to follow.

A typical scan report might appear as:

   G296w0g200f5
The letter G and 296 indicate that a total of 296 good passes have taken place; W0 indicates that the unit configured as Winchester 0 is being scanned; the letter g and 200 indicate that the most recent number of passes unbroken by a flaw has been 200; the letter f and 5 indicate that the total number of flaws detected has been 5. The important point to remember about this report is that if the number of passes unbroken by a flaw (i.e., g followed by a number) is large relative to the total number of good passes (i.e., G followed by a number), then you have a reasonable assurance that essentially all of the detectable flaws have been found and mapped.

5. After each normal cylinder scan, the following in-progress message is displayed:

<pass number><designation of device under test>c<number of last cylinder scanned>***[symbols displayed if a flaw was detected on this pass]>f<number of flaw count>

If, for example, a flaw were detected on pass 1008, the message would appear as follows:

1008w1c123***f12

where 1008 is the number of the most recent pass; W1 indicates that Winchester 1 is being tested; c123 indicates that cylinder 123 was just scanned; *** indicates that a flaw was detected on the last pass; and f12 indicates that 12 flaws have been detected since the start of the test. If a flaw had not been detected on pass 1008, the message would have been:

1008w1c123     f12

6. When the autoflaw mode is enabled and the flaw table is updated, the in-progress messages are updated after each cylinder-verify pass. Note that these messages have a different format from those described in Step 5. These messages have the following format:

<pass number><designation of device under test>c<number of last cylinder scanned>v<number of verification passes that have been run on the cylinder>f<number of flaw count>

For example, on pass 244, if cylinder 123 is being verified for the 12th time, with a flaw count currently standing at 9, the message would appear as:

244w1c123v12f9
WRITE/SCAN. The WRITE/SCAN command formats a disk under test with a data pattern determined by use of the DATA PATTERNS COMMAND (or its default data pattern); scans the disk for errors; and, in the case of Winchester disks when the autoflaw manager is enabled, performs flaw mapping and re-scanning as determined by the autoflaw "VrfyLim=" value.

CAUTION

The WRITE/SCAN command is destructive; that is, it can destroy data that was previously written to a disk. Therefore, be sure to back up your disk before starting this exercise.

After the WRITE/SCAN command is selected, the system displays a list of the parameters involved in the test. This list has the same format as the parameter list described in the WRITE ON WINCH command (above).

The WRITE/SCAN command performs the following steps:

1. Each disk is formatted with a predetermined pattern (see DATA PATTERNS COMMAND). Reserved areas are not written over. Existing flaw-map information is preserved.

2. The system next scans each sector on the disk for errors or flaws, between the maximum and minimum head/cylinder limits set using the DISK RANGES command.

3. The number of times the system scans the complete disk looking for flaws is set by the value of the "VrfyLim=" command (see MODES). This is true whether or not AUTO FLAW MODE is enabled. The current value of this count is indicated by the letter "V" followed by a value in the in-progress message (see below).

4. The number of times the system performs a complete pass, consisting of formatting and then scanning the disk, is set by the value of the PASS LIMIT command (see SPECIFY LIMITS).

5. At the end of each cylinder scan the system issues an in-progress message whose format is:

   <number of complete write/scan passes><designation of device being scanned>c<cylinder number just scanned> V<number of disk-verify scan passes thus far>
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f<new flaw count>

Thus, for example, at the end of pass 1008, on Winchester W1, cylinder 123, at the completion of verification pass 18, and with 22 flaws thus far found, the following message would be issued:

1008W1c123V18f22

6. If autoflaw mode is enabled and a flaw is found, the flaw is mapped as previously described in this chapter. The "VrfyLim=" counter is then reset and the disk is again scanned the number of times set in the "VrfyLim=" parameter (see MGDDES). A scan report is issued at the conclusion of the test. NOTE: Because of the ease with which flaws can be detected and mapped, it is recommended that you perform disk tests with the autoflaw mode enabled.

TAPE EXERCISES

The TAPE EXERCISES commands permit tests of data transfers between Winchester disks and the integral streaming tape drive. A variety of verification options are possible. A tape-status log records errors such as rewrites, rereads and underruns.

MENU STRUCTURE

TAPE EXERCISES
DISK->TAPE
<evaluation parameter list is displayed>
Ready?
DISK<--TAPE
<evaluation parameter list is displayed>
Ready?
Are you sure?
DISK <-->TAPE
<evaluation parameter list is displayed>
Ready?
Are you sure?

REMARKS

DISK->TAPE. The DISK->TAPE command performs a specialized form of the backup operation that requires no tape change. It permits the logging of various conditions detected by the tape drive during disk-to-tape (streaming) transfer. These conditions include logging the number of underruns, i.e. the tape running out of data to record and having to wait for the data stream to resume; and logging the number of blocks rewritten or
reread, i.e. retries because of bad spots on the tape.

After the DISK→TAPE command is selected, the system displays a list of the parameters involved in the test. This list has the same format as the parameter list described in the WRITE ON WINCH command (above).

Remember that this test will run only if an integral streaming tape drive and a Winchester are actually configured into your system. The following steps are involved in each pass of the test:

1. The tape is retensioned and rewound.

2. A test header is written to the tape.

3. A complete disk transfer to the tape (a "long" transfer) is initiated.

4. If either end of the Winchester's evaluation range has been reached, or if the end of the tape has been signaled, the tape status log is updated accordingly. The following is a typical in-progress message sequence:

<evaluation parameter list is displayed>
Ready? [user enters "Return" (or "]")]
Retension+Rewind
1 W0→T0u0 r0
Retension+Rewind
1 W1→T0u1 r1
Retension+Rewind
2 W0→T0u1 r1

where the first value in each message is the pass count; the value preceded by "u" is the number of underruns found on that pass; and the value preceded by "r" is the number of retries found on that pass.

Note that in the example above, two Winchesters (W0 and W1) are being tested at the same time. Refer to discussion of the ERROR LOGS commands for how to access the data logged on each pass.

DISK←TAPE. The DISK←TAPE command must be used in conjunction with the DISK→TAPE command. The DISK←TAPE command writes from tape to Winchester and, as with the DISK→TAPE command, counts underruns and retries during this transfer process.

CAUTION

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The DISK<->TAPE command is destructive; that is, it can destroy data that was previously written to a disk. Therefore, be sure to back up your disk before starting this exercise.

If you attempt to perform the transfer from tape to disk using a cartridge that does not have an evaluation header created by a specific DISK->TAPE test (see above), the system assumes that you are using tape from some other backup operation and returns the error message:

T0 has live data

The exercise is then terminated and you are returned to the "DISK<->TAPE" menu option. Similarly, if the tape has no header at all, it returns the message:

Blank tape?

and terminates the test as before. The following is a typical in-progress message sequence:

<evaluation parameter list is displayed>
Ready? [user enters "Return" (or "**")]
Retention+Rewind
1 T0->W0u0 r0
Retention+Rewind
1 T1->W0u1 r1
Retention+Rewind
2 T0->W0u1 r1

where the first value in each message is the pass count; the value preceded by "u" is the number of underruns found on that pass; and the value preceded by "r" is the number of retries found on that pass.

DISK<->TAPE. The DISK<->TAPE command permits you to perform both backup and restore tests that require no changes of tape cartridge. Thus, this command is, in effect, a combination of the two preceding commands.

CAUTION

The DISK<->TAPE command is destructive; that is, it can destroy data that was previously written to a disk. Therefore, be sure to back up your disk before starting
this exercise.

After the DISK<->TAPE command is selected, the system displays a list of the parameters involved in the test. This list has the same format as the parameter list described in the WRITE ON WINCH command (above). The system then performs the following steps for each fixed-disk device listed under the SPECIFY DRIVES command (see SPECIFY CONTROLS at the beginning of this chapter):

1. The tape is retensioned and rewound.

2. A complete disk transfer (i.e. a "long" transfer) to the tape is initiated.

3. The system updates the tape-status log if the end of either the disk or tape range has been reached.

4. The tape is again rewound and retensioned.

5. A complete tape transfer back to the disk is initiated.

6. The system updates the tape-status log if the end of either the disk or tape range has been reached.

The following is an example of a typical message sequence for this test:

<evaluation parameter list is displayed>
Ready? [user enters "Return" (or "*"')]
Are you sure? [user enters "Return" (or "*"')]
Retension+Rewind
1 W0->TU0 r0
Retension+Rewind
1 TU0->Wu0 r0
Retension+Rewind
2 W0->TU0 r0

where the first value in each message is the pass count; the value preceded by "u" is the number of underruns found on that pass; and the value preceded by "r" is the number of retries found on that pass.

LOGS COMMAND

In the preceding tests, errors have been recorded in logs located in controller RAM. Each log can store information on the last two errors for each device. There is a separate log for each peripheral device configured into your system. This com-
mand permits you to examine the contents of each log, to save the contents of any log in EEPROM, to call the contents of any log back from EEPROM, and to clear the contents of any log. The tape status log records the current count of retries and underruns for each test performed. The log also maintains a total count of retries and underruns for any series of tests.

**MENU STRUCTURE**

**COMMON ERROR LOG**

*W0*

-log parameter list is displayed-

*NEXT?*

*PREVIOUS?*

*CLEAR?*

*SAVE?*

*RESTORE?*

*W1*

(same as above)

*CO*

(same as above)

*FO*

(same as above)

*F1*

(same as above)

*T0*

(same as above)

**TAPE STATUS LOG**

*CURRENT*

**REWrites/REReads**

*Count=

**UNDERRUNS**

*Count=

**TOTAL***

**REWrites/REReads**

*Count=

**UNDERRUNS**

*Count=

*CLEAR?*

*SAVE?*

*RESTORE?*

**REMARKS**

**COMMON ERROR LOG.** For each device configured into the system, the error log records the last two error events that have occurred since the last time the log was cleared. Depending upon the status of the ERROR LOG WRAP command (see MODES above) the log will record either the first two or the last two errors as they occur. The error-log parameter list appears each time the COMMON ERROR LOG command is selected. The parameter list has
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the following structure:

#SysSErr=xxx [total soft errors for all devices]
#SysHErr=xxx [total hard errors for all devices]
#Wrap-ar=xxx [number of times #Records= wraps around]
#Records=xxx [where xxx = 0, 1, or 2]

where xxx is a decimal value supplied by the system. The first two entries in this list are global; that is, they record the total number of hard and soft errors for all tests since the last time the log was cleared. The last two items of the list are local; that is, they apply only to the current or latest test. The maximum number of records in the log for a given unit can be a maximum of two. If ERROR LOG WRAP is enabled, the two most recent error records will always be stored. As further errors occur, the oldest record is displaced. The value shown by #Wrap-ar= is the number of times the log has had its two records replaced (i.e. "wrapped around"). If, for example, 9 errors have occurred in a specific device test and ERROR LOG WRAP is enabled, then the last two lines of the parameter list will be:

#Wrap-ar=4
#Records=1

NEXT? and PREVIOUS? These two commands permit you to display the first error entry in the log (using NEXT?) or the last entry (using PREVIOUS?). When an entry is displayed using either of these commands, it has the following format:

<display of record number>
<error-frequency count>
<error message>
 e<error number><device designation>c<cylinder number>h<head number>s<sector number>

Thus, a typical log-entry display would be:

Record#= 1
FreqCnt= 5
"Drive not ready"
e64F0c1 h0 s1

Note that to display the next entry in the log after this entry, simply press Return again (or "*" if you are operating from the front panel).

CLEAR? The CLEAR? command, when selected, clears all entries in the error-log parameter list and also clears the two entries in the error log. Remember that CLEAR operates only with respect to one device at a time (see menu structure).
SAVE? and RESTORE? The SAVE? command causes error entries for a selected device to be written to the system's EEPROM. This means that the saved error-information is protected in the event of system power-down. Note, however, that the system's EEPROM is only large enough to store the error log of a single device. The RESTORE? command causes previously saved error-information for a device to be written back to the error log for that device. Note that if data is saved and then later restored after further entries have been made to the error log for a device, the data currently in the log for that device will be written over. Also, note that, because the log from only one device can be stored in the system's EEPROM, if, for example, you SAVE the log for W0 and then attempt to perform a RESTORE for W1, the system issues the message:

Wrong Error Log

TAPE STATUS LOG. The tape status log keeps a record of the current and total count of both underruns and retries/rereads (i.e. retries) since the last time the log was cleared. All operations involving tape, including BACKUP and RESTORE will update this log. The CLEAR?, SAVE? and RESTORE? commands operate in the same manner as for the COMMON ERROR LOG command.

SPECIAL

The SPECIAL command permits you to display the contents of any sector on a selected disk device. It also enables the user to use the MENU DEMO subcommand to perform a demonstration of the various capabilities of the SENSE menu system.

MENU STRUCTURE

MENU DEMO
DISPLAY SECTOR
   W0?
      <evaluation parameter list is displayed>
      Even boundary?
      Odd boundary?
      Cyl#=
      Head#=
      Sector#=
   W1
      (same as above)
   C0
      (same as above)
   F0
      (same as above)
SENSE MONITOR: EVALUATION MENU COMMANDS

F1
   (same as above)
T0
   (same as above)

REMARKS

While the SPECIAL menus are in effect, the hard and soft error limits that were set using the SPECIFY LIMITS command (see above) are temporarily changed from their assigned values to values of 1.

The DISPLAY SECTOR command permits you to display the contents of any sector for which you provide the cylinder-head-sector address. The system displays the contents of the sector, 16 or 17 words at a time, depending upon whether the word boundary specified for the first word is odd or even. The contents of the sector are displayed in hex. Note that by using this command you are able to display any sector, including reserved areas of Winchesters. The following is a typical message sequence:

<evaluation parameter list is displayed>
Even boundary? [user types Space, i.e. no]
Odd boundary? [user types Return, i.e. yes]
Cyl# = 108
Head# = 8
Sector# = 6

@0000: 0001
@0002: 0002 0003
@0006: 0004 0005
@000A: 0006 0007
@000E: 0008 0009
@0012: 000A 000B
@0016: 000C 000D
@001A: 000E 000F
@001E: 0010 0011
More? [user types Space, i.e. no]
Menu? [user types Return in order to return to the last menu option]

NOTE: In the above display of sector contents, the first part of each line (e.g. "@001E:") is the byte displacement (in hex) of that line from the start of the sector. The remainder of each line except the first contains the actual contents of the sector, expressed as two 16-bit words. The first line contains one word if you started on an odd boundary and two if on an even boundary.
SECTION 9

SENSE MONITOR:

CONFIGURATION MENU COMMANDS

GENERAL

The SENSE CONFIGURATION menus include commands used to enter or change system parameters. In effect, these commands answer questions such as: Is there a system console, and if so which serial port drives it? Or, what format specifications are to be used when formatting a floppy disk? The typical user may use the CONFIGURATION commands only for initial system set-up. Floppy disk formats can be an exception to this generalization: you may occasionally need to change formats if you exchange diskettes with other systems.

Note that every system is shipped with configurable parameters set in accordance with customer requirements. Where no specific customer requirement exists, each parameter is given a default setting determined by SMS.

VERY IMPORTANT:

STORING PARAMETER VALUES

WHEN MAKING CHANGES TO ANY OF THE PARAMETERS DESCRIBED IN THIS CHAPTER, REMEMBER THAT AFTER EACH CHANGE IS MADE YOU WILL SEE THE MESSAGE:

Task completed
Please RESTART!

IF YOU ARE MAKING A SERIES OF CHANGES, YOU DO NOT HAVE TO RESTART AFTER EACH CHANGE. BUT TO ACTUALLY STORE YOUR CHANGES IN THE SYSTEM, YOU MUST RESTART BY PRESSING THE RESTART AND "*" BUTTONS SIMULTANEOUSLY, AFTER THE LAST CHANGE IS MADE.

CONVENTIONS FOR USE IN THIS SECTION

The following conventions apply:

1. DEFAULT SETTINGS. Default settings are listed either to the right of the corresponding commands or in the accompanying REMARKS discussion.
2. Since storing parameter values requires a system restart, no configuration updates are allowed while the host is running.

3. CURRENT VALUES. You can query the system at any time as to current configuration settings. This is done by displaying the various levels in the menus. For each configurable parameter, the current setting is the first one displayed.

**COMMAND SUMMARY**

<table>
<thead>
<tr>
<th>FLOPPY FORMATS</th>
<th>Specifies the format to be used by the formatting commands in the OPERATION menu.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOTSTRAP</td>
<td>Specifies search sequence for bootable devices.</td>
</tr>
<tr>
<td>POWER ON/RESTART</td>
<td>Specifies actions to be taken when the system is powered on or reset, such as whether to auto-boot or enter the SENSE menu system.</td>
</tr>
<tr>
<td>SERIAL PORTS</td>
<td>Specifies baud rates, parity bit setting, terminal type, etc. for serial ports A0 and A1.</td>
</tr>
<tr>
<td>DEVICE PARAMETERS</td>
<td>Invokes a submenu of commands used for installing disk drives. These commands specify characteristics of the drives.</td>
</tr>
<tr>
<td>ADDRESSES</td>
<td>Modifies hardware addresses for the boot prom, controller, and/or port base for special applications.</td>
</tr>
<tr>
<td>SPECIAL</td>
<td>Controls user access level, error recovery, etc.</td>
</tr>
</tbody>
</table>

**LEGEND**

- C0 = Removable-Cartridge Winchester Drive 0
- F0 = Floppy Drive 0
- F1 = Floppy Drive 1
- T0 = Tape Drive 0
- W0 = Fixed-Disk Winchester Drive 0
- W1 = Fixed-Disk Winchester Drive 1

**NOTE:** ALL DEFAULT SETTINGS LISTED IN THIS SECTION AND IN APPENDIX A APPLY TO MODELS 40 AND 50 UNLESS OTHERWISE SPECIFIED.
SENSE MONITOR: CONFIGURATION MENU COMMANDS

FLOPPY FORMATS COMMAND

The FLOPPY FORMATS command specifies the disk format to be written by a FORMAT command in the OPERATION menu.

MENU STRUCTURE

FLOPPY FORMATS
  F0 FMT (5-1/4" floppy)
    DEC PC?
    F0 FMT (8" floppy)
      RX01?
      RX02? [Default setting. 256 BPS]
      IBM 1D?
      IBM 2D/FW?
      OTHER
        IBM 1D/256
        IBM 1D/512?
        IBM 2D/128?
        IBM 2D/256?
        IBM 2D/512 15SPT
        RX03
  F1 FMT
    (same as for F0 . . . see above)

LEGEND: SPT = Sectors per track
        BPS = Bytes per sector

REMARKS

When you select a particular format, that selection is highlighted on smart terminals and marked with an arrow on dumb terminals. Note the following system characteristic. Assume that you have selected a format from the menu: RX01?, RX02?, IBM 1D? or IBM 2D/FW?. If you now move down the menu and select the command OTHER in order to simply look at what the other options are, you will notice that the arrow or highlighting is present on one of the menu items in this group also, even though it has not been selected. Disregard the second arrow.

Although the menu shows a FMT command for both 5-1/4 and 8" floppy drives, you will see only the FMT command that applies to the drives configured into your system.

If you exchange 8" diskettes with another system, you should select a diskette format compatible with the other system.
If you use the diskettes on your own system only, you may select the format that provides the most storage. The double-sided formats (RX02 and IBM 2D) increase storage capacity. It is important to note that the 8" formats can be either single sided or double sided, depending upon the type of diskette you select. For the IBM formats, specifying larger sector sizes yields more storage since larger sectors leave fewer unusable gaps between sectors. When formatting a diskette to be used for backup, the diskette must have the same sector size as the Winchester disk. All Winchester disks in the SMS 1000 have 512 bytes per sector.

RX02 AND RX03 FORMATS. Note that for RX02 the controller converts logical block numbers into physical block numbers by incrementing head numbers all the way to the maximum before incrementing cylinder numbers. For RX03, however, the controller increments cylinder numbers all the way to the maximum before incrementing head numbers.

All 5-1/4 floppy drives supplied with the SMS 1000 use the DEC PC format (512 bytes per sector, ten sectors per track, 96 tracks per inch).

Diskette format specifications such as physical interleave, head offset and cylinder offset default to the appropriate industry standards and cannot be modified.

**BOOTSTRAP Command**

The BOOTSTRAP command invokes a submenu of commands used to control bootstrap events.

The bootstrap provides a bridge from SENSE to the application programs. Remember, the bootstrap is performed after a RESTART or an initial power up, but before operating system facilities are available to help find and read any programs.

The bootstrap has two main parts. The first part resides in read-only memory on the System Foundation Module. This part determines the size of the system memory and optionally performs tests on the LSI-11 CPU and system memory. It then finds and loads the boot block. The boot block contains a special application program that controls the loading of additional application code. Typically, the boot block loads in your operating system or a dedicated application program.
SENSE MONITOR: CONFIGURATION MENU COMMANDS

AUTOBOOT TIMEOUT Subcommand

The AUTOBOOT TIMEOUT subcommand specifies an approximate time delay that occurs after power up or RESTART and before the automatic loading of the boot block.

MENU STRUCTURE

BOOTSTRAP
AUTOBOOT TIMEOUT
DELAY (SEC)=0?
DELAY (SEC)=5?
DELAY (SEC)=10? [This is the default setting]
DELAY (SEC)=20?
DELAY (SEC)=30?
DELAY (SEC)=45
DELAY (SEC)=NL

REMARKS

The function of the AUTOBOOT TIMEOUT delay is to allow you to name an alternate drive for the boot operation as might be done to load a new version of the operating system from diskette.

Most users find an AUTOBOOT TIMEOUT of 10 seconds adequate. If you find this delay to be too short or too long, you can change it. The DELAY (SEC)=NL option specifies no time limit. This requires you to identify the boot device every time you RESTART or power up the system. Conversely, DELAY (SEC)=0 forces the system to boot immediately without allowing you to specify an alternate boot drive or use the menu system. This last option is sometimes used by dedicated applications such as those used for process control.

BOOT DRV Subcommand

The BOOT DRV subcommands specify the order in which the boot-strap searches through the disk drives when looking for the boot block.

MENU STRUCTURE

BOOT DRV#1
BOOT DRV=W0? [This is the default setting]
BOOT DRV=W1?
BOOT DRV=C0?
### SENSE MONITOR: CONFIGURATION MENU COMMANDS

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOT DRV=F0?</td>
<td>This is the default setting</td>
</tr>
<tr>
<td>BOOT DRV=F1?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=W0?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=W1?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=C0?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=F0?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=F1?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=W0?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=W1?</td>
<td></td>
</tr>
<tr>
<td>BOOT DRV=C0?</td>
<td></td>
</tr>
<tr>
<td>FIRST DU#</td>
<td>[Default is 0 for all models]</td>
</tr>
</tbody>
</table>

### REMARKS

The bootstrap checks the first drive for a boot block. If no boot block is found and the drive has not been initialized, the bootstrap checks the drive specified as the second boot drive. The search terminates when the system locates a valid boot block or when no valid boot block can be found among the specified drives.

Most users prefer to load the operating system as quickly as possible so that application processing can begin. This is done by naming the drive with the operating system (usually W0) as the first boot drive.

Users who frequently load special software from diskette may prefer to name a diskette drive as the first boot drive, and the fixed disk as the second boot drive. In this case, the system boots from diskette if the drive contains a DU bootable diskette; otherwise, the system boots from the fixed disk, if one exists.

**FIRST DU#.** This command is of importance only to users of the SMS 1000 Model 41 subsystem (refer to Appendix F). Users of the SMS 1000 Models 40 or 50 must either use the default value of 0 or enter 0 directly, in response to the prompt "DU#=". In the case of the Model 41, the first DU value must usually be chosen so that the resulting DU number series does not contain
SENSE MONITOR: CONFIGURATION MENU COMMANDS

duplicates of any DU numbers already used in the host system. Note that in the case of the Model 41 the choice of FIRST DU# may be dependent on the requirements of the host operating system.

POWER ON/RESTART COMMANDS

The POWER ON/RESTART command invokes a menu of commands that determine system actions when the power is turned on or when the front-panel RESTART and "*" buttons are pressed simultaneously. It includes the STARTUP MODE subcommand, the WINCHESTER SPINUP subcommand, the RE-LOAD EEPROM subcommand, the CPU TYPE subcommand, and the SYSTEM TYPE subcommand.

