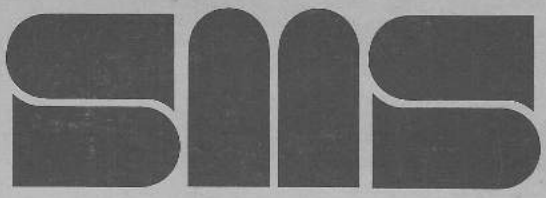

Scientific Micro Systems, Inc.

SMS 1000 MODEL 30
MICROCOMPUTER SYSTEM
OEM MANUAL

OCTOBER 1986

PUBLICATION NO: 3001457
REVISION: A

SMS 1000 MODEL 30

MICROCOMPUTER SYSTEM

OEM MANUAL

15 OCTOBER 1986

****
* PRELIMINARY *
****

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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.

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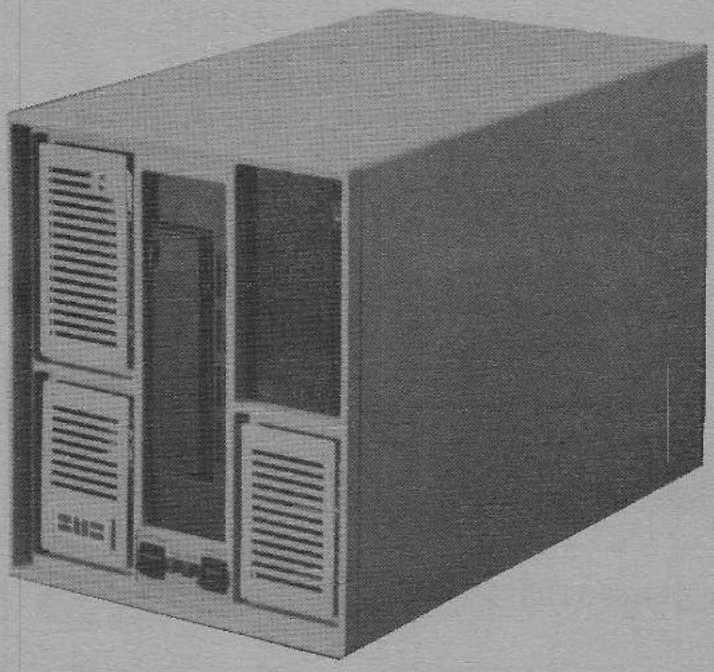

Fig. 1-1 SMS 1000 Model 30 Microcomputer System

(Tape option shown)

SECTION 1

SYSTEM OVERVIEW

INTRODUCTION

GENERAL. The SMS 1000 Model 30 (Figure 1-1) is a single- or multiple-user microcomputer system based on the DEC LSI-11 Q-bus architecture. The basic system consists of (1) a five-slot Q-bus backplane in which user-selected CPU's, memory cards, RS-232 interface cards, and other modules can be installed; (2) a fixed-disk Winchester drive; (3) a choice among removable-media peripherals such as an optional 1/4" cartridge-type streaming tape drive (including its own controller) that permits file-oriented backup, an optional cartridge-type Winchester drive, an optional 8" floppy drive or an optional 5 1/4" floppy drive; (4) an SMS 0107 peripheral-controller board that interfaces with the selected disk devices; and (5) a 250 watt power supply for the complete Model 30 system.

The SMS 1000 Model 30 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. Also, the SMS 1000 Model 30 is fully software compatible with DEC LSI-11 systems. All application and system software developed for the LSI-11/23 and LSI-11/73 CPUs may be operated on the SMS 1000 Model 30 without modification.

SMS 0107 DISK CONTROLLER. The SMS 0107 is a complete single-board (quad-width) controller designed to interface LSI-11 systems with Winchester drives and floppy drives. This controller uses an enhanced version of DEC's MSCP (Mass Storage Control Protocol) and is completely compatible with the DU device driver. The SMS 0107 includes a special set of programs known as the SENSE monitor that permit interactive setting of disk-drive and controller parameters. Additional SENSE functions include diagnostics, disk formatting, Winchester flaw mapping, and selection of bus

addresses. The SMS 0107 also contains controller-resident boot code that will boot DU, MU and MS devices on LSI-11 CPUs. The SMS 0107 disk controller is described in Appendix C of this manual.

MANUAL APPLICABILITY

This manual applies to the SMS 1000 Model 30 only.

PROCESSING POWER

The SMS 1000 Model 30 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 on the SMS 0107 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 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 Model 30 has the processing power to run a wide variety of operating systems, as described in the following paragraphs.

SOFTWARE

The following paragraphs describe various operating systems and languages that can run on your SMS 1000 Model 30. 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. MICROPOWER/PASCAL. With MicroPower/Pascal you can design, build and test real-time application software on a host development 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 Model 30. 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 Model 30. Section coverage of the manual is as follows:

Section 1. Introduction, general description, list of compatible software that can run with the SMS 1000 Model 30; equipment supplied; and tables of system characteristics.

Section 2. Site selection

Section 3. Installation and checkout

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

Section 5. Operating the SMS 1000 Model 30.

Section 6. Testing, maintenance and assembly/disassembly instructions

Appendix A. Peripheral-device Specifications

Appendix B. SMS 1000 Model 30: Table of Major system components

Appendix C. Description and Operation of SMS 0107 Controller

RELATED PUBLICATIONS

The following publications provide background and reference information relating to the SMS 1000 Model 30:

1. MICRO/PDP-11 Handbook. Digital Equipment Corporation, 1983. Publication No. EB-24944-18. This manual describes the various configurations and options available with MICRO/PDP-11 and LSI-11 based systems. A related volume is Microsystems Handbook, Digital Equipment Corporation, Pub. No. EB-26085-41.

2. PDP-11 Architecture Handbook. Digital Equipment Corp., Equipment Corp., 1982. Pub. No. EB-23657-18. Explains architecture of PDP-11/LSI-11 family, including data representation, addressing modes, instruction set, memory, busses,etc.

3. PDP-11 Processor Handbook. Digital Equipment Corporation, 1981. Publication No. EB-19402-20. Describes various levels of CPU's in PDP-11/LSI-11 family. Includes memory management, addressing, and detailed instruction-set description.

4. PDP-11 Microcomputer Interfaces Handbook. Provides users with reference material on characteristics, configuration, and strapping for various interface modules that operate with the

DEC LSI-11 Q-bus. Digital Equipment Corporation, 1983. Publication No. EB-23144-18. NOTE: This manual is the companion volume to the DEC "Microcomputers and Memories Handbook" (1982), Publication No. EB-20912-DP.

5. PDP-11 Systems and Options Handbook. Digital Equipment Corporation, 1984. Publication No. ED-30046-41. This is a catalog of all products associated with the PDP-11/LSI-11. Includes brief descriptions, and an index by part number.

6. PDP-11 Software Handbook. Digital Equipment Corporation, 1982. Publication No. EB-25398-41

7. PDP-11 Software Source Book. Digital Equipment Corp., 1985 (in two volumes). Pub. No. EB-27333-41. This is a catalog of software available for PDP-11/LSI-11 family. It includes full descriptions and ordering information for each program. Programs are cross indexed by operating system.

8. Guide to RT-11 Documentation. Digital Equipment Corporation., 1983. Pub. No. AA-5285G-TC. This guide explains the various intricacies of RT-11 documentation so that you can get where you need to go.

9. Introduction to RSX-11M and RSX-11M-PLUS. Digital Equipment Corporation, 1981. Publication No. AA-L763A-TC

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

11. ULTRIX Software Guidebook: A Reference to UNIX Software. Digital Equipment Corporation, 1984. Publication No. EJ-26153-20. This manual describes a wide variety of applications that run on ULTRIX software.

SYSTEM DESCRIPTION

A disassembly view of the units that make up the SMS 1000 Model 30 is shown in Figure 1-2. The system is designed for ease of disassembly. All fasteners attaching units to the frame are easily releasable by a standard screwdriver. See Figure 1-3 for a diagram showing the four possible peripheral options available with the SMS 1000 Model 30. The units that make up the Model 30 are described as follows:

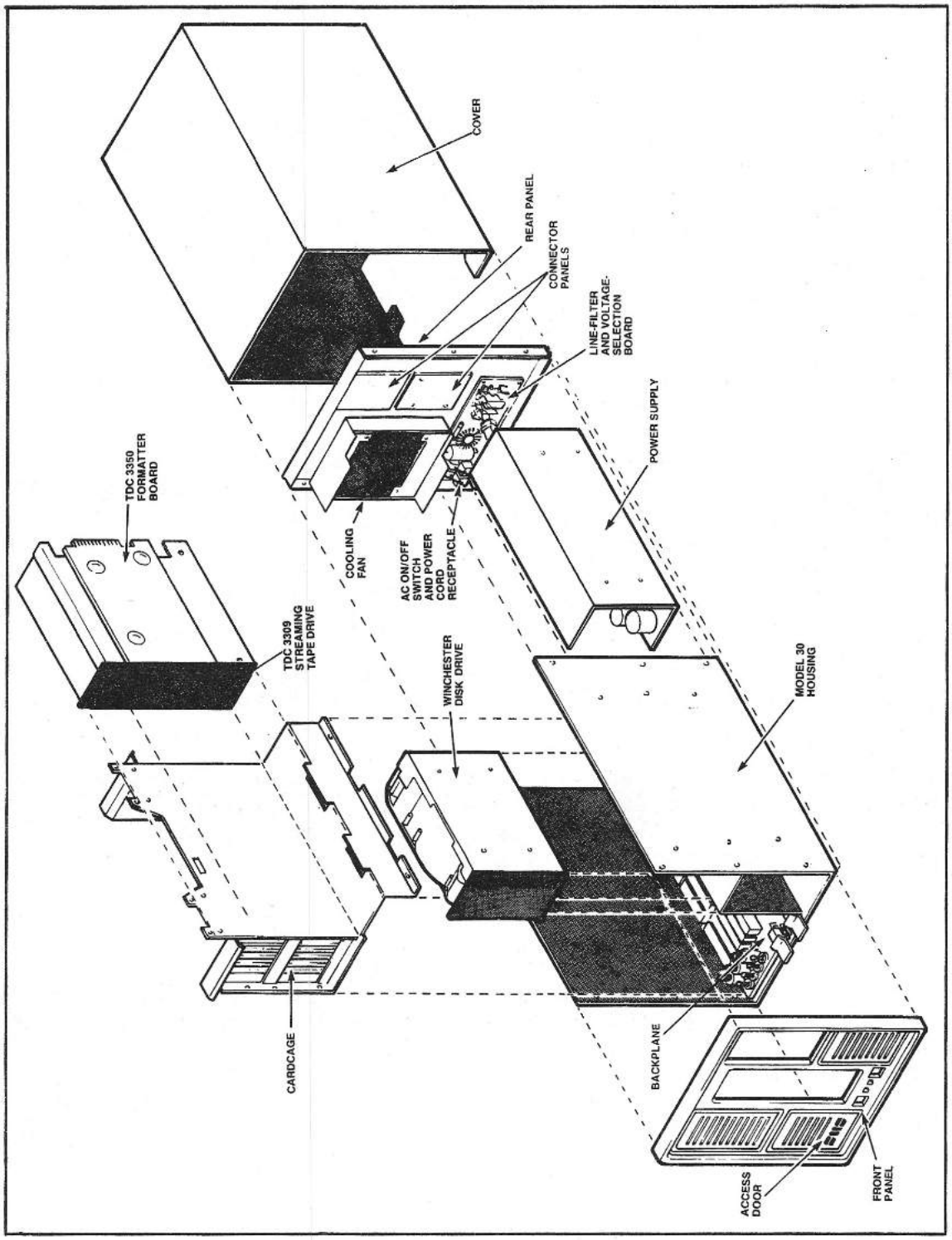

Fig. 1-2 Disassembly of SMS 1000 Model 30

1. ENCLOSURE, FRONT PANEL AND REAR PANEL. The enclosure (see Figure 1-2) contains mounting brackets for the backplane, card cage, power supply and peripheral devices. A door in the front panel opens to allow access to self-test switches and indicator LEDs.