STARTUP MODE SUBCOMMAND

The STARTUP MODE subcommand allows you to determine the system action to be performed when the system power is initially applied or when the front panel RESTART switch is used.

MENU STRUCTURE

POWER-ON/RESTART
  STARTUP MODE
    LOOP UNTIL ERR?
    OPERATE MENUS?
    BOOTSTRAP HOST? [This is the default setting]

REMARKS

These commands set the mode in which the system will operate following initial power-on or restart. Thus, the system can either enter the SENSE menus, boot-load the host CPU, or loop through the power-on tests until an error occurs.

OPERATE MENUS invokes the menu system. This option is especially useful in new systems where the user wants to modify the configuration, format diskettes, etc.

The SMS 1000 uses BOOTSTRAP HOST as its default option. When this option is in effect, the system automatically locates and loads your application software or the operating system when the power is applied or after a RESTART.
The LOOP UNTIL ERR option is of interest only to system engineers since it puts the system into an endless test loop. This testing terminates only if an error occurs, which is unlikely, or if the operator terminates the test by pressing the MENU switch. If an error does occur, however, further diagnosis should be done by using the EVALUATION menu commands. Terminating the tests manually invokes the SENSE menu system.

WINCHESTR SPINUP SUBCOMMAND

Your system cannot load and run an application immediately after power on because it takes approximately 20 seconds for most fixed-disk Winchester drives, and about 45 seconds for removable-cartridge drives, to reach operating speed. The WINCHESTR SPINUP command gives you some control over this delay. Note that no spinup delay will take place in systems that are not configured to include a Winchester drive.

MENU STRUCTURE

WINCHESTR SPINUP
  DELAY (SEC)=0?
  DELAY (SEC)=5?
  DELAY (SEC)=10?
  DELAY (SEC)=20? [This is the default setting]
  DELAY (SEC)=30?
  DELAY (SEC)=45?
  DELAY (SEC)=90?

REMARKS

DELAY (SEC)=0 specifies no delay. If your system is configured to run the menus after power-on, this option allows you to start work without waiting for the disks to reach operational speed. Also, this option can be specified if the system is configured to be booted from a floppy disk. Do not use this option if your system is configured to boot from a Winchester disk; attempting to boot when the disk is not ready causes an error. Similarly, the 5- and 10-second options may not allow enough time for the disk to reach speed.

DELAY (SEC)=20 is the default option configured for systems shipped by SMS. If you want to run SENSE utilities before the system loads the operating system, this delay also gives you an opportunity to press the front panel MENU switch. Use the 30-
or 45-second options if you need more time. If your system includes a removable-cartridge Winchester drive, a 45-second delay period should be specified because of its longer spinup time.

RE-LOAD EEPROM SUBCOMMAND

The RE-LOAD EEPROM subcommand permits you to reload the system's EEPROM from the EPROM image stored in the controller on the Foundation Module. The EEPROM stores the actual system configuration parameters that have been entered using the menus in the present section. The default values for these parameters are stored in the EPROM. Hence, by use of this command, all configuration parameters are changed back to these default values. THE SYSTEM WILL NOT WORK NORMALLY UNTIL IT IS RECONFIGURED USING THE MENUS IN THIS SECTION.

CAUTION

Reloading the EEPROM changes all configuration parameters to their default values and requires full system reconfiguration after reloading. Hence, reloading should be regarded as a radical procedure and should not be undertaken unless there is a compelling reason to do so.

VERY IMPORTANT!
WHAT TO DO AFTER A RELOAD

The first step in reconfiguration after an EEPROM reload should be to enter the SENSE menu system. Next, use the DEVICE PARAMETERS portion of the CONFIGURATION menus to enter the actual number of heads and cylinders, as well as the PRECOMP ENABLE/DISABLE status, for your Winchester drives. Doing this will set up the Winchester drives properly and restore access to the data stored there.

MENU STRUCTURE

RE-LOAD EEPROM
Are you sure?
SENSE MONITOR: CONFIGURATION MENU COMMANDS

REMARKS

After you select this command and give an affirmative response to "Are you sure?", the system displays the message:

Changing EEPROM!

When the reloading process is complete, the system displays:

Task completed.

However, to synchronize the new EEPROM image with the RAM data structures you must restart the system. Therefore, at this point, the following double prompt is displayed:

Please RESTART!
System shutdown.

RECONFIGURATION. The system now remains in a wait state until it is restarted. After you restart the system, all EEPROM parameters become the same as the default values stored in the EPROM on the System Foundation Module. This means, for example, that the configured number of cylinders and heads for each Winchester drive have been reset to their default values of 0. Attempting to operate the system in its default configuration will cause various types of errors to be reported. Therefore, the next step is to reconfigure the system to reflect its actual physical and electrical characteristics, using the menus in this chapter.

USING A CONFIGURATION LOG. As an aid in reconfiguring the system, after you have installed your SMS 1000 and gone through a complete system checkout, take some time to enter all your system parameters on a form similar to the following sample log of configuration settings. In this way, if you ever have to reconfigure, the correct parameters can easily be found in one place by reference to the log.
SENSE MONITOR: CONFIGURATION MENU COMMANDS

SAMPLE FORM

LOG OF SYSTEM CONFIGURATION SETTINGS

SYSTEM SERIAL NO. _______________ MODEL NO. ________________
NUMBER OF WINCHESTERS _______ WINCHESTER TYPE _____________
NUMBER OF FLOPPYS ____________ FLOPPY TYPE _______________
STREAMER TAPE ________________ CARTRIDGE WINCHESTER _______

CONFIGURATION MENU
FLOPPY FORMAT
F0 FMT _______
F1 FMT _______

BOOTSTRAP
AUTOBOOT TIMEOUT DELAY (SEC) _______
1ST BOOT DRV _______
2ND BOOT DRV _______
3RD BOOT DRV _______
4TH BOOT DRV _______
FIRST DU# _______

POWER-ON/RESTART
STARTUP MODE _______
WINCHESTER SPINUP DELAY (SEC) _______
CPU TYPE _______
SYSTEM TYPE _______

SERIAL PORTS
SERIAL PORT A0
BAUD RATE (BAUD) _______
DATA BITS _______
PARITY BIT _______
STOP BITS _______

SERIAL PORT A1
BAUD RATE (BAUD) _______
DATA BITS _______
PARITY BIT _______
STOP BITS _______

CONSOLE SETTINGS
CONSOLE ENAB/DISAB _______
CONSOLE PORT _______
BREAK FUNCTION _______

TERMINAL TYPE _______
ONLINE DELAY (SEC) _______

DEVICE PARAMETERS
F0 CONFIGURATION
DEVICE PRESENT _______
SIZE STRAPPING _______
#HEADS _______
#CYLS _______

SMS 1000 9-11
TIMINGS
STEP (MSEC) __________
SETTLE (MSEC) __________
MOTOR ON __________

F1 CONFIGURATION
DEVICE PRESENT __________
SIZE STRAPPING __________
#HEADS __________
#CYLS __________
TIMINGS
STEP (MSEC) __________
SETTLE (MSEC) __________
MOTOR ON __________

W0 CONFIGURATION
DEVICE PRESENT __________
CAPACITY
#HEADS __________
#CYLS __________
PHYS INTRLV __________
OFFSETS
CYL OFFSET __________
HED OFFSET __________
PRECOMP __________

W1 CONFIGURATION
DEVICE PRESENT __________
CAPACITY
#HEADS __________
#CYLS __________
PHYS INTRLV __________
OFFSETS
CYL OFFSET __________
HED OFFSET __________
PRECOMP __________

C0 CONFIGURATION
DEVICE PRESENT __________
CAPACITY
#HEADS __________
#CYLS __________
PHYS INTRLV __________
OFFSETS
CYL OFFSET __________
HED OFFSET __________
PRECOMP __________

TO CONFIGURATION
TO ENABLE/DISABLE __________

ADDRESSES
PORT VECTOR BASE
VECTOR= __________
BUS ADDRESSES
BOOT PROM ADDR __________
DU DEVICE ADDR __________
SENSE MONITOR: CONFIGURATION MENU COMMANDS

PORT BASE ADDR  

SPECIAL  
 ACCESS LEVEL  
 BANNER ENABLE/DISABLE  
 DISPLAY DEFAULT  
 FAN SPEED  
 SHIP  
 DATE  
 S/N  
 CLOCK  
 CLOCK SPEED  
 CLOCK CSR  

CPU TYPE COMMAND

The CPU TYPE command permits you to use a MicroVAX II quad-width CPU card in backplane slot 1 or 2 if your SMS 1000 system is equipped with a backplane that has specially wired C-D connectors in these slots. Systems with this type of backplane can be identified by the presence of a CAUTION label on the left rear of flange of the cardcage supporting structure.

MENU STRUCTURE

CPU TYPE
   LSI-11?  [This is the default option]
   VAX?

REMARKS

If you wish to use a MicroVAX II type quad-width CPU in an SMS 1000 equipped with a backplane having slot 1 and 2 C-D connectors wired to accept it, then select the VAX? option. Otherwise, select the LSI-11? option. LSI-11? is the default option.

SYSTEM TYPE COMMAND

This command allows you to specify whether the present system is to operate as a stand-alone system, as in the case of the SMS 1000 Model 40; or a subsystem, as in the case of the SMS 1000 Model 41.

MENU STRUCTURE
SENSE MONITOR: CONFIGURATION MENU COMMANDS

SYSTEM TYPE
SYSTEM? [Default for Models 40 and 50]
SUBSYSTEM? [Default for Model 41]

REMARKS

If your present system is a SMS 1000 Model 40 or 50, select the SYSTEM? option. If your present system is a SMS 1000 Model 41, select the SUBSYSTEM? option. NOTE: For the SMS 1000 Model 40, the default setting is SYSTEM. For the SMS 1000 Model 41, the default is SUBSYSTEM.

SERIAL PORTS COMMAND

The SMS 1000 provides support for two serial ports. Although you can use these ports to drive any serial devices, port A0 is typically assigned to a terminal that can be used as the system console. Port A1 is frequently assigned to a printer or another terminal. Use the SERIAL PORTS command to tell the system the characteristics of the devices assigned to these ports.

MENU STRUCTURE

SERIAL PORTS
SERIAL PORT A0
BAUD RATE
BAUD=9600?
BAUD=19200?
BAUD=300?
BAUD=600?
BAUD=1200?
BAUD=2400?
BAUD=4800?
DATA BITS
DATA BITS=7?
DATA BITS=8?
PARITY BIT
PARITY=NONE?
PARITY=ODD?
PARITY=EVEN?
STOP BITS
STOP BITS=1?
STOP BITS=2?
SERIAL PORT A1
(same as for A0)
CONSOLE SETTING
CONSOLE ENAB/DISAB

[This is the default setting]
[This is the default setting]
[This is the default setting]
SENSE MONITOR: CONFIGURATION MENU COMMANDS

DISABLE? [Model 41 default setting]
ENABLE? [Default for Models 40 and 50]
CONSOLE PORT
CONSOLE=A0? [This is the default setting]
CONSOLE=A1?
BREAK FUNCTION
BREAK=NOP? [This is the default setting]
BREAK=HALT?
TERMINAL TYPE
TERM=DUMB? [This is the default setting]
TERM=SMART?
ONLINE DELAY
DELAY (SEC)=0 [This is the default setting]
DELAY (SEC)=5
DELAY (SEC)=10
DELAY (SEC)=20
DELAY (SEC)=30
DELAY (SEC)=45
DELAY (SEC)=90

REMARKS

These conventions apply to both serial port A0 and A1.

If you equip your system with a console, it must be connected to port A0 or A1 or can be connected to the host system through an I/O card such as the DLV11-J, or equivalent.

The BAUD RATE, DATA BITS, PARITY BIT, and STOP BITS subcommands allow you to enter the information the controller needs to control the devices connected to these ports. These values must be set according to the requirements of the peripheral device. The owner's manual for the terminal should contain these specifications.

If port A0 or A1 is to be used for console operation, you must enter the information required by the CONSOLE SETTING commands.

The CONSOLE ENABLE/DISABLE subcommand enables or disables the console. Disabling the console will cause the system to change the port vector from 60 to the next vector not used by the other port. For example, if port A1 uses VECTOR=300, then disabling port A0 as the console will change the A1 assignment to VECTOR=310. See the discussion of PORT VECTOR BASE under the ADDRESSES command.

CONSOLE PORT identifies the port to which the console is connected. Port A0 must be selected as the console port if you are to use a terminal for communication with SENSE.
SENSE MONITOR: CONFIGURATION MENU COMMANDS

The BREAK subcommand specifies the function of the BREAK key on a video console. The BREAK key can be set to NOP (no operation), or HALT. If the keyboard design positions the break key where it may be pressed accidentally, NOP is recommended. The break key is commonly assigned the HALT option in DEC systems, and this option is recommended when compatibility with DEC systems is desired.

TERMINAL TYPE identifies the type of terminal used for communication with SENSE. SMART terminals must be able to emulate a VT-100 or equivalent. DUMB terminals, such as a printer with a keyboard, have no local intelligence.

ONLINE DELAY. If, during the start-up sequence, you select SENSE operation, a further delay occurs at the end of the Winchester spinup period. The purpose of the delay is to allow the user time to decide whether to operate SENSE from the video display terminal or the system front panel. The length of the delay is configurable from 0 to 90 seconds by use of the ONLINE DELAY command. During this delay period, the following message is displayed on the video terminal:

HIT ANY KEY WITHIN TIME LIMIT

Hitting any key will select the terminal as the device for communicating with SENSE. During the same period, the following message is displayed on the front panel:

VDU prompting

If you press the MENU button on the front panel during the delay period, then the front panel is selected instead of the terminal.

DEVICE PARAMETERS COMMAND

The DEVICE PARAMETERS menus permit you to enter, change or examine the disk-drive parameters that are currently configured into your system and used by the disk controller in the Foundation Module.

FO CONFIGURATION SUBCOMMAND MENU STRUCTURE

DEVICE PARAMETERS
   FO CONFIGURATION
      DEVICE PRESENT
      DISABLE?
      ENABLE?
      SIZE STRAPPING

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SENSE MONITOR: CONFIGURATION MENU COMMANDS

SIZE=5"? [This is the default setting]
SIZE=8"?

CAPACITY
#HEADS
#HEADS= [Default is 0]
#CYLS
#CYLS= [Default is 77]

TIMINGS
STEP (MSEC)
STEP= [Default is 3]
SETTLE (MSEC)
SETTLE= [Default is 15]
MOTOR ON (MSEC)
MOTOR ON= [Default is 700]

F1 CONFIGURATION
(same as fo F0)

REMARKS

These remarks apply equally to F0 and F1.

SIZE STRAPPING specifies whether the drive is for 8" or 5-1/4" floppies.

The #HEADS= and #CYLS= commands request the number of heads and cylinders available on the disk drive.

The TIMINGS subcommands request you to enter information pertaining to your particular floppy drives. This information is normally available in the drive manufacturer's literature. Do not attempt to use these commands without the proper information. Notice that some manufacturers use the term "ring time" instead of "settle time."

DEFAULTS. Drive strapping for an 8" floppy implies the following configuration defaults:

1. /FDSD drive signal enabled when #HEADS=0. This is overridden when #HEADS is greater than 0.
2. Buffered seek = enabled.
3. Precomp is always enabled.
4. Number of cylinders = 77.
5. Bytes per sector = 256.
6. Format = RX02.
7. #HEADS=0.

Drive strapping for a 5 1/4" floppy drive implies the following configuration defaults:
SENSE MONITOR: CONFIGURATION MENU COMMANDS

1. Stepping = single.
2. /FDSO signal always disabled.
4. Precomp is always enabled.
5. Number of cylinders = 80.
7. Format = DEC PC.
8. #HEADS=1.

W0 CONFIGURATION SUBCOMMAND

This subcommand, which is a continuation of the DEVICE PARAMETERS command, invokes a menu of commands used to define Winchester disk drive parameters for the disk controller.

W0 SUBCOMMAND MENU STRUCTURE

DEVICE PARAMETERS
  W0 CONFIGURATION
    DEVICE PRESENT?
    DISABLE?
    ENABLE?
    CAPACITY
      #HEADS
        #HEADS= [Default is 0]
      #CYLS
        #CYLS= [Default is 0]
      PHYS INTRLV
      INTRLV= [Default is 1]
    OFFSETS
      CYL OFFSET
      CYL OFF= [Default is 1]
      HEAD OFFSET
      HEAD OFF= [Default is 4]
    PRECOMP
      DISABLE?
      ENABLE? [This is the default setting]

W1 CONFIGURATION
  (same as for W0)

C0 CONFIGURATION
  (same as for W0)

TO CONFIGURATION
  DEVICE PRESENT?
    DISABLE?
    ENABLE? [This is the default setting]
SENSE MONITOR: CONFIGURATION MENU COMMANDS

REMARKS

These remarks apply to W0, W1 and C0.

IMPORTANT: If your system is configured with a removable-cartridge type Winchester drive (C0) in addition to a fixed-disk Winchester drive, the cartridge drive is designated as C0 and the fixed-disk drive must be designated as W0. The fixed-disk drive is, of course, also designated as W0 if it is the only Winchester drive in the system.

The DEVICE PRESENT command is used to take a drive off-line from the controller when it must be removed from the system for repairs. Respond DISABLE only if the drive is removed or is not to be accessed.

The #HEADS command specifies the number of heads provided by the drive. Obtain this information from Table B-1 of Appendix B.

The #CYLS command designates the highest cylinder number provided by the drive. Obtain cylinder-number information from Table B-1 of Appendix B.

INTRLV= specifies an interleave factor that controls the physical layout of sectors on the disk. The interleave factor can range from one (no interleave) through the maximum number of sectors per track. The SMS 1000 does not require interleaving, so a factor of one is recommended.

CYLINDER and HEAD offsets attempt to improve disk access time. These values may range from one through the maximum number of sectors per track. The SMS as-shipped defaults are one for cylinder offset and four for head offset. Depending upon the make, model and special characteristics of the Winchester drives in your system, careful experimentation with these values may improve access times. As a basis for experimentation, a typical optimized head-offset value is two.

PRECOMP should be enabled only if so indicated in Table B-1 of Appendix B for the drive in question. Precompensation is a recording technique used to make a signal easier to read. With ferrite media, and to a much smaller extent with plated media, the process of reading tends to exaggerate the spacing between adjacent bits. This is known as bit shift and needs to be compensated for only on the inner tracks of a platter. Precompensation causes bits to be written closer together so that they can be read back with the correct spacing between them. When PRECOMP=ENABLE is selected, the starting cylinder for precompensation is ((MAX CYL#)/2).
SENSE MONITOR: CONFIGURATION MENU COMMANDS

ADDRESSES COMMAND

The ADDRESSES command allows you to modify the interrupt vector addresses for the console, boot prom, controller, and the port base address.

MENU STRUCTURE

ADDRESS
PORT VECTOR BASE
VECTOR=300 [This is the default setting]
VECTOR=310
VECTOR=320
VECTOR=330
VECTOR=340
VECTOR=370
VECTOR=270

BUS ADDRESSES
BOOT PROM ADDR
DISABLE?
17775000?
17766000?
17773000? [Model 41 default setting]

DU DEVICE ADDR
17772150?
17760334? [Model 41 default setting]
17760340?
17760344?
17760350?
17760354?
17772154?

PORT BASE ADDR
DISABLE? [Model 41 default setting]
17776500? [Default for Models 40 and 50]
17776540?
17776600?

REMARKS

PORT VECTOR BASE assigns vector addresses to serial ports according to DLV11-J conventions. If the console is not selected, the vector for Port A1 will be the vector for Port A0 plus 10 (octal). If the console is enabled, the vector for the console will always be octal 60, and the vector for the other port will always be the port vector base address. For example, if the console is not selected, and the port vector base address is 300, then the vector for Port A0 is 300 (octal), and the vector for Port A1 is 310. Now, if Port A0 is selected as the console, the
SENSE MONITOR: CONFIGURATION MENU COMMANDS

vector for Port A0 is changed to 60, and the vector for Port A1 is changed to 300.

Serial ports A0 and A1 must have different interrupt vector addresses when both ports are used. Be careful to avoid duplicating interrupt vectors for any other devices included in the configuration. Notice that a port vector implies both the transmit and receive vector pair.

Initially, the first address (after DISABLE) displayed by a command is the one commonly used; remaining addresses are all the supported alternate addresses. If you select one of these addresses, you must pick an address not already in use by some other device such as a DL, DZ, or DU device. After you use this command to select an address, the system displays the address currently in effect first.

DISABLE indicates that the device is not used or is disabled. For the BOOT PROM, the DISABLE option applies to systems equipped with an LSI-11/23 Plus CPU or other boards that have on-board boot proms that use the same address as the boot prom on the System Foundation Module (SFM). Remember that the LSI-11 CPU will always attempt to boot from location 17773000. Therefore, the SFM boot prom's default address is 17773000. Also, if your system has two boot proms with the same address, you can either disable the boot prom on the System Foundation Module or the other board, or you can assign a different address to the SFM boot prom in order to have the option of booting the other device as well.

SPECIAL COMMAND

The SPECIAL commands enable the configuration of miscellaneous parameters and operating features. These pertain to entering passwords that limit access to various classes of users; setting of the system clock; fan speed; etc.

MENU STRUCTURE

SPECIAL
  ACCESS LEVEL
  USER?
  SYS MGR?
    PWkey=
    New PWkey=
  TECH?
    PWkey=
    New PWkey=

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SENSE MONITOR: CONFIGURATION MENU COMMANDS

BANNER
DISABLE?
ENABLE?
NewBanner= [This is the default setting]
[up to 16 characters]
FAN SPEED
LOW?
MED?
SHIP
DATE=
S/N=
CLOCK
CLOCK SPEED
SPEED=60 [This is the default setting]
CLOCK OFF
SPEED=50
SPEED=800?
CLOCK CSR
DISABLE?
ENABLE? [This is the default setting]

REMARKS

ACCESS LEVEL. The ACCESS LEVEL feature of SENSE restricts access to its menus to three levels or classes of users. These levels are:

1. Technician level (TECH). This level of access is primarily for technicians and other field support personnel and gives you access to the complete system. A special password having a value between 0 and 65535 must be entered using the TECH? command (see ACCESS LEVEL menus above) in order to gain this access level. Thus, at the TECH access level, you can gain entry to all the menus of SENSE. The system's as-shipped default value is the TECH access level.

2. System Manager level (SYS MGR). This level of access is for personnel such as system managers, who may require access to all commands except those that are either highly specialized or are primarily maintenance oriented. A special password having a value between 0 and 65535 (decimal) must be entered using the SYS MGR? command (see ACCESS LEVEL menus) in order to be granted the SYS MGR access level.

3. User level (USER). This level gives the user access to a subset of the commands available at the above two levels. As the name implies, these commands include all those required in normal day-to-day use. No password is required for access to the commands at this level.
SENSE MONITOR: CONFIGURATION MENU COMMANDS

ASSIGNING PASSWORDS. A password is assigned by entering a numeric value between 0 and 65535 (decimal) in response to the command "PWkey=" in the SYS MGR? and TECH? menus. As shipped from SMS, a default value of 0 is assigned to these two "PWkey=" fields. This means that the system will operate at the TECH level in its as-received condition. To change a password, proceed as follows:

1. In response to the query "PWkey=" , supply your existing password or, if there is none, the default value of 0.

2. The query "NewPWkey=" now appears. In response, supply your new password. This password will now give you access at the corresponding level.

SPECIAL ACCESS. In certain cases, you may require access to special-purpose test and evaluation firmware not part of the normal SENSE menu system. Access to this firmware is restricted to field support personnel and a special password is required in order to use it. To obtain more information about this access level, contact your SMS representative.

COMPLETE LISTING OF ACCESS LEVELS. Appendix A of this manual contains a summary of all the commands that make up the SENSE menus. Listed next to each command is its access level expressed as TECH, SYS MGR or ALL (for USER level).