2. BACKPLANE. The backplane (see Figure 1-4) is a group of five quad-width board 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 Model 30 microcomputer. The backplane can accomodate five quad-width Q-bus modules, 10 dual-width 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.

3. POWER SUPPLY (Figure 1-2). The power supply is contained on a single chassis located in a shielded section of the system enclosure. It provides regulated +5 volts, +12 volts and +24 volts for all system components.

4. 5-1/4-INCH WINCHESTER DRIVE. All SMS 1000 Model 30 configurations include one fixed-disk Winchester drive. Storage capacities between 12 and 140 megabytes can be selected.

5. 8-INCH FLOPPY DRIVE. An 8-inch floppy drive can be selected as an option in your SMS 1000 Model 30. This and other floppy drives used in this system are of the slim-line (i.e. half-height) design. The 8" floppy drive always connects to the SMS 0107 controller through a 50-pin-to-34-pin adapter so as to be compatible with the 5 1/4" floppy interface. See Figure 1-3 for a diagram of all currently available SMS 1000 Model 30 peripheral configurations.

6. 5-1/4-INCH FLOPPY DRIVE. The SMS 1000 Model 30 can accommodate an optional 5-1/4-inch, half-height floppy drive, as shown in Figure 1-3.

7. CARTRIDGE-TYPE TAPE DRIVE. File-oriented backup of data can be accomplished by means of an optional 1/4" cartridge-type tape drive. This facility includes a formatter board attached to the tape drive and a dual-width interface board that plugs into the backplane. For a full description of the file-oriented backup option, see Section 5.

8. CARTRIDGE-TYPE WINCHESTER DRIVE. An optional 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.

SYSTEM OPERATION

Figure 1-5 is a block diagram showing information flow between components of an SMS 1000 Model 30 system. The basic SMS 1000 Model 30 system is made up of the backplane into which plug the user-selected CPU, memory boards, and other modules such as the DLV11-J four-port communication interface; the power supply; the SMS 0107 peripheral controller; a fixed-disk Winchester drive; and a choice among various removable-media peripherals.