BANNER COMMAND. The function of the BANNER command is to enable you to control what is displayed on the front-panel 16-character display while this panel is not being used by SENSE. Note that enabling or disabling the banner can be done from the front panel, but entering a new banner must be done from your video terminal. You have three choices as to what is displayed:

1. COMPACT STATUS DISPLAY. To display a summary of current system status (see SYSTEM command under STATUS menus) press Return in response to the menu query "DISABLE?" (under the BANNER command).

2. USER-SELECTED BANNER. To enter a banner (or "logo") for display, first press the space bar in response to the query "DISABLE?". Then respond affirmatively to the query "ENABLE?" by pressing Return. To the query "NewBanner=" respond with a banner of up to 16 characters and then press return again.

3. DEFAULT BANNER. The system is shipped with the default banner "SMS 1000" installed. To display this banner, first press the space bar in response to the query "DISABLE?". Then respond affirmatively to the query "ENABLE?" by pressing return. Finally, when "NewBanners=" appears, press Return without making any other entry. NOTE: Once a user-generated banner has been
entered, it writes over the default banner in EEPROM. If you want to return to the default banner, it must be entered as in Step 2 above.

FAN SPEED. The speed of the system's cooling fans can be set by this command or by installing jumpers on the backplane. The backplane jumpers set the fans to the highest speed and should be used for maximum cooling.

When the backplane jumpers are not installed, the FAN SPEED command controls the fans. The LOW speed reduces fan noise, but should be used in areas with controlled temperatures such as an air conditioned office. Otherwise, use the MED speed.

SHIP. Use this command to enter the shipment date and serial number of your system. If you elect to alter this information, you are prompted for a character string specifying date and serial number (S/N) of your SMS 1000.

CLOCK. The default parameters for this command are CLOCK SPEED = 60 and CLOCK CSR = DISABLED.
SECTION 10

MAINTENANCE

PREVENTIVE MAINTENANCE

The SMS 1000 has been designed to require a minimum of maintenance, both preventive and corrective. Under normal circumstances, continuous, dependable service should result if floppy disk maintenance is performed regularly. Instructions for this procedure are given in the following paragraph.

FLOPPY-DISK MAINTENANCE

1. SCHEDULE. The read-write heads of a drive may need to be cleaned only if read or write errors occur with any consistency or regularity. In any case, in the event of consistently occurring read/write errors, you should clean the heads before assuming that anything more serious is the problem. Note, however, that excessive zeal is not warranted, as cleaning the heads too often can wear them out.

2. MATERIALS. Heads should be cleaned only with the drive manufacturer's approved cleaning kit and while precisely following the manufacturer's instructions.

3. IMPORTANT. Never attempt to lubricate any part of a drive or the media. Lubricants are a magnet for dust and dirt, the greatest enemy of the diskette and drive.

4. DISKETTE PROTECTION. The diskette is a remarkably rugged storage medium, but it is far from indestructible. Protect diskettes from magnetic fields such as those from hi-fi speakers, electrical appliances, etc. Diskettes should always be stored in their protective envelopes. Never touch the recording surface of a diskette. Fingerprints leave traces of body oils that are detrimental to both the diskette and the read/write heads.
MAINTENANCE

TROUBLESHOOTING
To be supplied.

POWER SUPPLY FUSE REPLACEMENT

There is only a single user-replaceable fuse in the power supply. CAUTION: before replacing any fuse, always be sure that the problem that caused the fuse to blow has been corrected. To replace the fuse, proceed as follows:

1. Turn off the system a-c switch (on the rear panel) and then remove all a-c input power by unplugging the power cord from its receptacle.

DANGER

Potentially lethal voltages can be encountered in the power supply for as long as two minutes after a-c power is removed from it. Therefore, wait at least two minutes after removing power before working on it.

2. Using a small screwdriver, carefully pry open the door of the fuse- and voltage-select compartment on the rear of the enclosure. There is a slot for prying open the door, at its left edge. Be careful not to disturb the voltage-selection cam at the left side of the compartment. See Figure 1-6.

3. Using a small screwdriver, carefully pry out the white plastic fuse holder from the fuse compartment.

4. Replace the defective fuse in the fuse holder with a Buss type ABC (ceramic body), or equivalent, rated at 3 amps if the system is operating at 230 volts, or 6 amps if the system operates at 115 volts.

CAUTION

Replace a blown fuse only if you have found and corrected the fault that caused it to blow. Be sure to re-install only a correct-amperage fuse corresponding to the supply voltage in use. Too large a fuse will provide ina-
MAINTENANCE

degate protection. Too small a fuse may fail unnecessarily.

5. Replace the fuse holder in the fuse compartment, making sure that the arrow on the front of the fuse holder points up. Then press in the fuse holder all the way to the end of its travel.

6. Close the fuse-compartment door, making sure that, after it is closed, the correct a-c operating voltage shows through the opening in the door.

7. Replace the a-c power cord in its receptacle.

SMS 1000 DISASSEMBLY SEQUENCE

Follow the disassembly sequence given here when it is necessary to remove or replace a component of the SMS 1000 system. Proceed as follows:

1. Unless otherwise specified, the disassembly instructions given here apply equally to rack-mount, floor-mount and table-mount models of the SMS 1000. Also, note that reassembly is essentially the reverse of disassembly.

2. RACK-MOUNTED UNITS. If the unit to be disassembled is rack mounted, first remove it from its rack by extending the slides until they catch, pressing down on the innermost slide-release levers, and then pulling the unit forward. Place the unit on a bench for disassembly. Because of the size and weight of the unit, two people should be used for this operation.

3. SIDE PANELS (Floor-mount and table-mount models). Remove the three captive slot-headed screws at the top of each panel. Each panel can now be lifted free from the pedestal. See Figure 10-1. After removing the side panels, place the unit on a bench for disassembly. NOTE: In the case of table-mount models, first fully loosen the four captive slot-headed screws that can be reached through access holes at the lower edges of the sides of the system cover. The cover can then be removed.

4. FRONT PANEL. Remove the front panel by grasping it firmly and pulling it away from the case. See Figure 10-2. Now disconnect the ribbon-cable connector
the five-pin d-c power-switch connector from the front edge of the foundation module. Remove the two safety wires holding the front panel by rotating their fasteners a quarter turn.

5. REAR PANEL. As shown in Figure 10-3, remove the rear panel by rotating its four captive fasteners by hand one quarter turn. Remove the ribbon connector from the rear panel and then remove the two safety wires by rotating their fasteners a quarter turn.

6. TOP COVER (FRONT). Loosen the six captive quarter-turn fasteners holding this cover over the peripheral units. The cover can now be lifted free. See Figure 10-4.

7. CONNECTORS ON FOUNDATION MODULE. Remove all the ribbon-cable connectors from the inner (i.e. rear) edge of the foundation module (next to the backplane), as shown in Figure 10-5.

8. FOUNDATION MODULE. The foundation module can now be removed by rotating the two plastic holders at its front corners and then pulling the module directly out the front of the unit. See Figure 10-6.

9. POWER SUPPLY. Loosen the two captive quarter-turn fasteners that hold the power supply to the sides of the case. The power supply can then be removed by grasping its handle and pulling directly to the rear. See Figure 10-7.

10. 8-INCH FLOPPY DRIVE. Disconnect the drive's five-wire power connector from the backplane and its ribbon-type signal cable from connector J106 on the foundation module. Unfasten the two captive screws holding the left side of the drive to the case. Now push the drive toward the rear of the case and lift up. The drive is now removed. See Figure 10-8.

11. SINGLE 5-1/4-INCH FLOPPY DRIVE. Disconnect the drive's four-wire power connector from the backplane and its signal cable from the foundation module. Unfasten the two captive screws holding the left side of the drive to the case. Now push the drive toward the rear of the case and lift up. The drive is now removed. See Figure 10-9.

12. DUAL 5-1/4-INCH FLOPPY DRIVES. Unplug the power connectors for these drives from the backplane and the signal cables from the foundation module. As shown in
MAINTENANCE

Figure 10-10, unfasten the four captive screws that are on the plate holding the upper drive. This drive can now be removed. Next, remove the two captive screws holding the left side of the lower drive and slide the drive toward the rear of the case. The lower drive can now be lifted up and removed.

13. SINGLE WINCHESTER DRIVE. Disconnect the drive's power connector from the backplane and its signal cables from the foundation module. As shown in Figure 10-11, release the two captive screws that attach the plate on which the drive is mounted, and push the drive toward the rear of the cabinet. The drive can now be lifted up and removed.

14. DUAL WINCHESTER DRIVES. First, disconnect the power connectors of the two drives from the backplane, and their signal cables from the foundation module. In the double Winchester configuration, both drives are mounted on a single removable mounting plate. To remove this plate, release the two captive screws at the front edge of the cabinet (see Figure 10-12) and then pull the mounting plate as far as it will go toward the front. The two drives can now be lifted up and removed.

15. BACKPLANE. To remove the backplane: the back panel, the cover over the disk-drive compartment, the power supply, the foundation-module connectors, and the foundation module itself must all first be removed, as previously described. Next, all four power connectors at the rear of the backplane (i.e. J13, J14, J15, and J16) must be disconnected. Also, on the backplane, remove the connections from J8 (20-pin connector), the two connectors going to the fans (J11 and J12), and the single-pin ground connector E21. See Figure 10-5 for these locations.

16. Now, as shown in Figure 10-4, release the six quarter-turn fasteners that hold the backplane mounting panel to the chassis. The backplane with its accompanying card cage and modules can then be lifted free. Any module can be removed from the card cage by simply grasping the plastic grip at the top of the card and pulling it directly away from the backplane.

17. PEDESTAL (Floor-mounted systems). The pedestal attaches to the chassis with four 10-32 screws, as shown in Figure 10-13. Note that the two pedestal halves are held together by metal braces at each end. Therefore the pedestal should be removed as a single
unit. From the bottom side of the pedestal, using a long-shank screwdriver, remove each of the four 10-32 screws. The pedestal can now be removed.

18. REASSEMBLY. Reassembly is the reverse of disassembly.

INTERCONNECTION WIRING DIAGRAMS

Figures 10-14 through 10-21 show the interconnection of SMS 1000 system components for a wide range of peripheral combinations. Note that all connecting cables between components of the system are identified by their SMS part numbers. For major system-component part numbers, refer to Appendix C.
Fig. 10-1  Removal of side panels
Fig. 10-2  Removal of front panel
Fig. 10-4  Removal of cover over peripherals
Fig. 10-5  Backplane and foundation module connectors
Fig. 10-6  Removal of foundation module
Fig. 10-7  Removal of power supply
Fig. 10-8 Removal of 8-inch floppy
Fig. 10-9   Removal of single 5-1/4-inch floppy
Fig. 10-10  Removal of dual 5-1/4-inch floppy drives
Fig. 10-11 Removal of single Winchester drive
Fig. 10-12 Removal of dual Winchester drives
Fig. 10-13 Removal of pedestal
Fig. 10-14  SMS 1000 Model 40 cabling diagram. Single Winchester and 8" floppy configuration (1002100).
Fig. 10-15 SMS 1000 Model 40 cabling diagram. Single Winchester and one 5 1/4" floppy configuration (1002107).
Fig. 10-16 SMS 1000 Model 40 cabling diagram. Dual Winchester and one 5 1/4" floppy configuration (1002102).
Fig. 10-17  SMS 1000 Model 40 cabling diagram. Single Winchester and dual 5 1/4" floppy configuration (1002103).
Fig. 10-18  SMS 1000 Model 40 cabling diagram. Dual Winchester and dual 5 1/4" floppy configuration (1002104).
Fig. 10-19  SMS 1000 Model 40 cabling diagram. Dual Winchester configuration (1002105).
Fig. 10-20 SMS 1000 Model 40 cabling diagram. 8" floppy configuration (1002106).
Fig. 10-21  SMS 1000 Model 40 cabling diagram. Dual 5 1/4" floppy configuration (1002101).
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

APPENDIX A

SENSE MONITOR:

SUMMARY OF COMMANDS

GENERAL. This appendix contains two command summaries for each of the four SENSE menu groups. The first summary for each group is a table that provides a general description of each command in the menu. A complete listing of each command in the menu then follows the table.

ACCESS LEVEL. The ACCESS LEVEL subcommand of the SPECIAL command in the CONFIGURATION menu permits restricting access to the system to three levels of users. The complete listings in this appendix specify access levels as USER, SYS MGR, or TECH to indicate an end user, system manager, or technician, respectively. ALL indicates that the command is available to all users.

SENSE also limits the menu display depending on your system configuration. For example, the commands for 5-1/4" floppy disk drives do not appear when your system is equipped with only an 8" floppy disk drive.

TABLE A-1

SENSE MONITOR:

STATUS MENU COMMAND SUMMARY

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM</td>
<td>Displays either the system logo or a 16-character status message in the front panel display window. NOTE: This display does not appear on a video display terminal.</td>
</tr>
<tr>
<td>IDENTIFY</td>
<td>Displays system serial number and shipment date.</td>
</tr>
<tr>
<td>ENVIRONMENT</td>
<td>Displays current system temperatures and voltage levels.</td>
</tr>
</tbody>
</table>

SMS 1000   A-1
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

<table>
<thead>
<tr>
<th>COMPLETE MENU STRUCTURE</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATUS MENU</strong></td>
<td></td>
</tr>
<tr>
<td>SYSTEM</td>
<td>ALL</td>
</tr>
<tr>
<td>&lt;compact status&gt;</td>
<td></td>
</tr>
<tr>
<td>IDENTIFY</td>
<td>ALL</td>
</tr>
<tr>
<td>&lt;banner&gt;</td>
<td></td>
</tr>
<tr>
<td>FIRMWARE V&lt;n.n&gt;</td>
<td></td>
</tr>
<tr>
<td>SFM S/N &lt;nnnn&gt;</td>
<td></td>
</tr>
<tr>
<td>SHIP &lt;mm/dd/yy&gt;</td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENT</td>
<td>ALL</td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td></td>
</tr>
<tr>
<td>DRIVES: &lt;fff&gt;F/&lt;cc&gt;C</td>
<td></td>
</tr>
<tr>
<td>CARDS: &lt;fff&gt;F/&lt;cc&gt;C</td>
<td></td>
</tr>
<tr>
<td>POWER SUPPLY</td>
<td></td>
</tr>
<tr>
<td>+5V: &lt;d.d&gt;V</td>
<td></td>
</tr>
<tr>
<td>+12PV: &lt;dd.d&gt;V</td>
<td></td>
</tr>
<tr>
<td>+12CV: &lt;dd.d&gt;V</td>
<td></td>
</tr>
<tr>
<td>-12V: &lt;dd.d&gt;V</td>
<td></td>
</tr>
<tr>
<td>+24V: &lt;dd.d&gt;V</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE A-2**

**SENSE MONITOR:**

**OPERATION MENU COMMAND SUMMARY**

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACKUP WINCHESTR</td>
<td>Copies the contents of a selected Winchester disk to a specified removable-cartridge Winchester disk, floppy diskette, or tape.</td>
</tr>
<tr>
<td>RESTOR WINCHESTR</td>
<td>Restores data copied, by a previous BACKUP command, to a removable-cartridge Winchester disk, floppy diskette, or tape, to a specified Winchester disk.</td>
</tr>
<tr>
<td>IDENTIFY</td>
<td>Displays the format (sector size, recording density, etc.) of the specified disk.</td>
</tr>
</tbody>
</table>
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

FORMAT FLOPPY
Formats the diskette in the specified drive.

BOOT HOST CPU
Runs the bootstrap program, which loads and starts the LSI-11 CPU.

WINCHESTR MGT
Invokes a submenu of infrequently used commands. These subcommands enable you to format Winchester disks and enter flaw management information for Winchester disks.

COMPLETE MENU STRUCTURE

OPERATION MENU

BACKUP WINCHESTR
BACKUP WO
BACKUP W0->TO READY?
BACKUP W1
BACKUP W1->TO READY?

RESTOR WINCHESTR
RESTOR WO
RESTOR W0<->TO ARE YOU SURE?
RESTORE W1
RESTOR W1<->TO ARE YOU SURE?

IDENTIFY
IDENTIFY F0 <Disk-format parameters>
IDENTIFY F1 <Disk-format parameters>
IDENTIFY W0 <Disk-format parameters>
IDENTIFY W1 <Disk-format parameters>
IDENTIFY C0 <Disk-format parameters>

FORMAT FLOPPY
FORMAT FLOPPY F0 <Parameter list appears here>

ACCESS LEVEL
SYS MGR
SYS MGR
ALL
ALL
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

READY?
FORMAT FLOPPY F1
  <Parameter list appears here>
  READY?
BOOT HOST CPU      ALL
  Are you sure?
WINCHESTR MGT     TECH
  FORMAT
  FORMAT W0?
  <Parameter list appears here>
  Are you sure?
  Save flaw tbl?
  Clear flaw tbl?
  Formatting W0.
  <Flaw management message sequence>
FORMAT W1?
  <Parameter list appears here>
  Are you sure
  Save flaw tbl?
  Clear flaw tbl?
  Formatting W1.
  <Flaw management message sequence>
FORMAT C0?
  <Parameter list appears here>
  Are you sure?
  Save flaw tbl?
  Clear flaw tbl?
  Formatting C0.
  <Flaw management message sequence>

FLAW MGT W0
RAW FLAW MGT
Entries= <system displays current number of entries in flaw table, unless number is zero, in which case this line is replaced by the message: "Tbl empty">

NEXT?
  Cyl# = xxxx
  Head# = xxxx
  BytDsp= xxxx
  BitCnt= xxxx
  Entry# = xxxx
PREVIOUS?
  Cyl# = xxxx
  Head# = xxxx
  BytDsp= xxxx
  BitCnt= xxxx
  Entry# = xxxx
NEW?
  Cyl# = 
  Head# =
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

BytDsp=
BitCnt=
Cyl# = xxxx
Head# = xxxx
BytDsp = xxxx
BitCnt = xxxx
Are you sure?
BadSct# = xxxx
[BadSct# = xxxx]
LBN# = xxxxxxx
[LBNN# = xxxxxxxx]
Entry# = xxxx

DONE/BLD TBL?

<Flaw management message sequence. System goes through the following steps in building the flaw table;>
Phase #1 [System sorts raw flaw table]
Phase #2 [Construct sector flaw records]
Phase #3 [Sort revectoring table]
Phase #4 [Allocate primary replacement blks]
Phase #5 [Alloc. secondary replacement blks]
#Groups=xx [Calc. no. of replacement blks]
#RawFla=xx [Calc. no. of raw flaw records]
#SctFla=xx [Calc. no. of sect flaw records]
Update tbls [Wrt updated support tbls to dsk]
Reload FlaTbls [Reload all revectoring tables]

REMOVE?
Cyl# = xxxx
Head# = xxxx
BytDsp = xxxx
BitCnt = xxxx
Entry# = xxxx
Are you sure?

CLEAR?
Are you sure?

SECTOR FLAW MGT

Entries = <system displays current number of entries in flaw table, unless number is zero, in which case this line is replaced by the message: "Tbl empty">

NEXT?
Cyl# = xxxx
Head# = xxxx
Sector# = xxxx
Entry# = xxxx
GrpDsp = +xxxx

PREVIOUS?
Cyl# = xxxx
Head# = xxxx
Sector# = xxxx
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

Entry# = xxxx
GrpDsp = +xxxx

NEW?
Cyl# =
Head# =
Sector# =
Cyl# = xxxx
Head# = xxxx
Sector = xxxx
Are you sure?
GrpDsp = +xxxx
LBN# = xxxxxxxx
BytDsp = xxxx
Entry# = xxxx

DONE/BLD TBL?
System displays the following in-process messages when updating the revectoring table during SECTOR FLAW MGT:

Sorting [Sort revectoring table]
Update tbls [Write updated support tables to disk]
Reload tbls [Reload all revectoring tbls]

REMOVE?
Cyl# = xxxx
Head# = xxxx
Sector = xxxx
Entry# = xxxx
Are you sure?
Done (no errs).

CLEAR?
Are you sure?

BLOCK FLAW MGT

NEXT?
LBN# = xxxxxxxxxxxx
Entry# = xxxx

PREVIOUS?
LBN# = xxxxxxxxxxxx
Entry# = xxxx

NEW?
LBN# =
Are you sure?
Cyl# = xxxx
Head# = xxxx
BytDsp = xxxx
BitCnt = xxxx
BadSct# = xxxx
GrpDsp = +xxxx
Entry# = xxxx

DONE/BLD TBL?
Are you sure?
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

REMOVE?
   LBN#=xxxxxxxxxxxx
   Entry#=xxxx
   Are you sure?
CLEAR?
   Are you sure?
FLAW MGT W1 (same as for W0)
FLAW MGT C0
C0 READY?
   (otherwise same as for W0)

TABLE A-3
SENSE MONITOR:
EVALUATION MENU COMMAND SUMMARY

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFY CONTROLS</td>
<td>Specifies the devices to be tested and the number of times an evaluation test is to be repeated.</td>
</tr>
<tr>
<td>SYSTEM EXERCISE</td>
<td>Enables or disables tests to write on storage devices.</td>
</tr>
<tr>
<td>DISK EXERCISES</td>
<td>Specifies the type of test to be performed.</td>
</tr>
<tr>
<td>DEMO</td>
<td>Smart terminals only. Provides a &quot;tour&quot; of the complete menu system.</td>
</tr>
</tbody>
</table>

COMPLETE MENU STRUCTURE                  ACCESS LEVEL

EVALUATION MENU

SPECIFY CONTROLS
   SPECIFY LIMITS
      PASS LIMIT
         Limit=
      HARD ERR LIMIT
         Limit=
      SOFT ERR LIMIT
         Limit=

SMS 1000 A-7
SPECIFY DRIVES

WO
  Disable?
  Enable?

W1
  Disable?
  Enable?

C0
  Disable?
  Enable?

F0
  Disable?
  Enable?

F1
  Disable?
  Enable?

T0
  Disable?
  Enable?

DISK RANGES

SET W0 RANGE
  MIN CYL
    Min cyl#=
  MAX CYL
    Max cyl#=
  MIN HEAD
    Min head#=
  MAX HEAD
    Max head#=

SET W1 RANGE
  MIN CYL
    Min cyl#=
  MAX CYL
    Max cyl#=
  MIN HEAD
    Min head#=
  MAX HEAD
    Max head#=

SET C0 RANGE
  (same as above)

SET F0 RANGE
  (same as above)

SET F1 RANGE
  (same as above)

DATA PATTERNS

PATTERN 1
  Byte#1=
  Byte#2=
  Byte#3=

PATTERN 2
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

Byte#1=
Byte#2=
Byte#3=

MODES
AUTO FLAW MODE
DISABLE?
ENABLE?
VrfyLim=
ERROR LOGGING
DISABLE?
ENABLE?
ERROR LOG WRAP
DISABLE?
ENABLE?
ERROR RECOVERY
ECC CORRECTION
DISABLE?
ENABLE?
AUTO RETRY
DISABLE?
ENABLE? [Default setting]

SYSTEM EXERCISES
WRITE ON WINCH?
<evaluation parameter list>
Are you sure?
READ-ONLY WINCH?
<evaluation parameter list>
Are you sure?

DISK EXERCISES
RANDOM WRITE?
<evaluation parameter list>
Are you sure?
RANDOM READ?
<evaluation parameter list>
RANDOM SEEK?
<evaluation parameter list>
READ-ONLY SCAN?
<evaluation parameter list>
WRITE/SCAN?
<evaluation parameter list>
Are you sure?

TAPE EXERCISES
DISK->TAPE
<evaluation parameter list>
Ready?
DISK<->TAPE
<evaluation parameter list>
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

Ready?
Are you sure?

DISK<->TAPE
<evaluation parameter list>
Ready?
Are you sure?

LOGS

COMMON ERROR LOG
WO
<log parameter list>
NEXT?
PREVIOUS?
CLEAR?
SAVE?
RESTORE?

W1
(same as above)

C0
(same as above)

F0
(same as above)

F1
(same as above)

T0
(same as above)

TAPE STATUS LOG
CURRENT
REWrites/REReads
Count=
UNDERRUNS
Count=

TOTAL
REWrites/REReads
Count=
UNDERRUNS
Count=

CLEAR?
SAVE?
RESTORE?

SPECIAL
MENU DEMO
DISPLAY SECTOR
WO?
<evaluation parameter list>
Even boundary?
Odd boundary?
Cyl#$=
Head#$=

SMS 1000 A-10
Sector#=
  W1  (same as above)
  C0  (same as above)
  P0  (same as above)
  F1  (same as above)
  T0  (same as above)

**TABLE A-4**

**SENSE MONITOR:**

**CONFIGURATION MENU COMMAND SUMMARY**

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOPPY FORMATS</td>
<td>Specifies the format to be used by the formatting commands in the OPERATION menu.</td>
</tr>
<tr>
<td>BOOTSTRAP</td>
<td>Specifies search sequence for boot devices.</td>
</tr>
<tr>
<td>POWER ON/RESTART</td>
<td>Specifies actions to be taken when the system is powered on or reset, such as whether to auto-boot or enter the SENSE menu system.</td>
</tr>
<tr>
<td>SERIAL PORTS</td>
<td>Specifies BAUD rates, parity bit setting, terminal type, etc. for serial ports A0 and A1.</td>
</tr>
<tr>
<td>DEVICE PARAMETERS</td>
<td>Invokes a submenu of commands used for installing disk drives. These commands specify various characteristics, or parameters, of the drives, such as number of cylinders, number of heads, etc.</td>
</tr>
<tr>
<td>ADDRESSES</td>
<td>Modifies hardware addresses for the boot prom, controller, and/or port base for special applications.</td>
</tr>
<tr>
<td>SPECIAL</td>
<td>Permits setting up such parameters as user access level, clock speed, etc.</td>
</tr>
</tbody>
</table>
# APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

## COMPLETE MENU STRUCTURE

### CONFIGURATION MENU

**FLOPPY FORMATS**

<table>
<thead>
<tr>
<th>F0 FMT</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC PC?</td>
<td>SYS MGR (5-1/4&quot; floppy)</td>
</tr>
<tr>
<td>RX01?</td>
<td>(8&quot; floppy)</td>
</tr>
<tr>
<td>RX02?</td>
<td>[Default setting]</td>
</tr>
<tr>
<td>IBM 1D?</td>
<td></td>
</tr>
<tr>
<td>IBM 2D/FW?</td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
</tr>
<tr>
<td>IBM 1D/256</td>
<td></td>
</tr>
<tr>
<td>IBM 1D/512?</td>
<td></td>
</tr>
<tr>
<td>IBM 2D/128?</td>
<td></td>
</tr>
<tr>
<td>IBM 2D/256?</td>
<td></td>
</tr>
<tr>
<td>IBM 2D/512, 15SPT</td>
<td></td>
</tr>
<tr>
<td>RX03</td>
<td></td>
</tr>
</tbody>
</table>

(F1 FMT (same as for F0 . . . see above)

### BOOTSTRAP

**AUTOBOOT TIMEOUT**

<table>
<thead>
<tr>
<th>DELAY (SEC)</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0?</td>
<td>SYS MGR [Default setting]</td>
</tr>
<tr>
<td>5?</td>
<td></td>
</tr>
<tr>
<td>10?</td>
<td></td>
</tr>
<tr>
<td>20?</td>
<td></td>
</tr>
<tr>
<td>30?</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
</tr>
<tr>
<td>NL</td>
<td></td>
</tr>
</tbody>
</table>

**BOOT DRV#1**

<table>
<thead>
<tr>
<th>BOOT DRV</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>W0?</td>
<td>SYS MGR [Default setting]</td>
</tr>
<tr>
<td>W1?</td>
<td></td>
</tr>
<tr>
<td>C0?</td>
<td></td>
</tr>
<tr>
<td>F0?</td>
<td></td>
</tr>
<tr>
<td>Fl?</td>
<td></td>
</tr>
</tbody>
</table>

**BOOT DRV#2**

<table>
<thead>
<tr>
<th>BOOT DRV</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>W0?</td>
<td>SYS MGR [Default setting]</td>
</tr>
<tr>
<td>W1?</td>
<td></td>
</tr>
<tr>
<td>C0?</td>
<td></td>
</tr>
<tr>
<td>F0?</td>
<td></td>
</tr>
<tr>
<td>Fl?</td>
<td></td>
</tr>
</tbody>
</table>

**BOOT DRV#3**

<table>
<thead>
<tr>
<th>BOOT DRV</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>W0?</td>
<td>SYS MGR [Default setting]</td>
</tr>
<tr>
<td>W1?</td>
<td></td>
</tr>
<tr>
<td>C0?</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

BOOT DRV=F0?
BOOT DRV=F1?

BOOT DRV#4
BOOT DRV=W0?
BOOT DRV=W1?
BOOT DRV=C0?
BOOT DRV=F0?
BOOT DRV=F1?  [Default setting]

FIRST DU#
DU#=[Model 40, 41 and 50 default = 0]]

POWER-ON/RESTART
SYS MGR

STARTUP MODE
LOOP UNTIL ERR?
OPERATE MENUS?
BOOTSTRAP HOST?

WINCHESTR SPINUP
DELAY (SEC)=0?
DELAY (SEC)=5?
DELAY (SEC)=10?
DELAY (SEC)=20?
DELAY (SEC)=30?
DELAY (SEC)=45?
DELAY (SEC)=90?
[Default setting]

RE-LOAD EEPROM
Are you sure?

CPU TYPE
LSI-11?
[Default setting]

VAX?

SYSTEM TYPE
SYSTEM?
[Default for Model 40 & 50]
SUBSYSTEM?
[Default for Model 41]

SERIAL PORTS
ALL

SERIAL PORT A0

BAUD RATE
BAUD=9600?
BAUD=19200?
BAUD=300?
BAUD=600?
BAUD=1200?
BAUD=2400?
BAUD=4800?
[Default setting]

DATA BITS
DATA BITS=7?
DATA BITS=8?
[Default setting]

PARITY BIT
PARITY=NONE?
PARITY=ODD?
PARITY=EVEN?
[Default setting]

STOP BITS
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

STOP BITS=1? [Default setting]
STOP BITS=2?

SERIAL PORT A1
(same as for A0)

CONSOLE SETTING
CONSOLE ENAB/DISAB
DISABLE? [Model 41 default]
ENABLE? [Model 40 & 50 default]

CONSOLE PORT
CONSOLE=A0?
CONSOLE=A1? [Default setting]

BREAK
BREAK=NOP?
BREAK=HALT? [Default setting]

TERMINAL TYPE
TERM=DUMB?
TERM=SMART?

ONLINE DELAY
DELAY (SEC)=0? [Default setting]
DELAY (SEC)=5?
DELAY (SEC)=10?
DELAY (SEC)=20?
DELAY (SEC)=30?
DELAY (SEC)=45
DELAY (SEC)=NL

DEVICE PARAMETERS

FO CONFIGURATION
DEVICE PRESENT
DISABLE?
ENABLE?

SIZE STRAPPING
SIZE=5"?
SIZE=8"?
[Default setting]

CAPACITY
#HEADS
#HEADS= [Default is 0]

#CYLS
#CYLS= [Default is 77]

TIMINGS
STEP (MSEC)
STEP= [Default is 3]
SETTLE (MSEC)
SETTLE= [Default is 15]
MOTOR ON
MOTOR ON= [Default is 700]

F1 CONFIGURATION
(same as for F0)

W0 CONFIGURATION
DEVICE PRESENT?
DISABLE?
APPENDIX A: SENSE MONITOR: SUMMARY OF COMMANDS

ENABLE?
CAPACITY
  #HEADS
    #HEADS=
    [Default is 0]
  #CYLS
    #CYLS=
    [Default is 0]
PHYS INTRLV
  INTRLV=
    [Default is 1]
OFFSETS
  CYL OFFSET=
    [Default is 1]
  CYL OFF=
    [Default is 1]
  HEAD OFFSET=
    [Default is 4]
PRECOMP
  DISABLE?
  ENABLE?
    [Default setting]
WL CONFIGURATION
  (same as for WO)
CO CONFIGURATION
  (same as for WO)
TO CONFIGURATION
  DEVICE PRESENT?
    [Default setting]
ADDRESS
PORT VECTOR BASE
  VECTOR=300
  VECTOR=310
  VECTOR=320
  VECTOR=330
  VECTOR=340
  VECTOR=370
  VECTOR=270
BUS ADDRESSES
  BOOT PROM ADDR
    DISABLE?
    17775000?
    17766000?
    17773000?
    [Model 41 default]
    [Model 40 & 50 default]
  DU DEVICE ADDR
    17772150?
    17760334?
    17760340?
    17760344?
    17760350?
    17760354?
    17772154?
    [Model 40 & 50 default]
    [Model 41 default]
PORT BASE ADDR
  DISABLE?
  17776500?
  [Model 41 default]
  [Model 40 & 50 default]
SPECIAL

ACCESS LEVEL
USER?
SYS MGR?
   PWkey=
   NewPWkey=
TECH?
   PWkey=
   NewPWkey=

BANNER
DISABLE?
ENABLE?
   NewBanner=

FAN SPEED
LOW?
MED?

SHIP
DATE=
S/N=

CLOCK
CLOCK SPEED
SPEED=60?
CLOCK OFF?
SPEED=50?
SPEED=800?
CLOCK CSR
DISABLE?
ENABLE?

SYS MGR
[Default setting]
[Up to 16 characters]

TECH
[Default setting]

[Default setting]
APPENDIX B

SPECIFICATIONS FOR
SMS 1000
PERIPHERAL DEVICES

TABLE B-1

5 1/4-INCH WINCHESTER DRIVES

<table>
<thead>
<tr>
<th>DRIVE</th>
<th>TYPE</th>
<th>UN-</th>
<th>FOR-</th>
<th>AVG.</th>
<th>MAX.</th>
<th>NO.</th>
<th>NO.</th>
<th>SEC-</th>
<th>BYTES/</th>
<th>BYTES/</th>
<th>ROTAT-</th>
<th>ION-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FOR-</td>
<td>MAT-</td>
<td>AC-</td>
<td>XFER</td>
<td>OF</td>
<td>OF</td>
<td>TORS</td>
<td>SEC-</td>
<td>TRACK</td>
<td>PER</td>
<td>TOR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAT-</td>
<td>TED</td>
<td>CESS</td>
<td>RATE</td>
<td>HDS</td>
<td>CYL</td>
<td>PER</td>
<td>TOR</td>
<td>(FOR-</td>
<td>AL</td>
<td>AL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TED</td>
<td>CAP-</td>
<td>TIME</td>
<td>(KB/</td>
<td>TRACK</td>
<td>(MAX)</td>
<td>MAT-</td>
<td>LAT-</td>
<td>EN-</td>
<td>CY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAP-</td>
<td>ACI-</td>
<td>(MS)</td>
<td>SEC</td>
<td>(MB)</td>
<td>(MAX)</td>
<td>^TET</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ST212 | 12  | 11.0 | 65   | 625  | 4   | 306 | 18  | 512  | 9K*   | 8.33  |
|       | (SEAGATE) | (550 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |

| ST213 | 12  | 11.2 | 65   | 625  | 2   | 615 | 18  | 512  | 9K*   | 8.33  |
|       | (SEAGATE) | (588 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |

| ST412 | 12  | 11.0 | 85   | 625  | 4   | 306 | 18  | 512  | 9K*   | 8.33  |
|       | (SEAGATE) | (345 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |

| ST419 | 19  | 16.5 | 85   | 625  | 6   | 306 | 18  | 512  | 9K*   | 8.33  |
|       | (SEAGATE) | (345 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |

| CM5619| 19  | 16.5 | 72   | 625  | 6   | 306 | 18  | 512  | 9K*   | 8.33  |
|       | (COMPUTER MEMORIES INC.) | (345 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |

| ST225 | 25  | 22.6 | 85   | 625  | 4   | 615 | 18  | 512  | 9K*   | 8.33  |
|       | (SEAGATE) | (580 TPI) | | | | | | | | |
| NOTE: | PRECOMP ENABLED |
## APPENDIX B: PERIPHERALS FOR MODELS 40 AND 50

### TABLE B-1

5 1/4-INCH WINCHESTER DRIVES (continued)

<table>
<thead>
<tr>
<th>DRIVE</th>
<th>TYPE</th>
<th>TY (MB)</th>
<th>(MB) (MAX)</th>
<th>UN-</th>
<th>FOR-</th>
<th>MAT-</th>
<th>AC-</th>
<th>AVG.</th>
<th>MAX.</th>
<th>NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q540</td>
<td>(QUANTUM) (591 TPI)</td>
<td>42</td>
<td>37.1</td>
<td>45</td>
<td>625</td>
<td>8</td>
<td>512</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
<tr>
<td>V170</td>
<td>(VERTEX) (960 TPI)</td>
<td>70</td>
<td>62.6</td>
<td>30</td>
<td>625</td>
<td>7</td>
<td>987</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
<tr>
<td>XT-1085</td>
<td>(MAXTOR) (980 TPI)</td>
<td>85</td>
<td>75.5</td>
<td>30</td>
<td>625</td>
<td>8</td>
<td>1024</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
<tr>
<td>XT-1140</td>
<td>(MAXTOR) (980 TPI)</td>
<td>140</td>
<td>122.4</td>
<td>30</td>
<td>625</td>
<td>15</td>
<td>918</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
<tr>
<td>DMA-360</td>
<td>DMA SYSTEMS REMOVABLE-CARTRIDGE WINCHESTER DRIVE (612 TPI)</td>
<td>12</td>
<td>10.6</td>
<td>107</td>
<td>625</td>
<td>2</td>
<td>612</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
<tr>
<td>SYQUEST</td>
<td>SYQUEST MODEL SQ312RD REMOVABLE-CARTRIDGE WINCHESTER DRIVE (741 TPI)</td>
<td>12.7</td>
<td>11.2</td>
<td>135</td>
<td>625</td>
<td>2</td>
<td>615</td>
<td>18</td>
<td>512</td>
<td>9K*</td>
</tr>
</tbody>
</table>

### LEGEND:
- KB = 1024 bytes (i.e. kilobyte)
- MB = 1,048,576 bytes (i.e. megabyte)
- MS = millisecond

* - Tracks with reserved replacement blocks have 8.5K byte/track.

### NOTE:
- In general, in drives with oxide media, precomp is enabled.
- In drives with plated media, precomp is disabled.
APPENDIX B: PERIPHERALS FOR MODELS 40 AND 50

TABLE B-2
1/4-INCH-CARTRIDGE STREAMING TAPE DRIVE

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RECORDING DENSITY (BPI)</th>
<th>NO. OF TRACKS</th>
<th>NORMAL TAPE SPEED (IPS)</th>
<th>FAST TAPE SPEED (IPS)</th>
<th>DATA XFER RATE (KB/SEC)</th>
<th>CAPACITY (MB MAX)</th>
</tr>
</thead>
<tbody>
<tr>
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MEDIA TYPES (all media QIC-24 compatible): (1) 3M DC300XL or DC300XL+ (450 foot); (2) DC600A (600 foot); (3) DEI 137m (450 foot); (4) DEI 169m (555 foot); or equivalent.

LEGEND

BPI = Bits Per Inch
IPS = Inches Per Second
m = metre

TABLE B-3
STANDARD 5 1/4" DISKETTE FORMATS

<table>
<thead>
<tr>
<th>FORMAT and DENSITY</th>
<th>SECTOR/TRACK</th>
<th>NO. OF SECTOR HDS.</th>
<th>BYTES/SECTOR</th>
<th>FORMATTED CAPACITY (MB)</th>
<th>TRACKS/INCH (TPI)</th>
<th>NO. OF CYL</th>
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# APPENDIX B: PERIPHERALS FOR MODELS 40 AND 50

## TABLE B-4

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<th>NO. OF CYL.</th>
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</table>

**LEGEND**

KB = 1024 bytes (i.e. kilobyte)  
MB = 1,048,576 bytes (i.e. megabyte)  
MS = millisecond
## APPENDIX C

### TABLE C-1

SMS 1000 Models 40 and 50: TABLE OF MAJOR SYSTEM COMPONENTS

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<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<td>9001385-0001</td>
<td>12MB Winchester. ST212, or equivalent.</td>
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<td>12MB Winchester. ST213, or equivalent.</td>
</tr>
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<td>9001006-0001</td>
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<td>9001336-0001</td>
<td>25MB Winchester. ST225, or equivalent.</td>
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<td>9001135-0001</td>
<td>70MB Winchester. V170, or equivalent.</td>
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<tr>
<td>9001331-0001</td>
<td>85MB Winchester. XT1085, or equivalent.</td>
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<td>9001136-0001</td>
<td>140MB Winchester. XT1140, or equivalent.</td>
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<td>9001292-0001</td>
<td>10MB Cartridge Winchester. DMA 360, or equivalent.</td>
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<tr>
<td>9001524-0001</td>
<td>12MB Removable-cartridge Winchester drive, SyQuest Model SQ312RD, or equivalent.</td>
</tr>
<tr>
<td>9001525-0001</td>
<td>SyQuest Model SQ200 cartridge for SyQuest SQ312RD removable-cartridge Winchester drive.</td>
</tr>
<tr>
<td>9001315-0001</td>
<td>60MB-capacity 1/4&quot; streaming tape drive. Model TDC 3309/3350 Mk. II, or equivalent.</td>
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<tr>
<td>9001258-0001</td>
<td>1MB 8&quot; floppy drive. TM848-2E, or equivalent.</td>
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<tr>
<td>9001256-0001</td>
<td>0.8MB 5 1/4&quot; floppy drive. JU465, or equivalent.</td>
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<tr>
<td>1002086-0001</td>
<td>SMS 1000 Foundation module (Models 40 and 50)</td>
</tr>
<tr>
<td>9001076-0001</td>
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<td>9001305-0001</td>
<td>500 watt power supply (Model 50)</td>
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<td>0004686-0001</td>
<td>Front-panel-display kit</td>
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<tr>
<td>0004567-0001</td>
<td>Fan assembly</td>
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<td>0004530-0001</td>
<td>SMS 1000 Model 40 backplane (five slot)</td>
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<td>0005007-0001</td>
<td>SMS 1000 Model 50 backplane (twelve slot)</td>
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SMS 1000 C-1
APPENDIX D

DECIMAL–OCTAL–HEXADECIMAL

CONVERSION TABLE

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SMS 1000 D-1
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APPENDIX E

ERROR MESSAGES

SELF-TEST ERRORS

GENERAL. Each time power is applied to the SMS 1000 system, or the RESTART and "*" buttons are pushed at the same time on the system front panel, the 80188 processor on the System Foundation Module is reset and a self test of major hardware components is started. During this self test an LED on the front edge of the Foundation Module (see Figure 1-4) will go on and will remain on for the duration of the test. If the test is successful and no errors are found, the LED goes out at the completion of the test. If an error is detected during the test, the LED remains on. Note, however, that the self test takes a very short time (roughly one second) and, if no errors are detected, it is possible to overlook the flashing of the LED.

USE OF ODT. In the event of a self-test failure not caused by the 80188 itself, the LED remains on and the 80188 writes the corresponding fatal-error code to the SA register (see first column of Table E-1 for a listing of these error codes). At the same time, the system halts and enters ODT so that the contents of the SA register can be read. The SA register address is the IP register address + 2. The IP register is SMS-factory configured at 17772150. The SMS configured address of the SA register is therefore 17772152.

PROCEDURE FOR FINDING ERROR CODE. If an error is encountered in self test, do the following:

1. Enter the following on your terminal:

   @17772152/

2. As soon as the "/" is entered (no carriage return is necessary) the system responds by printing the contents of the SA register after the "/". If, for example, there were a "Channel 0 test error", which has an error code of 104004 (see Table E-1), the query would appear as follows:

   @17772152/104004

Therefore, as long as an error is not caused by the 80188 or the console device, the user can examine the contents of the SA register to determine the nature of the error. If the LED remains on and the user cannot examine the SA register from the console device, it is an indication that the 80188 or the console is bad.
ERROR CODES DISPLAYED ON FRONT PANEL. During the hardware self
test sequence that takes place at initial startup or RESTART,
certain errors are reported on the front-panel display by means
of the message:

Self Test Err nn

where nn can be any of the decimal error codes shown
in the second column of Table E-1. Note that these error codes
 correspond to the same error events whose codes are detected by
use of the ODT facility described earlier in this section.

The following table (Table E-1) summarizes the self-test errors
and their meanings.

TABLE E-1

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<th>ODT ERROR CODE (OCTAL)</th>
<th>ERROR CODE DISPLAYED ON FRONT PANEL (DECIMAL)</th>
<th>ERROR TYPE OR DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>100011</td>
<td>9</td>
<td>Host access (protocol dependent)</td>
</tr>
<tr>
<td>100012</td>
<td>10</td>
<td>Credit limit exceeded</td>
</tr>
<tr>
<td>100013</td>
<td>11</td>
<td>Bus master error (DMA)</td>
</tr>
<tr>
<td>100016</td>
<td>14</td>
<td>Invalid connection identifier</td>
</tr>
<tr>
<td>100023</td>
<td>19</td>
<td>INIT sequence error</td>
</tr>
<tr>
<td>100024</td>
<td>20</td>
<td>Protocol incompatibility</td>
</tr>
<tr>
<td>104000</td>
<td>256</td>
<td>EEPROM checksum error</td>
</tr>
<tr>
<td>104001</td>
<td>257</td>
<td>First EPROM checksum error</td>
</tr>
<tr>
<td>104002</td>
<td>258</td>
<td>Second EPROM checksum error</td>
</tr>
<tr>
<td>104003</td>
<td>259</td>
<td>RAM error</td>
</tr>
<tr>
<td>104004</td>
<td>260</td>
<td>Channel 0 test error (Serial Port A0)</td>
</tr>
<tr>
<td>104005</td>
<td>261</td>
<td>Channel 1 test error (Serial Port A1)</td>
</tr>
<tr>
<td>104006</td>
<td>262</td>
<td>DMA-to-system-memory failure</td>
</tr>
<tr>
<td>104007</td>
<td>263</td>
<td>DMA-from-system-memory failure</td>
</tr>
<tr>
<td>104008</td>
<td>264</td>
<td>80188 test failure</td>
</tr>
</tbody>
</table>

SYSTEM-OPERATION ERRORS

OPERATOR-DEPENDENT ERRORS. There are two types of exception events
that cause the display of error messages on the console or on the
front panel 16-character display readout. See Tables E-2 and E-3 for a list of these messages and their meanings. The first type is the result of an operator giving invalid or inconsistent commands, e.g., attempting to perform a FORMAT FLOPPY with the drive not ready. The system handles this kind of event by outputting a message to the console's status field or to the front panel display and either prompting the user again or aborting the process altogether.

CONTROLLER-DEPENDENT ERRORS. The second type of exception is detected by the controller and can occur as the result of either hardware failures, or environmental failures such as, for example, failure to insert a diskette at the correct time, inserting an unformatted diskette when the system expects a formatted diskette, or write protecting the Winchester during a restore operation.

DISPLAY OF ERROR PARAMETERS. In the case of the console, errors are handled by displaying a complete set of error parameters in the console status field. In the case of the SMS 1000 front panel display, an error message first appears, after which successive error parameters are displayed by repeated pressing of the left or right arrow key.

HARD AND SOFT ERRORS. If an internal error-limit variable has been exceeded, the system will query the operator for the desired course of action. In the EVALUATION menus, limit variables can be specified for hard and soft errors. A soft error is detected when retries are required by the controller in order to successfully complete the command. Note that ECC correction implies the occurrence of a soft error. A hard error occurs when the controller detects a non-recoverable failure. Aside from EVALUATION menu activity, the default soft error limit is statically set to no limit, while the default hard error limit is set to one.

ERROR-MESSAGE STRUCTURE.

For both the console and the front panel display, error-message information is presented in the format given below. In the case of the console, all information is displayed at once on the CRT screen. With the front panel 16-character display, only the first line appears automatically, after which successive lines appear each time the right-arrow key is pressed. Note the following:

1. ERROR MESSAGE FORMAT. The following is the format of the error messages that appear on your terminal or front-panel display:

   <error-string>
   <error-status>
   ACTION?
       RESTART?
       MENU?
SMS 1000 MODELS 40 AND 50: ERROR MESSAGES

RESUME?