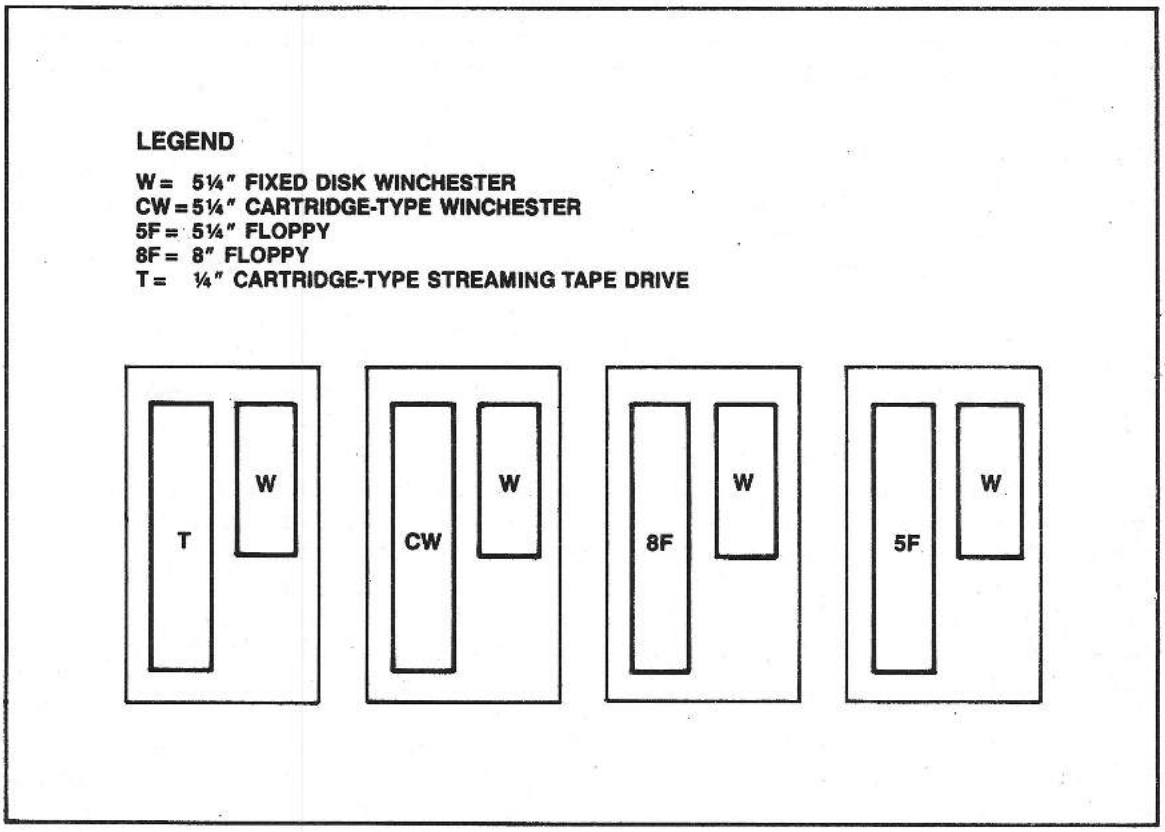

Fig. 1-3 SMS 1000 Model 30: System peripheral options

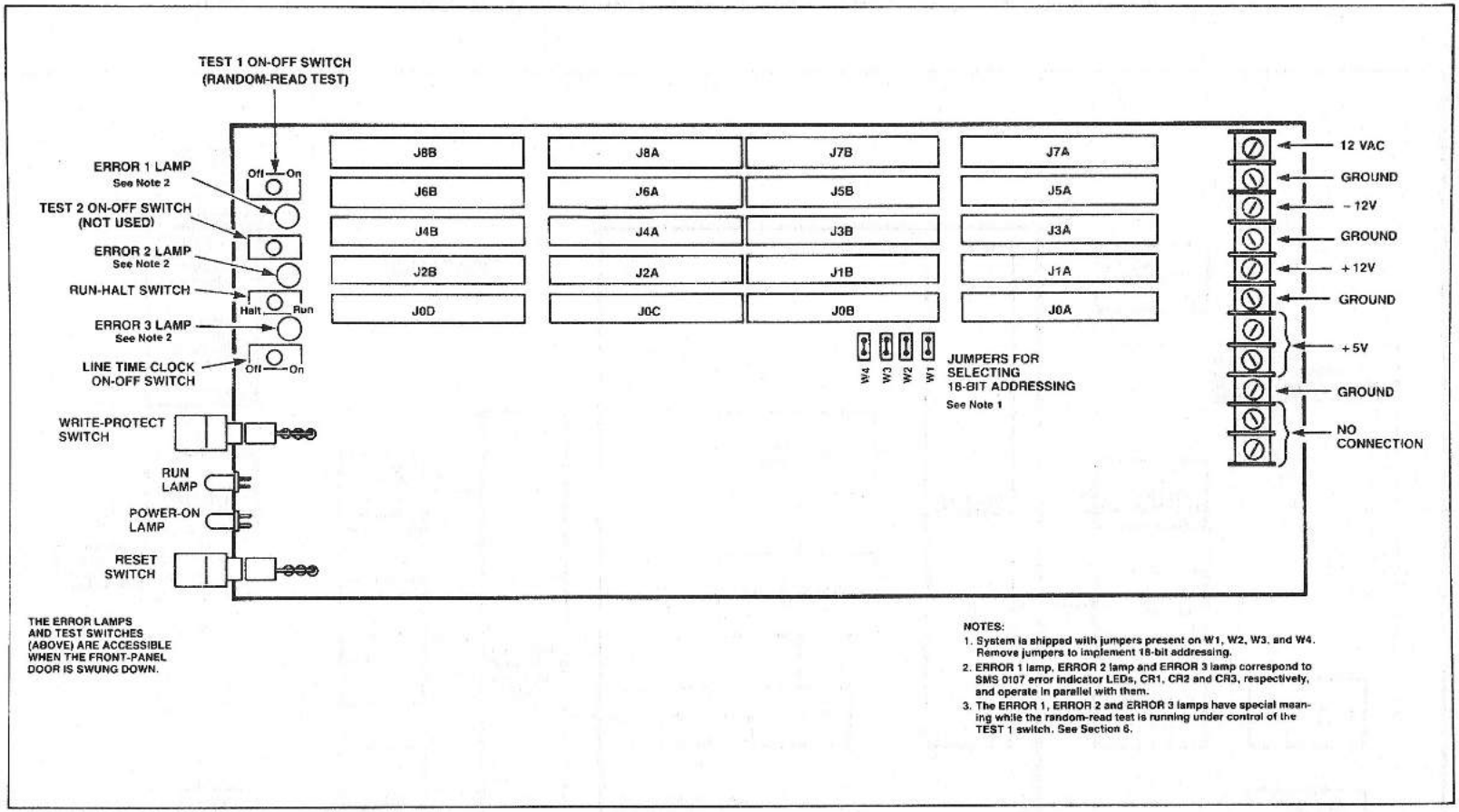

Fig. 1-4 SMS 1000 Model 30: Backplane

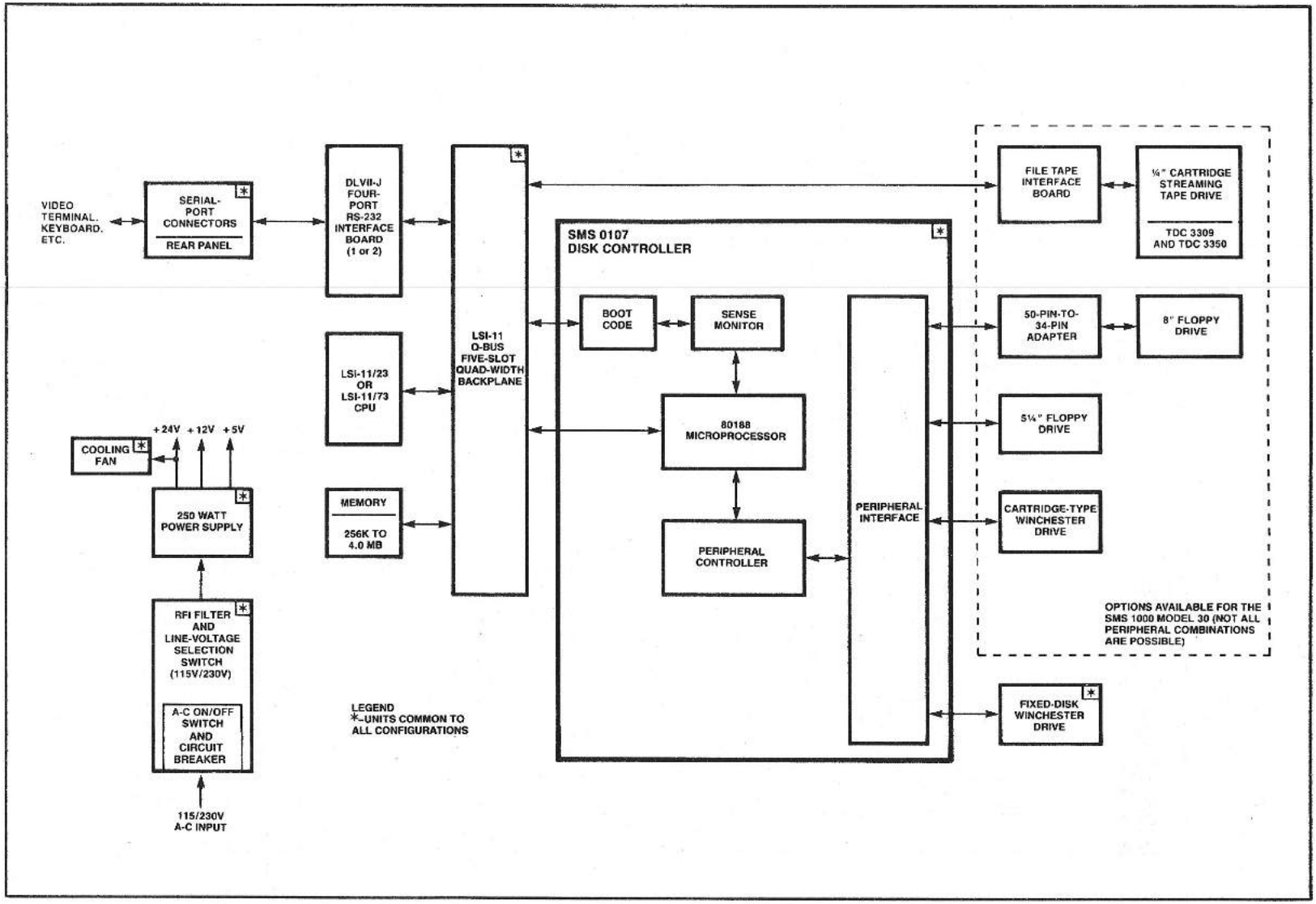

Fig. 1-5 SMS 1000 Model 30: Functional block diagram

SMS 0107 CONTROLLER

The SMS 0107 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, performs flaw mapping and error correction and supports block-mode transfers between the disk and main memory. The SMS 0107 also contains the SENSE Monitor, a ROM-resident set of programs that allow you to perform diagnostics, isolate component failures, 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 they can be changed as necessary, through interaction with the SENSE menu system. SENSE supplies your video display terminal with menus, parameters and test results. Signals from your terminal keyboard permit selection of menus, choice of parameters, the selection of other system functions, and Winchester write protection.

When you run SENSE, various menus associated with its three main functions appear on the video display. These three functions are: Configuration, Operation, and Evaluation. See Appendix C of this manual for a full descripton of SENSE operation and commands.

BOOT PROM. When you power-up or restart the system, the host calls upon the boot prom for the code necessary to initially load the operating system software to be run on the LSI-11 CPU or to activate SENSE. The SENSE monitor communicates with the CPU and other components via the boot code.

BACKPLANE