A description of these messages is given in the following steps.

2. ERROR-STRING MESSAGE. The SMS 1000 system develops 11 possible error messages of up to 16 characters each. They are general in nature and some of them can result from a number of different types of errors. The various controller events that could cause each of these messages are given in a table (Table E-2) at the end of this list. The 11 <error-string> messages are:

"DRIVE NOT READY"
"DRIVE WRITE PROT"
"BAD SCT DATA"
"BAD MEDIA"
"INCORRECT FORMAT"
"CTRLR TIMEOUT"
"SOFT ERROR"
"BAD DISK CMD"
"CTRLR ERROR"
"HOST ERROR"
"ERROR"

3. DISK-RELATED ERROR-STATUS MESSAGES. The format of error-status messages for disk error events is:

\[ e<error\text{ code}> <device\text{ identification}> c<cyylinder\text{ number}> h<head\text{ number}> s<sector\text{ number}> \]

where:

Error code ("e") is a decimal value as given in Tables E-2 and E-3 below.

Device identification can be W0, W1, C0, F0 or F1.

Cylinder number, head number and sector number ("c", "h", "s") provide the disk address of the error location.

An example of a typical error message would be:

Bad media
e70 W0c108h12s14

4. TAPE-RELATED ERROR-STATUS MESSAGES. The format of error-status messages for tape-related error events is:

\[ e<error\text{ code}> T0:<status\text{ byte } 0[\text{in hex}]> H<status\text{ byte } 1[\text{in hex}]> H \]
SMS 1000 MODELS 40 AND 50: ERROR MESSAGES

where:

Error code ("e") is a decimal value defined in Tables E-2 and E-3.

T0: is a delimiter indicating that the tape drive is the source of the error.

Status byte is an eight-bit status message, displayed in hex ("H"), that indicates the source of the error. Two status bytes are displayed.

A typical tape-related error-message sequence would appear as follows:

Tape error
e128T0;12H34H

EXPLANATION OF TAPE STATUS BYTES 0 AND 1.

All bits in both status bytes 0 and 1 are normally 0. A 1 in one of the eight positions indicates a specific error condition. The meaning of the bits in status bytes 0 and 1 is given in the following tables.

EXPLANATION OF TAPE STATUS BYTE 0

<table>
<thead>
<tr>
<th>BIT NUMBER</th>
<th>MEANING OF A &quot;1&quot; IN THIS POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Status byte 0 contains information. This bit is 1 if at least one of the other bits in the byte is 1.</td>
</tr>
<tr>
<td>6</td>
<td>Cartridge not in place. Set while no cartridge is in drive. Reset when cartridge is inserted.</td>
</tr>
<tr>
<td>5</td>
<td>Drive not selectable/Drive error. Possible drive defect, or error in communication link between formatter and drive.</td>
</tr>
<tr>
<td>4</td>
<td>Cartridge is write protected.</td>
</tr>
<tr>
<td>3</td>
<td>Cartridge full. End of media detected. Not set during a normal read operation.</td>
</tr>
<tr>
<td>2</td>
<td>Unrecoverable data error. The bit is set after 16 rewrite attempts or 24 reread attempts.</td>
</tr>
</tbody>
</table>
Bad block not located. Set in read mode only.

File mark detected.

---

EXPLANATION OF TAPE STATUS BYTE 1

<table>
<thead>
<tr>
<th>BIT NUMBER</th>
<th>MEANING OF A &quot;1&quot; IN THIS POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Status byte 1 contains information. Indicates that at least one of the other bits in byte 1 is 1.</td>
</tr>
<tr>
<td>6</td>
<td>Illegal command.</td>
</tr>
<tr>
<td>5</td>
<td>No data detected. Set if drive has not been able to detect data for at least 45 inches of track.</td>
</tr>
<tr>
<td>4</td>
<td>Marginal block(s) detected. May indicate that the cartridge in question is approaching the end of its useful life.</td>
</tr>
<tr>
<td>3</td>
<td>Drive is at the beginning of media. Drive is positioned at the Beginning of Tape (BOT, track 0). Remains set until the tape moves away from BOT area or a Reset occurs.</td>
</tr>
<tr>
<td>2</td>
<td>Bus parity error.</td>
</tr>
<tr>
<td>1</td>
<td>End of recorded area</td>
</tr>
<tr>
<td>0</td>
<td>Reset/Power-up sequence</td>
</tr>
</tbody>
</table>

5. "ACTION" OPTIONS. In the error message format given in Step 1 (above), the options listed under "ACTION?" are: "RESTART?", "MENU?", and "RESUME?". These options are discussed in the following steps:

(1) RESTART. In the event of an error, it may be possible to restart processing from some earlier predefined point in the program. This option is not displayed in the menu unless the appropriate checkpoints are present in the program.

(2) MENU. This option should be invoked when you wish to quit the current operation and return to the next higher level of the menu system.

(3) RESUME. Selecting this command when an error has been
found during SCAN exercises, BACKUP, RESTORE, COPY, or RESUME means that the sector address is incremented and an attempt is made to continue the operation. This option should be selected when there is a strong need to keep on going beyond a particular bad sector, as when backing up a Winchester, etc. This option has little benefit if the error continually re-occurs; e.g. "Drive not ready", or "TAPE ERROR" during backup. In these situations, the RESTART option may be more useful. Selecting the RESUME option during the random evaluation exercises causes the last server command to be reissued, using the disk address that was generated by the error event. If the error event was the result of a hard error on the disk, reissuing the server command will likely result in another error event.

MAPPING ERROR MESSAGES TO CONTROLLER EVENTS

The following table (Table E-2) maps the 11 basic system error messages to the possible controller events that could cause them. Note that the controller events are listed by their decimal error numbers, and are explained in the next table (Table E-3).

TABLE E-2

ERROR MESSAGES AND CONTROLLER EVENTS

<table>
<thead>
<tr>
<th>DISPLAYED ERROR-MESSAGE</th>
<th>POSSIBLE CONTROLLER EVENT(S) THAT COULD CAUSE THE ERROR MESSAGE (LISTED BY DECIMAL EVENT CODE. SEE FOLLOWING TABLE (TABLE E-3).)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;DRIVE NOT READY&quot;</td>
<td>64</td>
</tr>
<tr>
<td>&quot;DRIVE WRITE PROT&quot;</td>
<td>88</td>
</tr>
<tr>
<td>&quot;BAD SCT DATA&quot;</td>
<td>76*</td>
</tr>
<tr>
<td>&quot;BAD MEDIA&quot;</td>
<td>70*, 71*, 75*, 115, 117</td>
</tr>
<tr>
<td>&quot;INCORRECT FORMAT&quot;</td>
<td>66, 67, 72, 73, 74</td>
</tr>
<tr>
<td>&quot;CONTRLR TIMEOUT&quot;</td>
<td>69, 77, 78, 79, 87, 97, 100</td>
</tr>
<tr>
<td>&quot;SOFT ERROR&quot;</td>
<td>85</td>
</tr>
<tr>
<td>&quot;BAD DISK CMD&quot;</td>
<td>34, 35, 36, 37, 38, 39, 40, 41 42, 43, 51, 52, 54, 57, 126</td>
</tr>
</tbody>
</table>
"HOST ERROR" 114, 118

"ERROR" ALL OTHER EVENT CODES

NOTE: "*" following event code 70, 71, 75 and 76 indicates that the Support Monitor Subsystem's autoflaw manager is invoked when one of these events is reported by the controller, if the autoflaw mode is enabled for evaluation exercises.

CONTROLLER-EVENT CODES AND ERROR MESSAGES

The following table (Table E-3) lists controller event codes and their corresponding explanations. The codes are listed first in decimal, which is the form in which they are displayed on the console or front-panel display, and then both their hex and octal equivalents are given.

TABLE E-3

CONTROLLER-EVENT CODES AND THEIR MEANINGS (CODES ARE DISPLAYED IN DECIMAL)

<table>
<thead>
<tr>
<th>CONTROLLER-EVENT CODE</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEC.</td>
</tr>
<tr>
<td></td>
<td>USER-ERROR EVENTS</td>
</tr>
<tr>
<td>13 0D 15</td>
<td>Carriage retry</td>
</tr>
<tr>
<td>15 0F 17</td>
<td>Access retry</td>
</tr>
<tr>
<td>23 17 27</td>
<td>Tape drive in exception state</td>
</tr>
<tr>
<td>24 18 30</td>
<td>Power-up or reset occurred</td>
</tr>
<tr>
<td>25 19 31</td>
<td>File mark detected</td>
</tr>
<tr>
<td>26 1A 32</td>
<td>Marginal block(s) detected</td>
</tr>
<tr>
<td>27 1B 33</td>
<td>Beginning of tape</td>
</tr>
<tr>
<td>30 1E 36</td>
<td>Tape read/write retried</td>
</tr>
<tr>
<td>31 1F 37</td>
<td>Tape buffer underrun/overflow</td>
</tr>
<tr>
<td>34 22 42</td>
<td>Invalid command</td>
</tr>
<tr>
<td>35 23 43</td>
<td>Illegal unit</td>
</tr>
<tr>
<td>36 24 44</td>
<td>Invalid cylinder number</td>
</tr>
<tr>
<td>37 25 45</td>
<td>Invalid head number</td>
</tr>
<tr>
<td>38 26 46</td>
<td>Invalid sector number</td>
</tr>
<tr>
<td>39 27 47</td>
<td>Illegal number of bytes/sector</td>
</tr>
</tbody>
</table>
# SMS 1000 Models 40 and 50: Error Messages

<table>
<thead>
<tr>
<th>DEC.</th>
<th>HEX</th>
<th>OCTAL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>28</td>
<td>50</td>
<td>Too many Winchester cylinders</td>
</tr>
<tr>
<td>41</td>
<td>29</td>
<td>51</td>
<td>Too many Winchester heads</td>
</tr>
<tr>
<td>42</td>
<td>2A</td>
<td>52</td>
<td>Illegal no. of floppy sides specified</td>
</tr>
<tr>
<td>43</td>
<td>2B</td>
<td>53</td>
<td>Format not supported by this system</td>
</tr>
<tr>
<td>51</td>
<td>33</td>
<td>63</td>
<td>Illegal test number specification</td>
</tr>
<tr>
<td>52</td>
<td>34</td>
<td>64</td>
<td>Media overflow</td>
</tr>
<tr>
<td>54</td>
<td>36</td>
<td>66</td>
<td>Sector size not supported.</td>
</tr>
<tr>
<td>57</td>
<td>39</td>
<td>71</td>
<td>Non-existent or reserved drive strapping</td>
</tr>
</tbody>
</table>

---

**SYSTEM-ERROR EVENTS**

<table>
<thead>
<tr>
<th>DEC.</th>
<th>HEX</th>
<th>OCTAL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>3A</td>
<td>72</td>
<td>Invalid buffer descriptor</td>
</tr>
<tr>
<td>59</td>
<td>3B</td>
<td>73</td>
<td>Invalid byte count</td>
</tr>
<tr>
<td>60</td>
<td>3C</td>
<td>74</td>
<td>Invalid logical block number</td>
</tr>
<tr>
<td>61</td>
<td>3D</td>
<td>75</td>
<td>Host credit exceeded</td>
</tr>
<tr>
<td>64</td>
<td>40</td>
<td>100</td>
<td>Drive not ready</td>
</tr>
<tr>
<td>66</td>
<td>42</td>
<td>102</td>
<td>Deleted data address mark encountered</td>
</tr>
<tr>
<td>67</td>
<td>43</td>
<td>103</td>
<td>Data address mark mismatch</td>
</tr>
<tr>
<td>68</td>
<td>44</td>
<td>104</td>
<td>Write error</td>
</tr>
<tr>
<td>69</td>
<td>45</td>
<td>105</td>
<td>Format pass timeout</td>
</tr>
<tr>
<td>70</td>
<td>46</td>
<td>106</td>
<td>No sector ID address marks found on track</td>
</tr>
<tr>
<td>71</td>
<td>47</td>
<td>107</td>
<td>No good sector ID found on track</td>
</tr>
<tr>
<td>72</td>
<td>48</td>
<td>110</td>
<td>Sector length not initialization value</td>
</tr>
<tr>
<td>73</td>
<td>49</td>
<td>111</td>
<td>Cylinder no. mismatch: positioning error</td>
</tr>
<tr>
<td>74</td>
<td>4A</td>
<td>112</td>
<td>Sector ID/head (side) number mismatch</td>
</tr>
<tr>
<td>75</td>
<td>4B</td>
<td>113</td>
<td>Sector ID not found on track</td>
</tr>
<tr>
<td>76</td>
<td>4C</td>
<td>114</td>
<td>Data field CRC/ECC error</td>
</tr>
<tr>
<td>77</td>
<td>4D</td>
<td>115</td>
<td>Internal byte processor timeout error</td>
</tr>
<tr>
<td>78</td>
<td>4E</td>
<td>116</td>
<td>Track write timeout</td>
</tr>
<tr>
<td>79</td>
<td>4F</td>
<td>117</td>
<td>Data late</td>
</tr>
<tr>
<td>85</td>
<td>55</td>
<td>125</td>
<td>Winchester data corrected (ECC)</td>
</tr>
<tr>
<td>87</td>
<td>57</td>
<td>127</td>
<td>No track 0</td>
</tr>
<tr>
<td>88</td>
<td>58</td>
<td>130</td>
<td>Tape drive not ready</td>
</tr>
<tr>
<td>89</td>
<td>59</td>
<td>131</td>
<td>Bad block not located</td>
</tr>
<tr>
<td>90</td>
<td>5A</td>
<td>132</td>
<td>Unrecoverable data</td>
</tr>
<tr>
<td>91</td>
<td>5B</td>
<td>133</td>
<td>End of tape</td>
</tr>
<tr>
<td>92</td>
<td>5C</td>
<td>134</td>
<td>Tape drive error</td>
</tr>
<tr>
<td>93</td>
<td>5D</td>
<td>135</td>
<td>Cartridge not in place</td>
</tr>
<tr>
<td>94</td>
<td>5E</td>
<td>136</td>
<td>End of recorded area</td>
</tr>
<tr>
<td>95</td>
<td>5F</td>
<td>137</td>
<td>No data detected on tape</td>
</tr>
</tbody>
</table>
### Controller/Hardware-Error Events

<table>
<thead>
<tr>
<th>Dec.</th>
<th>Hex</th>
<th>Octal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>60</td>
<td>140</td>
<td>Default error; execute self test</td>
</tr>
<tr>
<td>97</td>
<td>61</td>
<td>141</td>
<td>Carriage registration timeout error</td>
</tr>
<tr>
<td>98</td>
<td>62</td>
<td>142</td>
<td>No Winchester seek complete</td>
</tr>
<tr>
<td>99</td>
<td>63</td>
<td>143</td>
<td>Immediate seek complete</td>
</tr>
<tr>
<td>100</td>
<td>64</td>
<td>144</td>
<td>Seek-complete timeout</td>
</tr>
<tr>
<td>104</td>
<td>68</td>
<td>150</td>
<td>80188 self-test failure</td>
</tr>
<tr>
<td>105</td>
<td>69</td>
<td>151</td>
<td>Program checksum error</td>
</tr>
<tr>
<td>106</td>
<td>6A</td>
<td>152</td>
<td>80188 system RAM error</td>
</tr>
<tr>
<td>107</td>
<td>6B</td>
<td>153</td>
<td>Buffer RAM failure</td>
</tr>
<tr>
<td>108</td>
<td>6C</td>
<td>154</td>
<td>Millisecond clock too slow</td>
</tr>
<tr>
<td>109</td>
<td>6D</td>
<td>155</td>
<td>Millisecond clock too fast</td>
</tr>
<tr>
<td>110</td>
<td>6E</td>
<td>156</td>
<td>Port failure</td>
</tr>
<tr>
<td>111</td>
<td>6F</td>
<td>157</td>
<td>Byte processor hung in execute-self-test data loop</td>
</tr>
<tr>
<td>112</td>
<td>70</td>
<td>160</td>
<td>Computed-write ECC error</td>
</tr>
<tr>
<td>114</td>
<td>72</td>
<td>162</td>
<td>Host DMA timeout</td>
</tr>
<tr>
<td>115</td>
<td>73</td>
<td>163</td>
<td>No stable ECC residue</td>
</tr>
<tr>
<td>116</td>
<td>74</td>
<td>164</td>
<td>Byte processor error</td>
</tr>
<tr>
<td>117</td>
<td>75</td>
<td>165</td>
<td>Failed to determine disk format</td>
</tr>
<tr>
<td>118</td>
<td>76</td>
<td>166</td>
<td>Host CPU error</td>
</tr>
<tr>
<td>119</td>
<td>77</td>
<td>167</td>
<td>Tape drive operation timeout</td>
</tr>
<tr>
<td>122</td>
<td>7A</td>
<td>172</td>
<td>Illegal tape command sequence</td>
</tr>
<tr>
<td>123</td>
<td>7B</td>
<td>173</td>
<td>Tape drive bus parity error</td>
</tr>
<tr>
<td>126</td>
<td>7E</td>
<td>176</td>
<td>Invalid RS-232 DL port number</td>
</tr>
</tbody>
</table>

NOTE: Where disk- or tape-related errors are involved, the most significant binary bit of the error code is 0 if no retry was done. If the error persists after retry, the most significant binary bit of the error code becomes 1. Thus, error code 71 (i.e. 47H, or 0100 0111) becomes 199 (i.e. C7H, or 1100 0111) if the error persists after retry.

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(IMM/)
APPENDIX F

DESCRIPTION OF SMS 1000 MODEL 41
DATA STORAGE SUBSYSTEM

GENERAL

The SMS 1000 Model 41 (Figures 1-1 and F-1) provides a packaged mass-storage subsystem for MicroVAX II and LSI-11 users who have specialized needs that do not permit the location of mass-storage components within the actual frames of their systems. In exactly the same manner as the Model 40, the Model 41 can be configured with a wide variety of peripherals that can be rapidly tested, checked or configured by means of the SENSE monitor. The Model 41 connects to its host system by means of a simple dual cable set and a dual-width interface card that plugs into the host backplane (see Figure F-1). Thus, all Model 41 peripherals and their associated MSCP controller are fully accessible to the host bus system.

The Model 41 is fundamentally a Model 40 with a backplane modified to contain only two A-B slots. The first receives an interconnection card that is part of the cable set that goes to the host, as shown in Figure F-1. The second slot is reserved for future expansion.

CONTENTS OF APPENDIX

This Appendix covers the following topics:

1. Equipment supplied
2. Discussion of differences between Model 40 and Model 41.
3. Installation and operation of Model 41
4. Backplane jumper strapping

EQUIPMENT SUPPLIED

The following table describes both the basic SMS 1000 MODEL 41 system that is common to all configurations and also describes the user-selectable peripherals that are available with this system.
Fig. F-1  SMS 1000 Model 41 Subsystem Functional Block Diagram
TABLE F-1  
EQUIPMENT SUPPLIED  

<table>
<thead>
<tr>
<th>NAME</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-bus backplane</td>
<td>0004530-0002</td>
<td>This is a 22-bit bus. It contains two dual-width A-B slots. 18-bit addressing is selectable by opening four jumpers on the backplane.</td>
</tr>
<tr>
<td>Front Panel</td>
<td>0004559-0001</td>
<td>Contains 16-character readout and seven pushbutton switches that provide communication with the SENSE Monitor. Also contains d-c ON/OFF switch (behind door).</td>
</tr>
<tr>
<td>Rear panel assembly</td>
<td>0004840-0001</td>
<td>Contains AC power switch, RS-232 connectors, and cable clamp and connectors for the cable set that connects the Model 41 to the host. Jumpers behind the rear panel permit optional selection of the 20-ma current-loop mode in conjunction with user-supplied equipment.</td>
</tr>
<tr>
<td>Interconnection cable set</td>
<td>0004842-0001</td>
<td>Ten-foot long cable set for connection between rear panel and host. At the host end, the cable set makes connection with an extender card that plugs into the host backplane.</td>
</tr>
</tbody>
</table>
### APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual-width extender card (host) 0005089-0001</td>
<td>Dual-width extender card that plugs into host backplane. Mates with interconnection cable set from Model 41.</td>
</tr>
<tr>
<td>Floor-mount, or rack-mount system enclosure 0004562-0001</td>
<td>Provides mounting locations for all components of the system, including various choices of peripherals. Also contains cooling fans. Rack-mount configuration includes slides.</td>
</tr>
<tr>
<td>Foundation module 1002086-0001</td>
<td>Contains peripheral control circuits; two RS-232 serial ports; Q-bus control circuits; and all circuits necessary to run the SENSE monitor.</td>
</tr>
<tr>
<td>Power supply 9001076-0001</td>
<td>Switch-selectable for input a-c power of 115 or 230 volts. Provides +5, +12, +24 and -12 volts to the SMS 1000. Power-supply fuse is accessible through opening on rear panel.</td>
</tr>
</tbody>
</table>

### USER-SELECTABLE PERIPHERALS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; Floppy (slimline) 9001258-0001</td>
<td>Tandon Model TM848-2E, double sided/double density, or equivalent.</td>
</tr>
<tr>
<td>5-1/4&quot; Floppy (slimline) 9001256-0001</td>
<td>Shugart Model 465, double sided/96 TPI, or equivalent.</td>
</tr>
</tbody>
</table>
APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

5-1/4" Winchester hard-disk drive

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9001006-0001</td>
<td>12 MB. Full height. Computer Memories Inc. (CMI) Model CM5412; or equivalent.</td>
</tr>
<tr>
<td>9001385-0001</td>
<td>12MB. Half height. Seagate Model ST212 or equivalent.</td>
</tr>
<tr>
<td>9001336-0001</td>
<td>25MB. Half height. Seagate Model ST225 or equivalent.</td>
</tr>
<tr>
<td>9001081-0001</td>
<td>42 MB. Quantum Model Q540, or equivalent.</td>
</tr>
<tr>
<td>9001331-0001</td>
<td>85 MB. Maxtor Model XT-1085, or equivalent.</td>
</tr>
<tr>
<td>9001136-0001</td>
<td>140 MB. Maxtor Model XT-1140, or equivalent.</td>
</tr>
</tbody>
</table>

5-1/4" Cartridge-type streaming tape drive (slimline)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9001315-0001</td>
<td>Tandberg TDC 3309 9-track drive with TDC 3350 QIC-02 controller and formatter board.</td>
</tr>
<tr>
<td>9001056-0001</td>
<td>DC600A-type 1/4&quot;-inch data cartridge for use with streaming tape drive</td>
</tr>
</tbody>
</table>

SYSTEM CHARACTERISTICS

The following table lists various physical and operational characteristics of the SMS 1000.
TABLE 1-2
SYSTEM CHARACTERISTICS

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>5.25 inches</td>
</tr>
<tr>
<td>Width</td>
<td>19 inches</td>
</tr>
<tr>
<td>Depth</td>
<td>25 inches (27 inches including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>50-60 lbs., based on configuration</td>
</tr>
<tr>
<td>Table-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>6.55 inches</td>
</tr>
<tr>
<td>Width</td>
<td>19.8 inches</td>
</tr>
<tr>
<td>Depth</td>
<td>26.65 inches (including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>50-60 lbs., based on configuration</td>
</tr>
<tr>
<td>Floor-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>25 inches</td>
</tr>
<tr>
<td>Width</td>
<td>10 inches (at base)</td>
</tr>
<tr>
<td>Depth</td>
<td>25 inches (27 inches including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>65-75 lbs., based on configuration</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>10 deg C to 35 deg C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 deg C to 50 deg C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 percent to 80 percent</td>
</tr>
<tr>
<td>Altitude</td>
<td>Sea level to 50,000 feet</td>
</tr>
<tr>
<td>Supply voltage and current</td>
<td>90 volts to 130 volts AC, 6 amps; or 180 volts to 250 volts AC, 3 amps, depending upon switch setting</td>
</tr>
</tbody>
</table>
APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

on power supply. Input a-c line is fused. The a-c input receptacle includes a line filter.

<table>
<thead>
<tr>
<th>Supply frequency</th>
<th>47 Hz to 63 Hz without degradation of operation</th>
</tr>
</thead>
</table>
| DC power supply output voltages | +5 volts at 45 amps.  
                                | +12(C) volts at 4 amps to backplane (cardcage).  
                                | +12(P) volts at 10 amps to peripherals.  
                                | -12 volts at 4 amps.  
                                | +24 volts at 2.5 amps for peripherals and fans.  
                                | Supply has automatic short-circuit protection. All d-c voltages are regulated.  
                                | Maximum peak-to-peak ripple and noise is 50 millivolts for +5 volts, and 100 millivolts for all other voltages, when measured under a constant load of at least 250 watts.  
                                | Maximum power output is 325 watts.  
| DC ON/OFF switch          | Located behind door on front panel. Controls all d-c power to system. |
| Cooling                   | Two fans, each under independent front-panel control, can be set at either a low or medium speed. Also, a third (and highest) speed for either fan can be selected by means of a jumper setting on the backplane. |
| R-F Interference          | Meets or exceeds FCC Class A requirements. |
DIFFERENCES BETWEEN MODEL 40 AND MODEL 41

The following are the differences between the Models 40 and 41:

1. BACKPLANE. The Model 41 can operate only as a data storage subsystem. Its backplane, therefore, contains no CPU or memory and functions primarily as an extension of the host bus. In all other respects such as, for example, distribution of d-c power and communication between the various components of the subsystem, it functions in the same manner as the Model 40 backplane.

2. FOUNDATION MODULE. The SMS 1000 Model 41 uses the same System Foundation Module as the Model 40. There are only two minor differences in how this module is used. The first is that because the Model 41 has no CPU it does not use the Line Time Clock circuits of the Foundation Module. The second is that with no CPU present, the CPU-running signal line (SRUNL) to the Foundation Module is open (i.e. the system is shipped with jumper W12 on the backplane not connected).

INSTALLATION AND OPERATION OF SMS 1000 MODEL 41

INSTALLATION.

In general, site selection and unit-location requirements for the Model 41 are the same as those for the Model 40. Installation instructions are as follows:

1. LOCATION. Locate your Model 41 within ten feet of its host system. Remove all power from both the host system and the Model 41. Loosen the interconnection cable clamp on the rear panel of the Model 41.

2. CABLES. Use the supplied interconnection cable set, consisting of two cables. One cable is marked with the number "5122-0002" and has the designation "J1" marked on each of its two connectors. The other cable is marked with the number "5122-0004" and has the designation "J2" marked on each of its two connectors.

3. Connect the J1 cable (5122-0002) between the connector marked "J1" on the Model 41 rear panel and the connector marked "J1" on the supplied host extender card. The connectors are keyed so that J1 cannot be inserted backwards and cannot be accidentally connected to J2.
NOTES:
1. CAUTION: DUAL WIDTH O-BUS MODULES PLUGGED INTO C-O CONNECTOR SLOTS 1 OR 2 MAY BE DAMAGED.
2. IF JUMPER W9 IS CONNECTED, FULL POWER IS APPLIED TO CARDCAGE AREA FAN B1 (VIA J11).
3. IF JUMPER W9 IS CONNECTED, FULL POWER IS APPLIED TO PERIPHERAL AREA FAN B2 (VIA J12).
4. CORRESPONDING PINS OF J13, J14, J15 AND J16 ARE ALL CONNECTED IN PARALLEL.

Fig. 2 SMS 1000 Model 41 Backplane
APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

4. Connect the J2 cable (5122-0004) between the connector marked "J2" on the Model 41 rear panel and the connector marked "J2" on the host extender card.

5. Tighten the interconnection cable clamp on the rear panel of the Model 41.

6. Plug the host extender card into the selected host backplane slot.

7. APPLYING POWER. You are now ready to apply power to both the host and to the Model 41 subsystem. Remember the special operation requirements given in the following note.

IMPORTANT

It is important to remember that the host cannot operate properly if it is powered up and the Model 41 is not. This is because a deenergized unit on the bus pulls down the various bus lines. If you have a need to power down the Model 41 subsystem at a time when it is necessary to keep the host system running in order to accomplish tasks not associated with the Model 41, you must first disconnect the cables either at the host or Model 41 end before actually powering down the Model 41. Note, also, that if the host is deenergized it is still possible to run the SENSE menu system in the Model 41 because these commands operate independent of the bus.

8. RESTART PRECAUTIONS. If you press the Model 41 front-panel RESTART and "*" buttons simultaneously, in addition to restarting the Model 41 you will also halt host operation because both units share the same bus. If you need to restart the Model 41 while the host is running an application, you should first disconnect the cables between the two units.

CONFIGURING THE MODEL 41.

As it is shipped from the factory, the Model 41 subsystem is configured with certain default parameters whose values differ from those used in the Model 40. Those parameters are listed here so that if it becomes necessary to reconfigure (for example, after reloading EEPROM from EPROM) you will know the exact Model 41 par-
APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

Parameters that need to be entered. Reconfiguration is done by means of the CONFIGURATION portion of the SENSE menus. See Sections 5 and 9 of this manual. The Model 41 configuration settings are:

1. SYSTEM/SUBSYSTEM. Set SYSTEM TYPE in the CONFIGURATION menus from SYSTEM to SUBSYSTEM. The Model 41 default is SUBSYSTEM (refer to SYSTEM TYPE command in Section 9).

2. FIRST DU#. The MODEL 41 default is FIRST DU#=0. When assigning DU numbers for Model 41 peripherals, remember that, in general, the Model 41 DU numbers should not duplicate those used in the host system. Also, note that requirements for DU number assignment may differ between various operating systems. For setting the FIRST DU# parameter, refer to the BOOTSTRAP portion of the CONFIGURATION menus in Section 9.

3. BOOT PROM ADDRESS. The Model 41 configuration setting is 17766000. See the ADDRESSES portion of the CONFIGURATION menus in Section 9.

4. CONSOLE. For the Model 41 the default for the CONSOLE ENAB/DISAB option is DISABLE. See the CONSOLE SETTING portion of the CONFIGURATION menus.

5. PORT BASE ADDRESS. For the Model 41 the configuration default for the PORT BASE ADDRESS option is DISABLE. See the BUS ADDRESSES portion of the CONFIGURATION menus.

6. DU DEVICE ADDRESS. For the Model 41 the configuration default for the DU DEVICE ADDRESS option is 17760334. See the BUS ADDRESSES portion of the CONFIGURATION menus.
APPENDIX F: DESCRIPTION OF SMS 1000 MODEL 41

BACKPLANE JUMPER STRAPPING

The Model 41 backplane as shipped from the SMS factory is fully configured and no user strapping is required. The strapping information is given here only to document this default (as-shipped) configuration. The jumper connections are as follows (see Figure F-2):

E5 TO E6
E7 TO E8

NO CONNECTION TO THE FOLLOWING PINS: E1, E2, E3, E4, E9, E10, E11, E12, E13, E14, E15, E16

W1: IN
W2: IN
W3: IN
W4: IN
W5: IN
W6: IN
W7: OUT
W8: OUT
W9: OUT
W10/1 TO W10/5
W11/1 TO W11/5
W12: OUT
APPENDIX G

DESCRIPTION OF SMS 1000 MODEL 50

GENERAL

The SMS 1000 Model 50 is a complete microcomputer system whose basic structure and architecture is the same as that of the SMS 1000 Model 40. The significant differences between the two models are:

1. BACKPLANE. The Model 50 backplane has 12 slots (as opposed to six in the Model 40). Slots 1, 2 and 3 of the backplane have been modified to permit the use of special quad-wide CPU boards. Because of the special wiring required to accommodate this type of quad board, dual-width boards plugged into any of these three C-D slots may be damaged. The A-B connectors in slots 1, 2 and 3 function in the same manner as those in a standard Q-bus backplane. In all other respects the Model 50 backplane operates in the same manner as the Model 40. Note, however, the special Model 50 backplane priority-strapping instructions given later in this Appendix.

2. POWER SUPPLY. The Model 50 has a 500 watt power supply (as opposed to a 325 watt supply in the Model 40) in order to support its larger backplane. Because of this, the power-supply fuses are larger than those in the Model 40. Fuse-replacement procedures for the Model 50 are given later in this Appendix.

EQUIPMENT SUPPLIED

The following table describes the basic SMS 1000 Model 50 system components that are common to all configurations.

<table>
<thead>
<tr>
<th>TABLE G-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQUIPMENT SUPPLIED</td>
</tr>
<tr>
<td>PART NO.</td>
</tr>
<tr>
<td>------------</td>
</tr>
</tbody>
</table>

SMS 1000 MODEL 50 G-1
### BASIC SYSTEM

<table>
<thead>
<tr>
<th>Component</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSI-11 Q-bus backplane</td>
<td>0005007-0001</td>
<td>This is a 22-bit bus. It contains twelve quad-wide slots that, with the exception of slots 1, 2 and 3, can accommodate any Q-bus-compatible card of dual or quad width. Slots 1, 2 and 3 have restricted C/D connectors. CAUTION: Dual-wide boards plugged into C/D connectors in slots 1, 2, or 3 may be damaged. 18-bit addressing is selectable by opening four jumpers on the backplane.</td>
</tr>
<tr>
<td>Front Panel</td>
<td>0004559-0001</td>
<td>Contains 16-character readout and seven pushbutton switches that provide communication with the SENSE Monitor. Also contains d-c ON/OFF switch (behind door).</td>
</tr>
<tr>
<td>Rear Panel Assembly</td>
<td>0004900-0001</td>
<td>Contains AC power switch and external connectors. Removable panels permit addition of extra connectors, depending upon configuration. Jumpers behind the rear panel permit optional selection of the 20-ma current-loop mode in conjunction with user-supplied equipment.</td>
</tr>
<tr>
<td>Floor-mount, table-mount, or rack-mount system enclosure</td>
<td>0004910-0001</td>
<td>Provides mounting locations for all components of the system, including various choices of peripherals. Also contains cooling fans. Rack-mount configuration includes slides.</td>
</tr>
<tr>
<td>Foundation module</td>
<td>1002086-0001</td>
<td>Contains peripheral control circuits; two RS-232 serial ports; Q-bus control circuits; and all circuits necessary to run the SENSE monitor.</td>
</tr>
</tbody>
</table>
Fig. G-1  Functional Block Diagram of SMS 1000 Model 50
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

---

Power supply (500 watt) 9001305-0001 Switch-selectable for input a-c power of 115 or 230 volts. Provides +5, +12, +24 and -12 volts to the SMS 1000. Power-supply fuse is located in compartment in power-switch housing on rear panel.

---

SYSTEM CHARACTERISTICS

The following table lists various physical and operational characteristics of the SMS 1000 Model 50.

TABLE G-2

SYSTEM CHARACTERISTICS

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>10.5 inches</td>
</tr>
<tr>
<td>Width</td>
<td>19 inches</td>
</tr>
<tr>
<td>Depth</td>
<td>25 inches (27 inches including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>60-70 lbs., based on configuration</td>
</tr>
<tr>
<td>Table-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>11.9 inches</td>
</tr>
<tr>
<td>Width</td>
<td>21.5 inches</td>
</tr>
<tr>
<td>Depth</td>
<td>26.7 inches (including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>65-75 lbs., based on configuration</td>
</tr>
<tr>
<td>Floor-mount system</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>25.2 inches</td>
</tr>
<tr>
<td>Width</td>
<td>14 inches (at base)</td>
</tr>
<tr>
<td>Depth</td>
<td>25 inches (27 inches including bezel)</td>
</tr>
<tr>
<td>Weight</td>
<td>75-85 lbs., based on configuration</td>
</tr>
</tbody>
</table>

---

SMS 1000 MODEL 50 G-4
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

Operating temperature 10 deg C to 35 deg C

Storage temperature -20 deg C to 50 deg C

Humidity 20 percent to 80 percent

Altitude Sea level to 50,000 feet

Supply voltage and current 90 volts to 130 volts AC, 10 amps; or 180 volts to 250 volts AC, 5 amps, depending upon switch setting on power supply. Input a-c line is fused. The a-c input receptacle includes a line filter.

Supply frequency 47 Hz to 63 Hz without degradation of operation

DC power supply output voltages +5 volts at 75 amps.
+12(C) volts at 4 amps to backplane (cardcage).
+12(P) volts at 10 amps to peripherals.
-12 volts at 4 amps.
+24 volts at 2.0 amps for peripherals and fans.
Supply has automatic short-circuit protection. All d-c voltages are regulated.

Maximum peak-to-peak ripple and noise is 50 millivolts for +5 volts, and 100 millivolts for all other voltages, when measured under full load.

Maximum power output is 500 watts.

DC ON/OFF switch Located behind door on front panel. Controls all d-c power to system. System has negligible power consumption with ac on and dc off.
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

Cooling
Three fans, each under independent front-panel control by means of SENSE Monitor commands, can be set at either low or intermediate speed. Also, a third (and highest) speed for any fan can be selected by means of jumper settings on the backplane.

R-F Interference
Meets or exceeds FCC Class A requirements.

INSTALLATION INFORMATION

In general, installation and operation requirements for the Model 50 are essentially the same as those for the Model 40. The only difference involves the selection of power-supply fuses that correspond to the a-c input voltage in use.

SELECTION OF 115-VOLT OR 230-VOLT A-C POWER

The SMS 1000 MODEL 50 system can operate on either of two ranges of input voltage: (1) 90 to 130 volts ac, nominally 115 volts; or (2) 180 to 250 volts ac, nominally 230 volts. Either type of operation can be selected by making a corresponding setting of a rotor-type cam that actuates voltage-selection switches within the fuse compartment. Note, also, that for each supply voltage there is a correct size of power-supply fuse that must be used. These will be described in the following procedure. See Figures G-2 or G-3 for location of the fuse- and voltage-selection compartment. To make the fuse selection and voltage setting, proceed as follows:

CAUTION

An incorrect voltage setting can damage your SMS 1000 Model 50. Before applying power, be sure you know what the line voltage is, that you have made the corresponding voltage setting on the Model 50, and that you have the correct power-supply fuse installed.

1. REMOVAL OF POWER. Turn off the SMS 1000 Model 50 a-c switch on the rear panel and then remove all input power by unplugging the a-c power cord from the receptacle at the rear of the enclosure.
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

DANGER

Potentially lethal voltages can be encountered in the power supply for as long as two minutes after a-c power is removed from it. Therefore, wait at least two minutes after removing power before working on it.

2. FUSE SELECTION. Using a small screwdriver, carefully pry open the fuse- and voltage-select door at the rear of the enclosure, as shown in Figures G-2 or G-3. There is a slot for prying open the door at its left edge.

3. Using a small screwdriver, carefully pry out the white plastic fuse holder from the fuse compartment. If the system is to be set for 115-volt operation, the fuse must be a Buss type ABC (ceramic body), or equivalent, rated at 10 amps. If the system is to be set for 230-volt operation, the fuse must be the same type, but rated at 5 amps.

4. Place the correct fuse in the fuse holder, replace the holder in the fuse compartment, and press the holder all the way to the end of its travel.

5. VOLTAGE SELECTION. Carefully remove from the compartment the irregular-shaped cam having the markings "115Vac" and "230Vac". Note that the shafts on each end of the cam are of different diameters and that they fit into corresponding-width slots. Thus, the cam cannot be re-installed backwards.

6. Turn the cam so that, depending upon the system operating voltage desired, either of the two "115Vac" cam markings, or either of the two "230Vac" cam markings, is facing you after the cam is replaced in its slots.

7. After the cam has been replaced, with the desired voltage marking facing outward, firmly close the compartment door. Be sure that it is fully closed and that the selected voltage setting can be seen through the opening in the door after closure.

8. Reconnect the a-c power cord to its receptacle on the rear panel. Power can now be re-applied to the system.
NOTES:
1. Both side covers are removable by
loosening three screws per cover.
Cover lifts up, then off.
2. Entire unit rolls on six ball casters.
Bottom of pedestal is 0.19 inches
above the floor.
3. All dimensions in inches.

Fig. G-2 SMS 1000 Model 50 Outline drawing: Floor-mounted systems
Fig. G-3  SMS 1000 Model 50 Outline drawing: Rack-mounted systems

NOTES:
1. THIS UNIT FITS INTO ANY 19" EIA STANDARD [RS-310] OR RETMA RACK WITH A 17.75" MINIMUM OPENING
2. ALL DIMENSIONS ARE IN INCHES
CONFIGURING YOUR MODEL 50

With the exception of the following bus-priority procedure, the Model 50 configuration instructions are the same as those for the Model 40. The Model 50 backplane is shipped from the factory wired in the Option 1 (as-shipped) configuration shown below. Strapping information is given here only to document the various alternate options.

ASSIGNING BUS PRIORITY: STRAPPING E1-E16 ON SMS 1000 MODEL 50 BACKPLANEs

The SMS 1000 Model 50 backplane priority-assignment jumper pins, E1 through E16 (see Figure G-4) can be strapped to implement any of three possible priority schemes. These are:

1. **SMS AS-SHIPPED CONFIGURATION:**
   1. **(1) HIGHEST PRIORITY:** CPU (J1A/B on backplane)
   2. **(2) SECOND HIGHEST PRIORITY:** Foundation Module
   3. **(3) NEXT HIGHEST PRIORITY:** Backplane slots J2A/B, through J12C/D, in the sequence shown in the following diagram:

   ![Diagram showing backplane slots J2A/B through J12C/D with priority assignments]

   **CAUTION**
   DUAL-WIDTH Q-BUS MODULES PLUGGED INTO C-D CONNECTOR SLOTS 1,2 OR 3 MAY BE DAMAGED.

   **IMPORTANT**
   Note the serpentine priority-assignment path in the above diagram. The CPU (whether dual or quad) in backplane Slot 1 always has the
highest priority. All backplane slots are listed in order of descending priority. That is, J7C/D has a higher priority than J7A/B; J2A/B has a higher priority than J3A/B, etc. Note that J1C/D, J2C/D and J3C/D are not included in this priority scheme.

The SMS-shipped jumper connections are as follows (refer to Figure G-4 for the location of bus-priority jumper pins):

E1 TO E2
E3 TO E4
E5 TO E6
E7 TO E8
E9 TO E10
E11 TO E12
E13 TO E14
E15 TO E16

2. FIRST OPTIONAL CONFIGURATION:

(1) HIGHEST PRIORITY: CPU (J1A/B on backplane)

(2) SECOND HIGHEST PRIORITY: Backplane slots J2A/B, J3A/B, J4A/B, J4C/D

(3) NEXT HIGHEST PRIORITY: Foundation Module

(4) LOWEST PRIORITY: Backplane slots J5A/B through J12C/D, in the order shown in the above diagram.

To implement this priority scheme, make the following connections:

E1 TO E9
E2 TO E8
E3 TO E11
E4 TO E6
E5 TO E12
E7 TO E10
E13 TO E14
E15 TO E16

3. SECOND OPTIONAL CONFIGURATION:
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

(1) HIGHEST PRIORITY: CPU (J1A/B on backplane)

(2) SECOND HIGHEST PRIORITY: Backplane slots J2A/B through J7A/B, in the order shown in the above priority diagram.

(3) NEXT HIGHEST PRIORITY: Foundation Module

(4) LOWEST PRIORITY: Backplane slots J8A/B through J12C/D, in the order shown in the above priority diagram.

To implement this priority scheme, make the following connections:

E1 TO E14
E2 TO E8
E3 TO E16
E4 TO E6
E5 TO E15
E7 TO E13
E9 TO E10
E11 TO E12

STRAPPING BACKPLANE JUMPERS

The following table describes the as-shipped (default) strapping for backplane jumpers W1 through W11.

<table>
<thead>
<tr>
<th>JUMPER DESIGNATION</th>
<th>SMS AS-SHIPPED CONNECTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>IN</td>
<td>Opening W1, W2, W3 and W4 enables 18-bit addressing</td>
</tr>
<tr>
<td>W2</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W3</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W4</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>W5</td>
<td>IN</td>
<td>Fan 1: highest speed</td>
</tr>
<tr>
<td>W6</td>
<td>IN</td>
<td>Fan 2: highest speed</td>
</tr>
</tbody>
</table>
Fig. G-4  SMS 1000 Model 50 Backplane

NOTES:

1. Do not plug dual-width modules into C-D connectors of backplane slots 1, 2, or 3. To do so may cause damage to dual-width modules.

2. J20: not used
   J19: to fan 3 (card cage)
   J12: to fan 2 (drives)
   J11: to fan 1 (card cage)

3. Corresponding pins of J13, J14, J15, J16, J17, and J18 are all connected in parallel.
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

W7 IN Fan 3: highest speed
pins 1 & 2

W8 OUT Not used

W9 OUT Manufacturing use only

W10 OUT Manufacturing use only

W11 OUT Manufacturing use only

MAINTENANCE INFORMATION

With the exception of the following fuse-replacement procedure, the maintenance instructions for the SMS 1000 Model 50 are the same as those for the Model 40.

POWER SUPPLY FUSE REPLACEMENT

There is only a single user-replaceable fuse in the power supply. CAUTION: before replacing any fuse, always be sure that the problem that caused the fuse to blow has been corrected. To replace the fuse, proceed as follows:

1. Turn off the system a-c switch (on the rear panel) and then remove all a-c input power by unplugging the power cord from its receptacle.

DANGER

Potentially lethal voltages can be encountered in the power supply for as long as two minutes after a-c power is removed from it. Therefore, wait at least two minutes after removing power before working on it.

2. Using a small screwdriver, carefully pry open the door of the fuse- and voltage-select compartment on the rear of the enclosure. There is a slot for prying open the door, at its left edge. Be careful not to disturb the voltage-selection cam at the left side of the compartment. See Figures G-2 or G-3 for compartment location.

3. Using a small screwdriver, carefully pry out the white plastic fuse holder from the fuse compartment.
APPENDIX G: DESCRIPTION OF SMS 1000 MODEL 50

4. Replace the defective fuse in the fuse holder with a Buss type ABC (ceramic body), or equivalent, rated at 5 amps if the system is operating at 230 volts, or 10 amps if the system operates at 115 volts.

CAUTION

Replace a blown fuse only if you have found and corrected the fault that caused it to blow. Be sure to re-install only a correct-amperage fuse corresponding to the supply voltage in use. Too large a fuse will provide inadequate protection. Too small a fuse may fail unnecessarily.

5. Replace the fuse holder in the fuse compartment, making sure that the arrow on the front of the fuse holder points up. Then press in the fuse holder all the way to the end of its travel.

6. Close the fuse-compartment door, making sure that, after it is closed, the correct a-c operating voltage shows through the opening in the door.