Modules such as CPU card, memory cards, interface cards, etc., are plugged into a common-circuit board called the backplane (Figure 1-4). The SMS 1000 Model 30 backplane consists of an LSI-11 22-bit Q-bus with five slots, each capable of taking one quad-height printed-circuit board or two dual-height printed-circuit boards. The backplane can accomodate any combination of dual- or quad-height cards.

The Q-bus provides communication among CPU, memory, the SMS 0107 peripheral controller, and the file-tape facility (if used). There are 22 address lines in the Q-bus, corresponding to the 22 bits of the system's physical address space. Sixteen of these 22

lines are timeshared for data transfer. Optionally, 18-bit addressing can be selected by opening four jumpers on the backplane. All bus transactions are asynchronous.

REAR PANEL

The rear panel (Figure 3-1) contains external connectors for RS-232 communication with a terminal, printer, or additional users. The rear panel also contains cutouts to permit the addition of other connectors and external cables. All cutout shapes and dimensions are DEC compatible. Also located on the rear panel is the 115 volt/230 volt selection panel and RFI filter. The a-c power ON/OFF switch is also a 4 amp circuit breaker.

POWER SUPPLY

The power supply for the SMS 1000 Model 30 (Figure 1-2) is contained on a single chassis that supplies all voltages to the backplane, to all peripherals, and to the cooling fan. In addition to the 4-amp circuit breaker that is part of the a-c ON/OFF switch, the power supply is also protected by its own 5-amp fuse. 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.

EQUIPMENT SUPPLIED

The following table describes both the basic SMS 1000 Model 30 system that is common to all configurations and also describes the user-selectable modules, options and peripherals that are available with this system.