7. Replace the a-c power cord in its receptacle.

MODEL 50 INTERCONNECTION WIRING DIAGRAMS

Figures G-5 through G-24 show the interconnection of SMS 1000 Model 50 system components for a wide range of peripheral combinations. Note that all connecting cables between components of the system are identified by their SMS part numbers. For major system component part numbers, refer to Appendix C.
Fig. G-5   SMS 1000 Model 50 cabling diagram. Single 8" floppy configuration. (1002249)
Fig. G-6  SMS 1000 Model 50 cabling diagram. Single 8\" floppy and single Winchester configuration. (1002250)
Fig. G-7  SMS 1000 Model 50 cabling diagram. Single 5 1/4" floppy and single Winchester configuration. (1002252)
Fig. G-8 SMS 1000 Model 50 cabling diagram. Single 5 1/4" floppy and dual Winchester configuration. (1002253)
Fig. G-9  SMS 1000 Model 50 cabling diagram. Dual 5 1/4" floppy configuration (1002254)
Fig. G-10  SMS 1000 Model 50 cabling diagram. Dual 5 1/4" floppy and single Winchester configuration. (1002255)
Fig. G-11  SMS 1000 Model 50 cabling diagram. Dual 5 1/4" floppy and dual Winchester configuration. (1002256)
Fig. G-12  SMS 1000 Model 50 cabling diagram.  Single Winchester configuration. (1002257)
Fig. G-13  SMS 1000 Model 50 cabling diagram. Dual Winchester configuration.  (1002258)
Fig. G-14  SMS 1000 Model 50 cabling diagram. 8" floppy, streaming tape, and single Winchester configuration.
(1002259)
Fig. G-16  SMS 1000 Model 50 cabling diagram.  5 1/4" floppy, streaming tape and dual Winchester configuration.
(1002261)
Fig. G-17  SMS 1000 Model 50 cabling diagram. Streaming tape and single Winchester configuration. (1002262)
Fig. G-18  SMS 1000 Model 50 cabling diagram. Streaming tape and dual Winchester configuration. (1002263)
Fig. G-19  SMS 1000 Model 50 cabling diagram. 8" floppy, cartridge Winchester and single fixed-disk Winchester configuration. (1002264)
Fig. G-20  SMS 1000 Model 50 cabling diagram. 5 1/4" floppy, cartridge Winchester and single fixed-disk Winchester configuration. (1002265)
Fig. G-21  SMS 1000 Model 50 cabling diagram. Single cartridge-Winchester configuration. (1002266)
Fig. G-22  SMS 1000 Model 50 cabling diagram. Single cartridge-Winchester and single fixed-disk Winchester configuration. (1002267)
Fig. G-23  SMS 1000 Model 50 cabling diagram. 8" floppy and streaming-tape configuration. (1002282)
Fig. G-24
SMS 1000 Model 50 cabling diagram: 5 1/4" floppy and streaming-tape configuration. (1002283)
APPENDIX H

DESCRIPTION OF SMS 1000 FILE TAPE OPTION

GENERAL

The SMS 1000 system can be configured with one of two possible tape-backup options. One option is streaming tape backup. This allows offline image copies to be made of the system hard disks, using SENSE. The other option is an online combined file tape backup and image backup capability, termed the "file tape option". Besides the image backup tape function, the file tape option allows the tape drive to back up files individually. This function is also sometimes called an online file archive, conventional, or start/stop tape facility.

Both these options incorporate a Tandberg TDC-3309 9-track streaming tape drive, which is mounted inside the SMS 1000. Tape load and unload access to the tape drive is provided through the SMS 1000 front panel door. A procedure for inserting and write protecting tape cartridges is given in Section 5 of this manual. Strapping information for the tape drive is given in Section 4.

When the tape drive is used for the offline image backup function only (i.e. streaming tape option), a TDC-3350 QIC-02 controller/formatter board is equipped in the SMS 1000, as indicated in equipment supplied Tables 1-1, F-1, or G-1, as applicable. Controller/formatter board connector J3 is cabled to system foundation module connector J109 (via cable part number 0004602), and connector J1 is cabled to signal connector J1 of the tape drive (via cable part number 0004690).

However, when the file tape option is specified, an additional board is added into the above configuration. This board is the file tape interface module (part number 9001425-0001).

As shown in Figure H-1, the dual-height file tape interface module is plugged into one of the SMS 1000 Q-bus backplane slots at the factory, and the system interrupt scheme is configured accordingly. Since the module is a dual-height board, a SMS 1000 Bus-Grant Continuity Card (part number 004670) will generally be installed in the remaining two unused slot connectors. Refer to Section 4 for information on the Bus-Grant Continuity Card.
***CAUTION***

The file tape interface module can be plugged into any backplane slot except C-D connectors of slots 1 and 2 on Model 40/41 systems, or slots 1 through 3 on model 50 systems. These systems are marked with a CAUTION label on the left side of the card cage supporting structure (see Figure 1-5B or G-4, as applicable).

Note that if the file tape interface module is removed from the SMS 1000 backplane at some stage, it must be replaced with a SMS 1000 Bus-Grant Continuity Card (part number 004670). When the file tape interface module is reinstalled in its factory-assigned slot, the Bus-Grant Continuity Card should be removed. If the interface module must be relocated to a different slot due to a system configuration change, the SMS 1000 bus priority jumpers may require reconfiguration. Configuration of the bus priority jumpers is described in Section 4.

As shown in Figure H-1, connector J1 on the file tape interface module is cabled to TDC-3350 controller/formatter board connector J3 (via cable part number 0005222-0001). Cable 0004602, which is associated with the streaming tape option, is not equipped when file tape option is specified. Table H-1 summarizes the equipment supplied for the file tape option.
NOTES:

* = Edge connector

1. CAUTION: The dual-width file tape interface module may be damaged if plugged into C-D connectors of slots 1 or 2 (see text).

Figure H-1. SMS 1000 File Tape Option Cabling Diagram.
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

TABLE H-1

SMS 1000 FILE TAPE OPTION
EQUIPMENT SUPPLIED

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9001315-0001</td>
<td>Tandberg TDC-3309 9-track streaming tape drive with TDC-3350 QIC-02 controller/formatter board.</td>
</tr>
<tr>
<td>0004723</td>
<td>Power interconnect cable (installed between a backplane DC power connector and connector J2 of TDC-3309 tape drive).</td>
</tr>
<tr>
<td>0004690</td>
<td>Cable assembly (installed between TDC-3350 controller/formatter board and TDC-3309 tape drive).</td>
</tr>
<tr>
<td>0004719</td>
<td>Power interconnect cable (installed between a backplane DC power connector and connector J2 of TDC-3350 controller/formatter board).</td>
</tr>
<tr>
<td>9001425-0001</td>
<td>File tape interface module.</td>
</tr>
<tr>
<td>0005222-0001</td>
<td>Cable assembly (installed between file tape interface module and TDC-3350 controller/formatter board).</td>
</tr>
</tbody>
</table>

FILE TAPE INTERFACE MODULE DESCRIPTION

The file tape interface module (part number 9001425-0001) is a dual-height board that can interface a wide variety of 1/4" cartridge streaming tape drives, having QIC-02 standard electrical interface, to a LSI-11 Q-bus. In the SMS 1000, it interfaces the optional Tandberg TDC-3309 9-track streaming tape drive to the SMS 1000 Q-bus. Besides providing an online disk image backup capability, the module contains the logical functions needed to perform online backup of individual files. From the software perspective, the module emulates a standard DEC TSV05 tape subsystem, thereby providing conventional software interface through DEC-standard software I/O drivers.

The interface module is a self-contained file-oriented tape peripheral controller. A set of built-in diagnostics are included to verify proper operation of the module whenever it is initialized or first powered up.
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

Internal operation of the file tape interface and the associated tape drive is transparent to the user. User operational interface to the tape facility is provided through standard DEC operating system utilities, which are described in the applicable DEC software manuals. Some of these manuals are listed under related publications in Section 1. Use of specific utility commands to operate the SMS 1000 file tape facility is described later in this appendix. When using these commands, the tape drive is accessed by specifying device type "MS".

CONFIGURING THE FILE TAPE INTERFACE

The file tape interface module is configured for normal operation when the SMS 1000 is shipped from the factory. Configuration of the module is performed solely by installation or removal of jumpers. Typically, the jumpers will not be changed by the user unless:

* A non-standard tape drive is to be used (i.e. having different characteristics than the Tandberg TDC-3309)

* The file tape interface interrupt priority must be changed

* Operating system software has been, or will be, generated with a device address and/or interrupt vector that is different than the default.

Additionally, one jumper provides an internal diagnostic loop enable capability. The jumper can be installed temporarily to allow loop diagnostic testing of the interface for hardware or software debugging activities. However, this feature precludes normal operation of the module. Rather, it is intended for use by technical support personnel only and, typically, will not be of interest to the user.

Figure H-2 shows the jumper pin locations on the interface module. Table H-2 summarizes the jumper options available. The default jumper configuration, equipped in the SMS 1000 at the factory, is noted in the "DEFAULT SETTINGS" column of the table and in Figure H-2.

Tables H-3 through H-8 indicate the jumper setup details for available strapping options.
NOTE:
Jumpers are shown for factory-preset default configuration.

Figure H-2. File Tape Interface Module Jumper Locations.
### TABLE H-2

**FILE TAPE INTERFACE MODULE JUMPER OPTION SUMMARY**

*(See Figure H-2)*

<table>
<thead>
<tr>
<th>JUMPER PINS</th>
<th>USED FOR:</th>
<th>DEFAULT SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1-E2</td>
<td>Not used</td>
<td>OUT</td>
</tr>
<tr>
<td>E5-E6</td>
<td>Not used</td>
<td>OUT</td>
</tr>
<tr>
<td>E7-E8</td>
<td>Diagnostic loop enable</td>
<td>OUT</td>
</tr>
<tr>
<td>E9-E10</td>
<td>Device address select Bit 0</td>
<td>IN</td>
</tr>
<tr>
<td>E11-E12</td>
<td>Device address select Bit 1</td>
<td>IN</td>
</tr>
<tr>
<td></td>
<td>defined as</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$E9-E10,,E11-E12 = Address(8)$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td></td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td></td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td></td>
<td>OUT</td>
<td>OUT</td>
</tr>
<tr>
<td>E13-E14</td>
<td>Drive configuration (Bit 2) (refer to Table H-7)</td>
<td>IN</td>
</tr>
<tr>
<td>E15-E16</td>
<td>Extended Features Enable</td>
<td>IN</td>
</tr>
<tr>
<td>E17-E18</td>
<td>Drive configuration (Bit 1) (refer to Table H-7)</td>
<td>OUT</td>
</tr>
<tr>
<td>E19-E20</td>
<td>Drive configuration (Bit 0) (refer to Table H-7)</td>
<td>OUT</td>
</tr>
<tr>
<td>E21-E22</td>
<td>Interrupt vector Bit 7</td>
<td>OUT</td>
</tr>
<tr>
<td>E23-E24</td>
<td>Interrupt vector Bit 6</td>
<td>IN</td>
</tr>
<tr>
<td>E25-E26</td>
<td>Interrupt vector Bit 5</td>
<td>IN</td>
</tr>
<tr>
<td>E27-E28</td>
<td>Interrupt vector Bit 4</td>
<td>OUT</td>
</tr>
<tr>
<td>E29-E30</td>
<td>Interrupt vector Bit 3</td>
<td>IN</td>
</tr>
<tr>
<td>E31-E32</td>
<td>Interrupt vector Bit 2</td>
<td>OUT</td>
</tr>
<tr>
<td></td>
<td>(for interrupt vector bit definition, refer to Table H-4)</td>
<td></td>
</tr>
<tr>
<td>E33-E34</td>
<td>Interrupt priority level 5</td>
<td>IN</td>
</tr>
<tr>
<td>E35-E36</td>
<td>Interrupt priority level 4</td>
<td>OUT</td>
</tr>
<tr>
<td>E37-E38</td>
<td>DMA block mode enable</td>
<td>OUT (disabled)</td>
</tr>
</tbody>
</table>
When strapping options are to be changed, BERG 76264-101 (or equivalent) jumper plugs are added or removed from the appropriate pin location(s) shown in Figure H-2. If these or similar jumpers are not available, use number 30 wire wrap between the designated jumper pins.

DEVICE ADDRESS and INTERRUPT VECTOR values for the interface module are selected by jumpering pin groups E9 through E12 and E21 through E32, respectively, as shown in Tables H-2 through H-4. Factory-preset default values are 172520 (octal) for the device address, and 224 (octal) for the interrupt vector. As shown in Table H-3, three alternate device address assignments are available, namely: 172524, 172530, and 172534 (all values octal). The interrupt vector can be set to any number within the range of 0 through 374 (octal), as determined by the vector address (byte) bit/pin arrangement shown in Table H-4. Note, however, that the least significant digit of the vector must be either 0 or 4, since bits 1 and 0 of the vector address byte are not configurable (i.e. always zero). Changing the default device base address or interrupt vector is done merely by adding or removing jumpers, as defined by Tables H-3 and H-4.

For example, the default device address is 172520 (octal), which is selected by installation of jumpers on pins E11-E12 and pins E9-E10, as given in Table H-3. If the address was to be changed from this value to 172534 (octal), both jumpers would be removed (i.e. from E11-E12 and E9-E10).

If default interrupt vector 224 (octal) is to be changed to 104 (octal), a bit equivalency for address vector 104 is determined, namely 010001— (for bits 7 through 2 of the vector address byte, respectively). In turn, Table H-4 shows that jumpers would be installed on pins E21-E22, E25-E26, E27-E28, and E29-E30. Jumpers would be removed from E23-E24 and E31-E32.

***WARNING***

Any change to the factory-preset default device address or interrupt vector jumper configuration may necessitate a change in system software.
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

TABLE H-3

FILE TAPE INTERFACE MODULE
DEVICE ADDRESS CONFIGURATION
(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>ADDRESS OPTION (octal)</th>
<th>JUMPER PINS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E11-E12</td>
</tr>
<tr>
<td></td>
<td>E9-E10</td>
</tr>
<tr>
<td>* Default standard</td>
<td>IN</td>
</tr>
<tr>
<td>address - 172520</td>
<td>IN</td>
</tr>
<tr>
<td>1st alternate address</td>
<td>OUT</td>
</tr>
<tr>
<td>- 172524</td>
<td>IN</td>
</tr>
<tr>
<td>2nd alternate address</td>
<td>IN</td>
</tr>
<tr>
<td>- 172530</td>
<td>OUT</td>
</tr>
<tr>
<td>3rd alternate address</td>
<td>OUT</td>
</tr>
<tr>
<td>- 172534</td>
<td>OUT</td>
</tr>
<tr>
<td>* = Factory-preset default</td>
<td></td>
</tr>
</tbody>
</table>

TABLE H-4

FILE TAPE INTERFACE MODULE
INTERRUPT VECTOR CONFIGURATION
(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>VECTOR (octal)</th>
<th>VECTOR ADDRESS BYTE-SELECTION BITS/JUMPER PINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>224</td>
<td>Octal values:</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Binary equivalent:</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Jumper settings:</td>
</tr>
<tr>
<td></td>
<td>OUT</td>
</tr>
</tbody>
</table>

where OUT = 1, and IN = 0
* = Factory-preset default
Bits 0 and 1 of the vector address byte are always zero and not configurable.
DEVICE INTERRUPT PRIORITY is configured by jumpering pins E33-E34 and E35-E36, as shown in Table H-5. The interface module supports the four level device interrupt scheme compatible with the LSI-11 CPU. However, the interface module only generates interrupts at priority levels 4 or 5. The factory-preset default interrupt level is level 5, which is selected by installation of a pin jumper at pins E33-E34, and absence of a jumper at E35-E36.

If interrupt priority level 4 operation is desired, it can be configured as indicated in Table H-5.

TABLE H-5

FILE TAPE INTERFACE MODULE
INTERRUPT PRIORITY LEVEL CONFIGURATION
(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>PRIORITY LEVEL</th>
<th>JUMPER PINS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E33-E34</td>
</tr>
<tr>
<td>* Interrupt priority level 5</td>
<td>IN</td>
</tr>
<tr>
<td>Interrupt priority level 4</td>
<td>OUT</td>
</tr>
</tbody>
</table>

* = Factory-preset default

The EXTENDED FEATURES mode of operation is selected by installing a jumper on pins E15-E16, as shown in Table H-6. The interface module extended features option is normally enabled in the SMS 1000, as a factory-preset default.

When the extended features option is enabled, 22-bit addressing is provided. This allows the interface module to access memory devices having addresses in the upper region of the Q-bus memory map (i.e. address 200000 octal and above) during DMA operations. When the option is disabled, 16-bit addressing is provided, which limits the address range to 177777 octal maximum.
TABLE H-6

FILE TAPE INTERFACE MODULE
EXTENDED FEATURES CONFIGURATION
(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>EXTENDED FEATURES</th>
<th>JUMPER PINS E15-E16</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Enabled</td>
<td>IN</td>
</tr>
<tr>
<td>Disabled</td>
<td>OUT</td>
</tr>
</tbody>
</table>

* = Factory-preset default

The DRIVE TYPE option is configured by jumpering pins E13-E14, E19-E20, and E17-E18, as shown in Table H-7. The interface module can be configured to interface with a number of different tape drive units. In the SMS 1000, the Tandberg TDC-3309 9-track drive is standard. For this reason, the factory-preset default arrangement is for a cartridge 9-track drive. Besides the TDC-3309 drive, the default setting can accommodate any QIC-02 standard, QIC-24 format 9-track tape drive. As given in Table H-7, the default drive type has been set up by installation of a pin jumper on pins E13-E14, and absence of jumpers on E19-E20 and E17-E18.

If a different drive is to be used, the drive must be compatible with the QIC-02 electrical interface standard, and must be compatible with either QIC-11 or QIC-24 standard tape formats. Cartridge tape drives must also operate at 90 ips. Additionally, the tape drive must correspond to one of the configurable drive types given in Table H-7. Provided the tape drive meets these criteria, configuration of the interface module is accomplished by merely installing and/or removing jumpers, as indicated in Table H-7, for the applicable device type.
TABLE H-7

FILE TAPE INTERFACE MODULE
DRIVE TYPE CONFIGURATION
(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>DRIVE TYPE</th>
<th>JUMPER PINS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E13-E14</td>
</tr>
<tr>
<td>* Cartridge 9-track</td>
<td>IN</td>
</tr>
<tr>
<td>Cartridge 4-track</td>
<td>IN</td>
</tr>
<tr>
<td>Cartridge reserved</td>
<td>IN</td>
</tr>
<tr>
<td>(not used)</td>
<td></td>
</tr>
<tr>
<td>Cartridge 12-track</td>
<td>IN</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>OUT</td>
</tr>
<tr>
<td>Rosscomp 190 MB</td>
<td>OUT</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>OUT</td>
</tr>
<tr>
<td>Cassette 20 MB</td>
<td>OUT</td>
</tr>
</tbody>
</table>

* = Factory-preset default

The DIAGNOSTIC ENABLE option controls loop mode or power up/initialize operation of the interface module's built-in internal diagnostics. The option is configured by installation or absence of a jumper at pins E7-E8, as shown in Table H-8. The factory-preset default is to disable the loop diagnostic capability, by absence of a jumper at E7-E8. With this setup, the interface module's internal diagnostics are only executed once during system power up or reinitialization (i.e. hard or soft reset).

When the interface module is installed in the SMS 1000 system, system power up or reinitialization causes the internal diagnostics to be executed. A comprehensive suite of six internal self tests are performed. When the tests are completed successfully, the green indicator LED on the module will light. Once self test pass status is received, the module is ready to accept commands from the system CPU. If a failure is encountered during the self tests, the LED indicator will remain unlit, and an error message will be displayed on the system console.
Diagnostic loop mode can be enabled by installing a jumper at E7-E8, as indicated in Table H-8. If this mode is enabled, diagnostics are performed continuously from initial power up. This mode precludes normal operation of the interface module, and is intended as a debugging aid only. This mode will not be required for user operations in most cases.

With diagnostic loop mode enabled, the green LED indicator on the interface module will be unlit when self tests begin execution, and will light when self tests are completed successfully. In this case, each successful re-execution of the diagnostics will cause the LED to blink at a consistent rate. If a failure is encountered, the LED will not light, and the self test that failed will be re-executed continuously. When a hard failure is encountered, the LED will not light at all. If a soft or intermittent failure is encountered, the LED will light at erratic intervals.

***WARNING***

If loop diagnostic mode is enabled for debugging or any other reason, ensure that it is disabled (by removing jumper from E7-E8) before normal operation of the SMS 1000 is resumed. Keeping loop diagnostic mode enabled will preclude normal operation of the file tape device.

<table>
<thead>
<tr>
<th>TABLE H-8</th>
</tr>
</thead>
</table>

FILE TAPE INTERFACE MODULE
DIAGNOSTIC ENABLE CONFIGURATION

(See Figure H-2 and Table H-2)

<table>
<thead>
<tr>
<th>DIAGNOSTIC ENABLE</th>
<th>JUMPER PINS E7-E8</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Disabled</td>
<td>OUT</td>
</tr>
<tr>
<td>Enabled</td>
<td>IN</td>
</tr>
</tbody>
</table>

* = Factory-preset default
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

CONFIGURING THE ASSOCIATED TAPE DRIVE

The file tape interface module provides a standard QIC-02 electrical interface compatible with many currently available tape drive units. However, the tape drive must be correctly strapped to operate properly with the module. In SMS 1000 systems shipped with the standard Tandberg TDC-3309 drive, this strapping has already been performed by the factory. If a drive is being added to an existing SMS 1000 system, the strapping will have to be added. In this case, the drive must be strapped to respond as the first tape drive in the system.

For the Tandberg TDC-3309, this is accomplished by configuring the drive as "drive 1". Other drive types may designate the first drive as "drive 0". For strapping of the TDC-3309, refer to the strapping information in Section 4 of this manual. For other drives, refer to the relevant tape drive manual for strapping information.

Note that the TDC-3350 controller/formatter board must be used with the TDC-3309 tape drive. Strapping instructions for the controller/formatter board are also given in Section 4.

TAPE DRIVE CABLING REQUIREMENTS

The file tape interface module connects to the Tandberg TDC-3350 controller/formatter board, or other compatible QIC-02 standard device, through a 50-conductor ribbon cable (part number 0005222-0001). This cable is normally supplied with the SMS 1000 system when the file tape option is included. To connect the cable, proceed as follows:

Install the cable (part number 0005222-0001) between connector J1 of the interface module and connector J3 of the TDC-3350 controller/formatter, ensuring that the red lead of the cable (connector pin 1) is aligned with the arrow on interface module connector J1 (refer to Figure H-2). The cable connector that is connected to the TDC-3350 board is keyed for correct pin orientation.

Figure H-3 is an interconnect diagram of the cable connection. Table H-9 defines the QIC-02 interface signals associated with pin assignments of interface module connector J1.

In unusual circumstances, the 50-conductor cable can be obtained from an independent source, Table H-10 gives a list of required materials (or equivalent) to construct the cable.
Figure H-3. File Tape Interface Module Cabling Interconnect Diagram.
### TABLE H-9

**FILE TAPE INTERFACE MODULE**

**CONNECTOR J1 I/O PIN ASSIGNMENTS**

(Refer to Figure H-3)

<table>
<thead>
<tr>
<th>PIN</th>
<th>MNEMONIC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>BBP</td>
<td>HOST BUS ODD PARITY - reserved for optional odd bus parity</td>
</tr>
<tr>
<td>12</td>
<td>BB7</td>
<td>HOST BUS BIT 7 - MSB of 8-bit bi-directional data bus</td>
</tr>
<tr>
<td>14</td>
<td>BB6</td>
<td>HOST BUS BIT 6</td>
</tr>
<tr>
<td>16</td>
<td>BB5</td>
<td>HOST BUS BIT 5</td>
</tr>
<tr>
<td>18</td>
<td>BB4</td>
<td>HOST BUS BIT 4</td>
</tr>
<tr>
<td>20</td>
<td>BB3</td>
<td>HOST BUS BIT 3</td>
</tr>
<tr>
<td>22</td>
<td>BB2</td>
<td>HOST BUS BIT 2</td>
</tr>
<tr>
<td>24</td>
<td>BB1</td>
<td>HOST BUS BIT 1</td>
</tr>
<tr>
<td>26</td>
<td>BB0</td>
<td>HOST BUS BIT 0 - LSB of 8-bit bi-directional data bus</td>
</tr>
<tr>
<td>28</td>
<td>ONL</td>
<td>ON LINE - This signal is grounded by the interface module to indicate that it is always on-line.</td>
</tr>
<tr>
<td>30</td>
<td>REQ</td>
<td>REQUEST - Signal generated by interface module indicating that command data have been placed on the host bus, or status data have been accepted from the host bus.</td>
</tr>
<tr>
<td>32</td>
<td>RST</td>
<td>RESET - Signal generated by interface module to reset the connected tape drive unit.</td>
</tr>
<tr>
<td>34</td>
<td>XFR</td>
<td>TRANSFER - Signal generated by interface module indicating that write data have been placed on, or read data have been taken from, the host bus.</td>
</tr>
<tr>
<td>36</td>
<td>ACK</td>
<td>ACKNOWLEDGE - Signal generated by tape drive indicating that it has taken write data from, or placed read data on, the host bus.</td>
</tr>
</tbody>
</table>
TABLE H-9 (CONTINUED)

<table>
<thead>
<tr>
<th>PIN</th>
<th>MNEMONIC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| 38  | RDY      | READY - Signal generated by tape drive indicating that:  
1. command data have been taken from the bus,  
2. status data have been placed on the bus,  
3. a rewind, retension, or erase command has been completed,  
4. a buffer is ready to be filled, or a write file mark command can be issued by the interface module (in write mode),  
5. a write file mark command has been completed,  
6. a buffer is ready to be emptied in read mode, or  
7. the tape drive is ready to receive a new command. |
| 40  | EXC      | EXCEPTION - Signal generated by the tape drive to indicate that an exception condition exists within the drive. |
| 42  | DIR      | DIRECTION - Signal generated by the tape drive to control the direction of data transfer on the host bus. False (high) indicates a data transfer from the interface module to the tape drive; true (low) indicates a data transfer from the drive to the interface module. |

NOTE: All odd pins of connector J1 are grounded.