TABLE 1-1

EQUIPMENT SUPPLIED

NAME	PART NO. OR DESIGNATION	DESCRIPTION
		BASIC SYSTEM
LSI-11 Q-bus backplane	0004315-0001	This is a 22-bit bus. It contains five quad-width slots that can accomodate any Q-bus compatible card of dual or quad height. 18-bit addressing is selectable by opening four jumpers on the backplane

Front Panel	0004266-0001	Contains RESET and WRITE PROTECT switches, self-test switches, and self-test indicator lamps. Also provides access to removable-media peripheral devices.
Rear Panel Assembly	0004261-0001	Contains A-C power switch, external connectors and cooling fan. A-C power switch also includes a 4-amp circuit breaker.
System enclosure	0004271-0001	Provides mounting locations for all components of the system, including peripheral devices.
Power supply	9001076-0001	Switch-selectable for a-c input of 115 or 230 volts. Provides +5, +12, -12, and +24 volts to the Model 30.
	USER-SELECTABLE CPU MODULES	
LSI-11/23	9000881-0001	KDF11-AA dual-width board. 16-bit CPU with memory management.
LSI-11/73	9001085-0001	KDJ11-AB dual-width board. 16-bit CPU with 8KB cache, floating point, and memory management. Can accommodate FP-73 floating-point upgrade option.
	USER-SELECTABLE MEMORY MODULES	
256KB Card	9001342-0001	22 bit addressing. Does not support block mode. This option includes the MSV11-LK module or equivalent, integration and test.
512KB Card	9001343-00001	22-bit addressing. Supports block mode. This option includes the MSV11-PL module or equivalent, integration and test.
1024KB Card	9001277-0001	22-bit addressing. Supports block mode. This option includes a CMV-254 or equivalent module, SMS strapping, integration and test.

2048KB Card	9001327-0001	22-bit addressing. Supports block mode. This option includes a CMV-504 or equivalent module, SMS strapping, integration and test.
	OTHER USER-SELECTABLE MODULES	
Serial Line Unit	9000829-0001	Interfaces four asynchronous serial RS-232 I/O ports to the LSI-11 bus. This option includes the DLV11-J dual-height module, or equivalent, internal cables, rear panel plate, integration, and test.
Four-Port MUX	9001330-0001	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	9001325-0001	This option is an asynchronous multiplexer which provides eight full-duplex asynchronous serial data channels for Q-bus systems. Applications include data concentration, terminal interfacing, and cluster controlling. The DHV8 option includes the DHV11 dual-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. The FP11 consists of the KEF11-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 LS-11/73. The FP73 option consists of the FPJ11-AA accelerator board, which mounts on the KDJ11-AB CPU board.

USER-SELECTABLE PERIPHERALS

8" Floppy (slimline)	9001258-0001	Tandon Model TM848-2E, double sided/ double density, or equivalent.
5-1/4" Floppy (slimline)	9001256-0001	Panasonic Model JU465, double sided/ 96 TPI, or equivalent.
5 1/4" Winchester fixed-disk drive	9001468-0001	12MB. Half height. Seagate Model ST213 or equivalent.
	9001336-0001	25MB. Half height. Seagate Model ST225 or equivalent.
	9001081-0001	42 MB. Quantum Model Q540, or equivalent.
	9001331-0001	85 MB. Maxtor Model XT-1085, or equivalent.
	9001136-0001	140 MB. Maxtor Model XT1140, or equivalent.
5-1/4" Cartridge-type Winchester disk drive (slimline)	9001524-0001	12MB. SyQuest Model SQ312RD.
	9001525-0001	Type SQ200 removable cartridge used with the SyQuest Model SQ312 drive.
5-1/4" Cartridge-type streaming tape drive for use in file-oriented backup	9001315-0001	Tandberg TDC 3309 half-height 9-track drive with TDC 3350 QIC-02 controller and 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.

SYSTEM CHARACTERISTICS

The following table lists various physical and operational characteristics of the SMS 1000 Model 30.

TABLE 1-2

SYSTEM CHARACTERISTICS

CHARACTERISTIC	DESCRIPTION
Height Width Depth Weight	11.2 inches 9.5 inches 17 inches 35 lbs.
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
A-C Supply voltage and current	90 volts to 130 volts AC, 3.4 amps; or 180 volts to 250 volts AC, 2.1 amps. A-C ON/OFF switch includes a 4 amp circuit breaker.
Supply frequency range	47 Hz to 63 Hz without degradation of operation
DC power supply output voltages	+5 volts at 35 amps. +12 volts at 5 amps. -12 volts at 1 amp. +24 volts at 6 amps. 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 and 100 millivolts for all other voltages, when measured under a constant load of at least 250 watts. Maximum d-c power supplied is 250 watts.
R-F Interference	Meets FCC Class A requirements.

SECTION 2

SITE SELECTION

SITE SELECTION CONSIDERATIONS

In selecting a site for installing your SMS 1000 Model 30 the main considerations relate to such matters as ambient 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 requirements. In general, an office environment that is comfortable for people is suitable for the SMS 1000 Model 30. Place the SMS 1000 Model 30 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 Model 30 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. 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, 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 a diagram showing actual system dimensions, refer to Figure 3-1.

6. COMPUTER SECURITY. Pay attention to the security aspects of potential sites. Avoid high-traffic sites and sites in which access to your SMS 1000 Model 30 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 Model 30 system should not be located near sources of these emissions. Some typical examples of such sources include electric motors, particularly large ones that are nor 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 Model 30 is designated as an FCC class A computing device and is therefore designed exclusively for commercial environments. The SMS 1000 Model 30 is not meant for use in residential areas because of the amount of radiation it emits. Radiation emissions must also be considered with regard to the security and confidentiality aspect of a system's location.

SYSTEM GROUNDING

The SMS 1000 Model 30 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 line. Safety demands that ground continuity be provided at the user's installation. The three-wire a-c line cord supplied with the system permits such ground continuity.

SECTION 3

SYSTEM INSTALLATION AND 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 Model 30 computer unit.

6. Now lift the computer unit from the shipping box. CAUTION: The computer weighs approximately 35 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 cover. See Section 6 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 6-1 through 6-4, for the correct connection.

9. After completing inspection followed by replacement of the cover, the Model 30 is ready to be moved to its working location.