TABLE H-10

INTERFACE MODULE/TAPE DRIVE  
INTERCONNECT CABLE PARTS LIST

(Refer to Figure H-2)

<table>
<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>MFR</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EACH</td>
<td>50-pin socket connector</td>
<td>3M</td>
<td>3425-3000</td>
</tr>
<tr>
<td>1 EACH</td>
<td>50-pin edge connector</td>
<td>3M</td>
<td>3415-0001</td>
</tr>
<tr>
<td>4 FEET</td>
<td>50-conductor ribbon cable</td>
<td>3M</td>
<td>3365-50</td>
</tr>
</tbody>
</table>
HOW TO OPERATE THE FILE TAPE FACILITY

Operational characteristics of the Tandberg TDC-3309 tape drive (with TDC-3350 controller/formatter), and other QIC-02 compatible cartridge tape drives supporting QIC-24 tape format, limit the file tape interface module from fully emulating the DEC TSV05 subsystem. A few operating system utility commands are not supported. This portion of the appendix describes those limitations and points out some typical procedures for operation of the file tape facility. Note that although SMS 1000 system supports XXDP+ diagnostic programs, which are part of the standard DEC operating system utilities, the file tape facility does not. The file tape interface module provides its own built-in diagnostic routines that are performed when the system is powered up or reinitialized.

***IMPORTANT***

The following information does not describe all possible usage options for your operating system. Additionally, the information suggests some typical methods of use, but is not intended as a comprehensive tutorial of operating system capabilities. Therefore, the manuals for your specific operating system should be referenced as required.

OPERATION WITH RT-11

The file tape facility supports a comprehensive set of file and device-oriented backup utilities for RT-11. These include the backup utility program (BUP), the device utility program (DUP), the peripheral interchange program (PIP), and the source and binary compare utilities (SRCCOM AND BINCOM). Although there are several methods of using the tape facility, the following paragraphs outline the optimal method of use based on the file tape interface module architecture. It should be noted that COPY and PIP utilities under RT-11 do not support multi-volume operations. Upon detecting the end of a tape, PIP will prompt with a "Pipe-F-device full" message.

BACKUP UTILITY PROGRAM (BUP). BUP is a specialized file transfer program used to back up or restore large files or volumes. Using this utility, an RL02 or equivalent disk can be backed up in less than three minutes. The program's design makes effective use of the file tape facility's streaming mode. The
following examples show keyboard monitor and applicable command string interpreter (CSI) commands to perform device and file backup and restore operations:

**Keyboard**

Backing up a device from tape:

```
.BACKUP/DEVICE DU: MS:
```

Restoring the device from tape:

```
.BACKUP/DEVICE/RESTORE MS: DU:
```

Backup of a file:

```
.BACKUP DU:FILENAME.EXT MS:
```

Restoring a file:

```
.BACKUP/RESTORE MS:FILENAME.EXT DU:
```

Multi-volume backup operations should be performed as follows:

```
.BAC/DEV DU: MS:
```

Mount output volume in MS0; Continue? Y

```
MS0:/BUP Initialize; Are you sure? Y
```

```
?BUP-I-Creating volume 1
```

Mount output volume in MS0; Continue? Y

```
MS0:/BUP Initialize; Are you sure? Y
```

```
?BUP-I-Creating volume 2
```

```
BUP-I-Copy operation complete
```

**DEVICE UTILITY PROGRAM (DUP).** DUP is used to initialize and create files. Although DUP doesn't make full use of file tape interface features, it provides several alternate backup methods. The following examples show the various DUP functions supported by the file tape facility:
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

Keyboard

Initializing the tape:

.RUN DUP
*MS:/Z

COPY/DEVICE/FILE DU: MS:DU.DSK

Copying a device to a file:

.RUN DUP
*MS:DU.DSK=DU:*.*/I/F

Restoring a device from a file:

.RUN DUP
*DU:*.*=MS:DU.DSK/I/F

Initialize bootable tape:

.RUN DUP
*MS:=DU:MBOT16.BOT/Z

An alternative to BUP for storing multi-volumes on tape:

.RUN DUP
*MS:DU0.DSK=DU0:*.*/I/F
.RUN DUP
*MS:DU1.DSK=DU1:*.*/I/F
.RUN DUP
*MS:DY1.DSK=DY1:*.*/I/F

Restoration of multi-volumes can be selective:

.RUN DUP
*DU:Z/Y
.RUN DUP
*DU:*.*=MS:DY1.DSK/I/F

PERIPHERAL INTERCHANGE PROGRAM (PIP). PIP is a file transfer and file maintenance utility program. Like DUP, the PIP utility does not buffer its I/O data sufficiently to take advantage of the file tape interface's streaming feature. However, all PIP functions are supported by the file tape facility except the VERIFY or /H switch option. Source and binary compare utilities can be used to provide the verify function, when required. An example of PIP commands to copy various types of files to and from the tape facility are as follows:

Keyboard

Copying all MAC files to tape:

.RUN PIP
*MS:/M:-1=DU:*.*.MAC

Copying entire tape to disk:

.RUN PIP
*DU:*.*=MS:*.*/M:0/W
Selective copy of a tape file to disk:

```
.RUN PIP
.COPY MS:ONEFIL.MAC/POS:0 DU: *DU:*.*=MS:ONEFIL.MAC/M:0/W
```

Operations involving multiple file transfers to tape should include the position switch setting of minus one (-1). This eliminates excess tape positioning performed by PIP at the end of each file transfer.

SOURCE AND BINARY COMPARE PROGRAMS (SRCCOM and BINCOM). Source and Binary Compare programs SRCCOM and BINCOM, respectively, perform a comparison of two ASCII or two binary files (respectively) and list the differences between them. The utilities can also be used to perform a file verification function, which is unsupported under PIP. A usage example for each utility follows:

**Keyboard**

**Verification of ASCII files:**

```
.DIFF MS:*.*MAC DU:*.*MAC
```

**Verification of binary files:**

```
.DIFF/BINARY MS:*.*SAV DU:*.*SAV
```

CREATING BOOTABLE RT-ll TAPES. Creating bootable RT-ll tapes is desirable when the file tape facility is used as the primary system backup device. These tapes typically contain executable programs allowing the user to format Winchester disks, perform initial loading of the operating system, and/or restore system backups. The following example command file will create a bootable tape containing all required files. To use the example, substitute the files required for your system, and specify the correct device (disk) designations for your system. The tape generated can be used as one method to add the BUP utility onto a disk, thus allowing restoration of a previously generated BUP backup tape. It could also be used to run standalone programs, such as diagnostics or applications.
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

Command File Example

ASSIGN DUn DIS
ASSIGN MS TAP

| LOGICAL NAME 'DIS:' MUST BE ASSIGNED TO SOURCE DISK
| LOGICAL NAME 'TAP:' MUST BE ASSIGNED TO TAPE BEING BUILT
| INITIALIZE BOOTABLE TAPE
| DIS MT 1/2
| BUILD THE TAPE - FILE ORDERING IS IMPORTANT!
| COPY MDUP FILES
| COPY/SYS DIS:MSBOOT.BOT TAP:MSBOOT.BOT/POS:-1
COPY/SYS DIS:MDUP.MS TAP:MDUP.MM/POS:-1
COPY/SYS DIS:MDUP.MS TAP:MDUP.MT/POS:-1
COPY/SYS DIS:MDUP.MS TAP:MDUP.MS/POS:-1
| COPY MONITOR FILES
| COPY/SYS DIS:SWAP.SYS TAP:SWAP.SYS/POS:-1
COPY/SYS DIS:RT11SJ.SYS TAP:RT11SJ.SYS/POS:-1
| TT MUST FOLLOW MONITOR
| COPY/SYS DIS:TT.SYS TAP:TT.SYS/POS:-1
| COPY ALL DISK HANDLERS
| COPY/SYS DIS:DL.SYS TAP:DL.SYS/POS:-1
COPY/SYS DIS:DY.SYS TAP:DY.SYS/POS:-1
COPY/SYS DIS:DU.SYS TAP:DU.SYS/POS:-1
COPY/SYS DIS:MS.SYS TAP:MS.SYS/POS:-1
COPY/SYS DIS:VM.SYS TAP:VM.SYS/POS:-1
COPY/SYS DIS:NL.SYS TAP:NL.SYS/POS:-1
| COPY SYSTEM UTILITIES
| COPY DIS:PIP.SAV TAP:PIP.SAV/POS:-1
COPY DIS:DUP.SAV TAP:DUP.SAV/POS:-1
COPY DIS:DIR.SAV TAP:DIR.SAV/POS:-1
COPY DIS:IND.SAV TAP:IND.SAV/POS:-1
COPY DIS:BUP.SAV TAP:BUP.SAV/POS:-1
COPY DIS:STARTS.COM TAP:STARTS.COM/POS:-1
| COPY STANDALONE DISK FORMATTER/DIAGNOSTIC
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

COPY DIS:RL02DG.SYS TAP:RL02DG.SYS/POS:-1

Note that the COPY commands in the above example use the qualifier /POS:-1. This keeps the tape from rewinding between each file, making the data transfer operation much faster. Copy operations from tape to disk should use the qualifier /POS:0. This qualifier causes the tape to rewind initially, and precludes tape rewinds between file transfers.

The following bootable tape command file example can be used to build a bootable image of any standalone RT-ll type program. Bootable programs copied to tape using the example will be self-starting, and will prompt the user shortly after the boot operation is started.

Command File Example For Bootable Standalone Programs

ASSIGN DU n DIS
ASSIGN MS TAP

! LOGICAL NAME 'DIS:' MUST BE ASSIGNED TO SOURCE DISK
! LOGICAL NAME 'TAP:' MUST BE ASSIGNED TO TAPE BEING BUILT
!
! INITIALIZE BOOTABLE TAPE
!
INITIALIZE/NOQUERY/VOLUMEID/FILE:DIS:MBOT16.BOT TAP:
RTV5
DIS MT 1/2
!
! COPY STANDALONE PROGRAM ONTO TAPE RENAMING IT MSBOOT.BOT
! SO MBOT16.BOT CAN FIND AND BOOT IT.
!
COPY/SYS DIS:PROGR.BOT TAP:MSBOOT.BOT/POS:-1

Tapes generated by these command files will be bootable using available hardware bootstraps. Once a tape containing MSBOOT is successfully booted, it will give the following prompt:

MSBOOT V05-00
*

If the tape has been booted to load a standalone program, the appropriate program name would be entered in response to the '*' prompt. In response, MSBOOT will search the tape for the desired program, load it into memory, and transfer program control to the starting address of the program. If the tape was booted to load system software or perform a backup operation, the user must enter 'MDUP.MS' to the '*' prompt. The file tape facility will respond by loading MDUP.MS from the tape and prompt with:
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

MDUP V05.01

* The user can initialize the target disk by entering 'DUn:/Z', or cause MDUP to restore the disk by entering 'DUn:A=MS:', where 'DUn:' is the target disk designation. MDUP restores a minimal RT-11 system from the file tape facility and attempts to boot it. Once this minimal system is running, other files on the tape facility can be restored using the COPY command:

COPY/SYS/NOREPLACE MS:*.* DUn:

or

COPY MS:INFILE.EXT DUn:

At this point, the BUP utility can be used to restore backup tape files to the appropriate devices.

Any RT-11 structured STANDALONE PROGRAM can be setup as an MSBOOT bootable program. When such a program is to be executed, the MSBOOT program searches the input device to locate and read the specified file into memory. After successfully loading the program, MSBOOT starts the loaded program at the relative start address minus 2, which is specified in block 0 offset 40 of the program image. Therefore, the program must be designed such that the bootable program start address is preceded by a valid one word instruction, such as HALT, NOP, etc. An alternate method is to modify location 40 of the program as follows:

.R SIPP
*Program.SAV
Base?
Offset?  40
Base Offset Old New?
000000  000040 xxxxxxx xxxxxxx+2
000000  000042 xxxxxxx <CTRL>Y

*<CTRL>C
.

Note that this method requires that the program's location be restored before execution under an RT-11 monitor.

If you are attempting to create a bootable tape, containing only the desired program as described the above Command File Example, it is not necessary to change the start address.

As described previously, all RT-11 utility switch options are supported except the PIP verify function, switch option /V. This option requires the backspace command, which is not cur-
rently supported by the file tape facility. Instead, the source and binary compare utilities can provide this function when required.

NOTE

The file tape facility is fast and reliable for disk backup. However, when used with utilities not designed for high data transfer rates, the tape drive may not stream continuously. If the tape drive stops and starts during backup or restore operations, the cause is probably slow software execution, rather than any characteristic of the file tape facility.

OPERATION WITH RSX-11M

All volume manipulation utilities supported under the multiuser RSX-11M operating system are compatible with the file tape facility. However, the backup and restore utility /VERIFY switch is unsupported, because the file tape interface module will not support backspace operations. If verification is attempted, the file tape facility will generate an error message.

PERIPHERAL INTERCHANGE PROGRAM (PIP). Following is an example of a typical PIP file copy operation:

```plaintext
>ALL MS0:
>INIT MS0:XXX
>MOU MS0:XXX
>PIP
PIP>MS0:DUO:[*,*]*.*:*;*

MTAAP - MOUNT NEXT VOLUME ON MS0: ;This message only
;appears if another ;tape is required to ;complete the file ;transfer.

PIP>
```

BACKUP AND RESTORE UTILITY (BRU). Both online and standalone versions of the BRU utility (BRUSYS.SYS and BRU64K.SYS, respectively) are compatible with the file tape facility. Following are typical examples of backup and restore commands using BRU:
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

Backing up the system device:

>BRU/REWIND/MOUNT/VERIFY SYS: MS:

Restore to a like device:

>BRU/REWIND/VERIFY/INITIALIZE MS: DU:

Restoring a file:

>BRU/REWIND/VERIFY MS:[1,51]BRU64K.SYS DU:

Backing up an account:

>BRU/REWIND/MOUNT DU:[1,54] MS:

Appending an account to a previously generated backup tape:

>BRU/REWIND/MOUNT/APPEND DU:[1,54] MS:

Preparing for account restore:

>PIP [ggg,mmm]*.*;/DE

Restoring account:

>BRU/REW DU:[ggg,mmm]

Comparing previous restore for verification:

>BRU/COMPARE/REW MS: DU:[ggg,mmm]

An example of multivolume BRU:

>BRU/REW/MOU/ DU: MS:

BRU - Starting Tape 1 on MS0:
BRU - End of Tape 1 on MS0:
BRU - Mount Tape 2 on MS0:
BRU - End of Tape 2 on MS0:
BRU - Completed
BRU>
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

CREATING A STANDALONE BRU TAPE. The following example assumes that standalone backup and restore program BRU64K.SYS and BRU64K.STB, its symbol table file, are located in UIC [1,51]:

Build image of standalone program:

>VMR [1,51]BRU64K

Write bootable image:

VMR>SAVE MS:BRU64K

CREATING A BOOTABLE BRU TAPE. The MS: boot program on LSI-11/23 and 11/73 CPU boards will not boot RSX standalone BRU tapes, because the program loads the tape boot block into memory and looks for a NOP (240) in location 0. RSX standalone boot blocks have a BR+20 (410) in location 0 so the program will assume it is not bootable. To use either processor's boot program, the boot block must be patched to contain a NOP (240) in location 0 and a BR+16 (407) in location 2. The following example shows one method of patching to generate a bootable tape:

>VMR
ENTER FILENAME: BRU64K
VMR>SAV MS:BRU64K
VMR><CTRL>Z
>FLX
FLX>MS:[*,*]/DO/LI

DIRECTORY
MS:[0,0]
30-JAN-86
MFRH$/LN8.LAL 257. 15-JAN-86 <40> [40,40]

TOTAL OF 257. BLOCKS IN 1. FILES

FLX>DU0:[1,51]/IM=MS:[*,*].LAL/DO ;Copy the image from tape to disk
FLX><CTRL>Z ;Exit FLX
>RENAME *.* BRU64K,SAV/AB ;Give the file a name
>ZAP ;Invoke ZAP
ZAP>DU0:[1,51]BRU64K.SAV/AB
0/
000: 000000/ 000410
240
407
-X
>FLX
FLX>MS:/ZE/DO ;Initialize the tape
FLX>MS:/IM/DO=DUO:[1,51]BRU64K.SAV/RS ;Copy the patched
;file
FLZ><CTRL>Z ;Exit FLX
> ;Done

RESTORING A BOOTABLE TAPE. After the CPU has been booted from
power up or reinitialized, enable the line clock. Additional
information will then be displayed. Refer to Section 7.5 of
the RSX-11M Utilities manual for further operating instruc-
tions. Since the default vector address established for the MS
device is incorrect in the boot program, it is important to
enter the following command when using the file tape facility
as one of the BRU devices:

MS:/VEC=224

DISK SAVE AND COMPRESS UTILITY (DSC). The disk save and com-
press utility (DSC) and standalone versions (DSCSYS.SYS/
DC64K.SYS) can be used with the file tape facility to save and
restore disk volumes. The following RSX commands are examples
of how to use DSC with the tape facility:
Compressing disk to tape:

>DSC MS:/RW=DU:

Restoring tape to disk:

>DSC DU:=MS:/RS

Comparing input and output volumes:

>DSC DU:=MS:/RW/CMP

OPERATION WITH RSTS

The file tape facility supports the full range of backup pro-
grams under the RSTS timesharing environment. The backup
package of programs allows the user to preserve and recall
files stored under one or more user accounts.

SAVE AND RESTORE UTILITY (SAV/RES). All tape options of the
save and restore function are supported by the file tape facili-
ty. An example of SAV/RES operation is as follows:

Option: SAVRES <CR>

SAV/RES Function: SAVE <CR>
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

From RSTS disk? DU0: <CR>

*** Pack ID/default Save Set Name is "NAME"

To device? MS0: <CR>

*** Save Set Name is "NAME"

Expiration Date <dd-mm-yy>? <LF>

Verify (Yes or No)? No <LF>

Proceed (Yes or No)? Yes <CR>

*** Initiating first SAVE volume

*** Begin SAVE from DU0: to MS0: at hh:mm AM/PM

The SAVRES utility now performs the save operation. After completion, the utility reports results and timing information. If a restore operation is required, it would be performed as above except 'RESTORE' would be entered to the function request prompt.

BACKUP UTILITY. BACKUP is a menu driven utility allowing the user to backup any number of individual accounts or files. All basic functions provided by the utility are supported by the file tape facility. However since the backspace command is not supported by the file tape interface, BACKUP will report an error after execution if the the index file contains more than approximately 160 entries. Even though an error is reported, the tape generated will be good. The index file may be dumped and accounts restored as required. An error is also encountered at the end of tape during a multivolume backup. The message "retry legal" will be displayed. When this error message is received, enter "RETRY <CR">. In turn, the backup utility will rewind the tape, search forward, verify the next record, and request the next volume.

RSTS/E PERIPHERAL INTERCHANGE PROGRAM (PIP). All PIP functions are supported by the file tape facility. A few examples of typical PIP operation follow:

*MS0:/ZE ;Zero MS0:

*MS0: = SY:[1,2] ;Copy all files in account [1,2] onto tape
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

*SY[1,1] = MS0:[1,2]*.SAV ;Copy all files with .SAV
 ;extension in account [1,2]
 ;from tape to system disk
 ;account [1,1]

The following DCL commands demonstrate additional RSTS/E tape operations:

>INIT MS0: ;Initialize the tape
Density will be 1600
Tape will be in DOS format
Any existing files on the tape will be deleted
Proceed (Y or N)? Y
>COPY SY:[2,3] MS0:[2,3] ;DCL logs files copied

[File SY:[2,3]ERRLOG.FIL copied to MS0:[2,3]ERRLOG.FIL]
" "
[File SY:[2,3]ERRDIS.HLP copied to MS0:[2,3]ERRDIS.HLP]
>

PIP does not support multivolume tapes when in DOS format. If this is attempted, the following scenario results:

>PIP
*MS0:/ZE
Really zero MS0:/PARITY:ODD/DENSITY:1600 ? Y
*MS0:[*,*]=SY:[*,*]..*.

Upon reaching end of tape, PIP will prompt with:

? No room for user on device - MS0:[*,*]file.ext

The following command sequences show typical examples of multivolume operation in ANSI mode:

>INIT MS0:
Density will be 1600
Tape will be in ANSI format
Any existing file will be deleted
Proceed (Y or N)? Y
>
>PIP
*MS0:[*,*]=SY:[*,*]..* ;Copy all files

% End of ANSI magtape output volume ; End of tape
% has been reached
APPENDIX H: SMS 1000 FILE TAPE OPTION DESCRIPTION

%Please type the device name and %unit number of the drive where %the next volume may be found? ;New, initialized ;tape must be ;inserted
MSA:
* ;Normal completion

OPERATION WITH MICROVMS

The file tape facility supports file backup and restore operations, provided that the System Program Development option (SYSP) has been included in your version of MicroVMS. Included in the SYSP option is the Magnetic Tape Ancillary Control Process (MTACP), which is required to support the tape facility as a file structured device. The copy function of MicroVMS is not supported since no driver for TS-11 type devices is provided by DEC in baseline MicroVMS.

Some default files, such as SYSLOGIN.COM, equate the INIT command to INIT/NOHIGHWATER. Since magnetic tapes do not support this option, an error occurs during initialization as follows:

$ INIT MSA0: LABEL<CR>
%INIT-F-ILLOPT, qualifier(s) not appropriate to this %device

If this occurs, the SYSLOGIN.COM file can be modified, or the INIT/HIGHWATER command can be used to override the defaults as follows:

$ INIT/HIGHWATER MSA0: LABEL<CR>

MICROVMS BACKUP. The MicroVMS backup facility can be used to backup entire disks, accounts, or individual files. Backup requires that the tape be mounted foreign, which can be accomplished as follows:

$ MOUNT/FOR MSA0:
%MOUNT-I-MOUNTED, mounted on _MSA0:
$

By default, the BACKUP utility uses three data buffers during backup operations. Each of these is 8 kB in size. The utility also performs a cyclic redundancy check (CRC) on save-set data. The following command shows a method for disk image backup using defaults:

$ BACKUP /REWIND /IMAGE
_From: DUA0:
_To: MSA0: LABEL /SAVE_SET
A major improvement in performance can be obtained by invoking the '/NOCRC' switch, since CRC is performed by the file tape facility automatically. This eliminates software CRC calculation on save-set data, thus reducing software execution time. In turn, the tape facility can stream without interruption, reducing the time required for backup operations. The /NOCRC switch is invoked as follows:

```
$ BACKUP /REW /IMAGE /NOCRC
     _From:  DUA0:
     _To:    MSA0: LABEL /SAVE_SET
```

Additional speed improvements can be obtained by increasing the number of buffers used to five, using the '/BUFFER' switch. The size of blocks written to tape can also be increased from 8 kB to 65 kB using the '/BLOCK_SIZE=65354' switch, as follows:

```
$ BACKUP /REW /IMAGE /NOCRC /BUFFERS=5 /BLOCK_SIZE=65354
     _From:  DUA0:
     _To:    MSA0: LABEL /SAVE_SET
```

Using a standalone backup kit, the image save-sets created by the previous command sequences can be restored to disk as follows:

```
$ BACKUP
     _From:  MSA0: LABEL /SAVE_SET
     _To:    DUA0:
```

Refer to the MicroVMS users manual for further information on using the backup command.