SELECTION OF 115-VOLT OR 230-VOLT A-C POWER

The SMS 1000 Model 30 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 slide switch mounted on the back panel. As shown in Figure 3-1, sliding the switch to the left (using a small screwdriver or similar tool) selects 230-volt operation and sliding it to the right selects 115-volt operation.

CAUTION

> An incorrect voltage setting can damage your SMS 1000 Model 30. Before applying power, be sure you know what the line voltage is, that you have made the corresponding voltage setting on the SMS 1000 Model 30, and that you have the correct power-supply fuse installed.

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 Model 30 system while one of these inserts is in a drive.

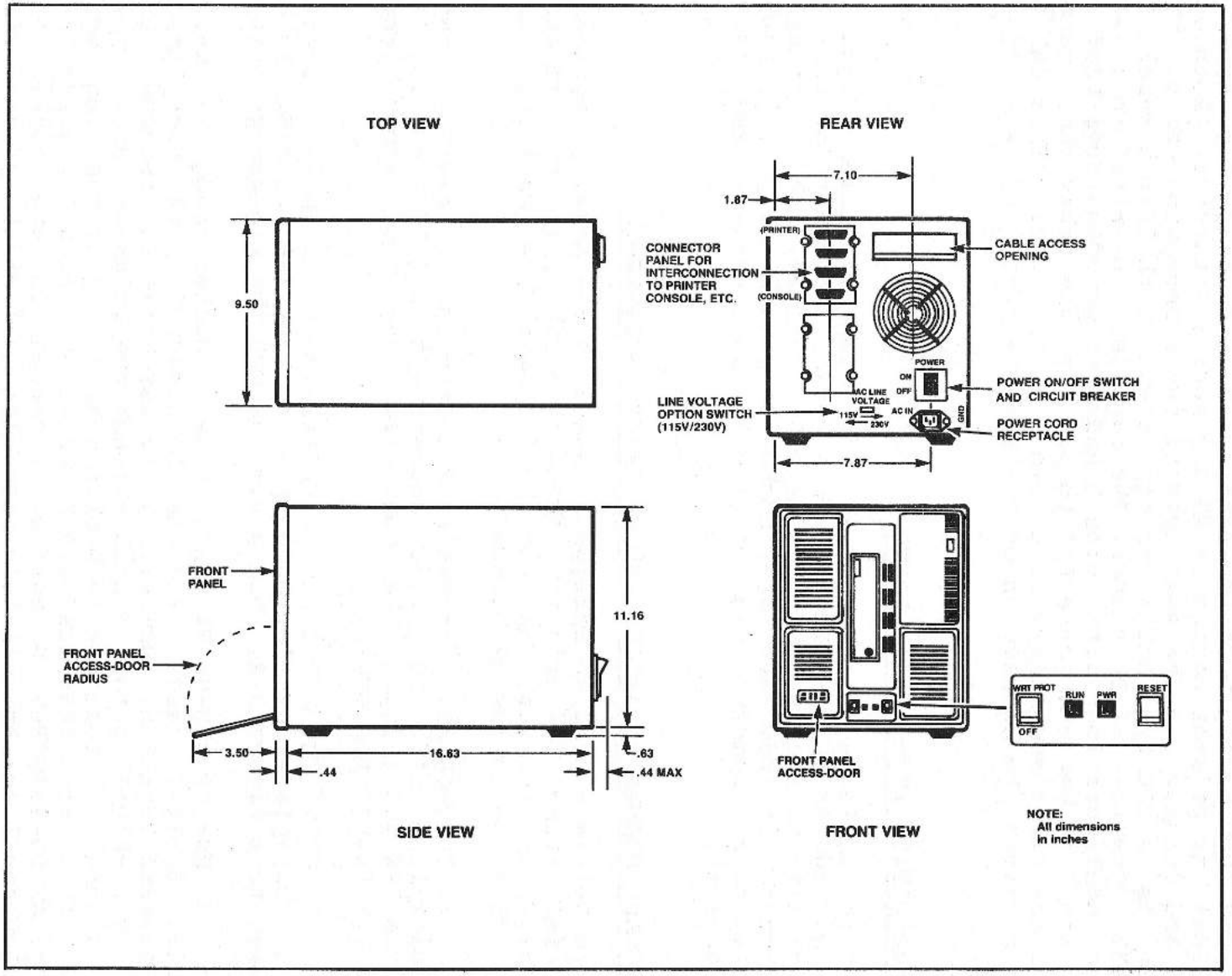

Fig. 3-1 SMS 1000 Model 30

CONNECTION TO CONSOLE AND PRINTER

Your SMS 1000 Model 30 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.

COMMUNICATION WITH SERIAL PORTS

Refer to Section 4 of this manual for complete instructions on configuring the DLV11-J four-channel serial line unit for communication with terminals, printers or other devices. The parameters configured include baud rate, number of data bits, parity, number of stop bits, communication protocol, and address and vector assignments.

BACKPLANE MODULE LOCATIONS AND PRIORITY ASSIGNMENTS

Figure 3-2 is a diagram showing a layout of the Model 30 backplane and indicating the priority scheme, i.e. the priority path among the backplane sockets, that must be followed when inserting modules. Note the following points:

1. CONTROLLER. The SMS 0107 controller is always located in backplane slot J0, i.e. sockets J0A, J0B, J0C and J0D (see Figures 1-4 and 3-2). The controller has the second-highest priority (after the CPU).

2. CPU. The LSI-11/23 or LSI-11/73 CPU is always located in the backplane A-B slot made up of sockets J1A and J1B. As can be seen from Figure 3-2, this gives the CPU the highest priority.

3. USE OF BUS-GRANT CARD. Other modules such as memory boards, DLV11-J cards, etc. may be inserted in the backplane at any desired location. However, it is essential to remember that the "S" shaped priority path through the backplane socket pairs (see Figure 3-2) must not be broken when adding or removing modules. This means that dual-width bus-grant continuity cards (part number AW 0004670 Rev. B) must be inserted in any socket pair (except the last) that is left open when quad-width and dual-width cards are intermixed in the backplane. For full instructions on use of the bus-grant cards, refer to the configuration instructions in Section 4 of this manual.

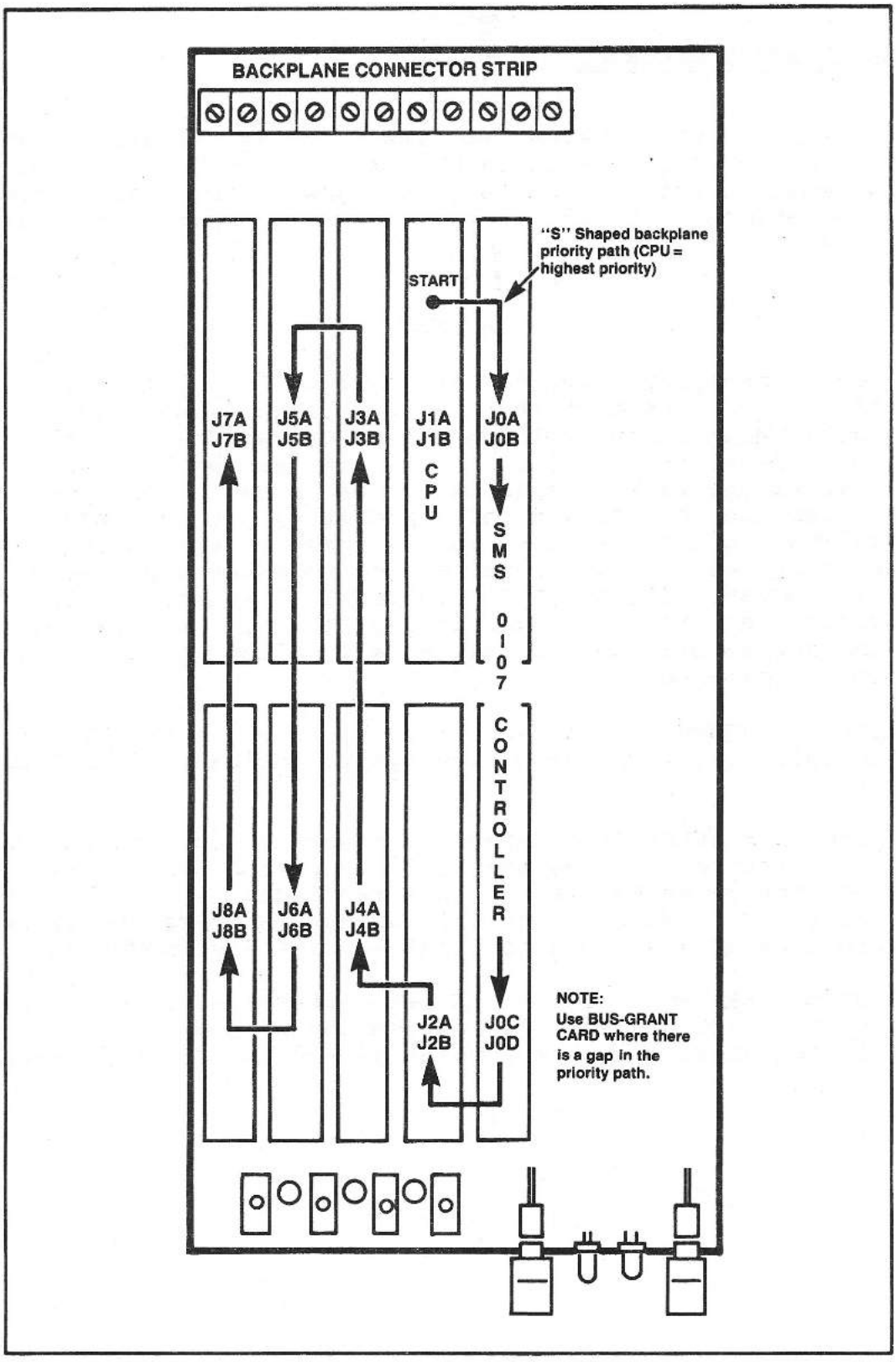

Fig. 3-2 Backplane priority scheme

POST-INSTALLATION CHECKOUT

After installing your system in its working location, making connections to external units and plugging in both the SMS 1000 Model 30 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 voltage-selection window on the rear panel (Figure 3-1) 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 or the circuit breaker will blow, and damage to other components will occur. If your SMS 1000 Model 30 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 "1" side of the switch at the rear of the system enclosure (see Figure 3-1).

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 procedure for checking out initial system operation assumes the presence of a video data terminal with your Model 30.

3. SYSTEM OPERATION. For a complete description of system operation, starting with the application of power and including all self-test sequences, refer to Section C3 of Appendix C.

SECTION 4

HARDWARE CONFIGURATION

INSTRUCTIONS

POWER-SUPPLY LOADING RULES

All of the following three 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 Model 30 power supply. The four basic rules are:

1. TOTAL POWER OUTPUT. The total power output must not exceed 250 watts.

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

SUPPLY	MAXIMUM CURRENT (AMPERES)
+5 VOLTS	35
+12 VOLTS	5
-12 VOLTS	1
+24 VOLTS	6

4. CURRENT CONSUMPTION OF INDIVIDUAL UNITS. The following table lists the current consumption (by supply) of SMS 1000 Model 30 individual system components including some typical backplane modules. (For the current consumption of other modules consult 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 4-1

CURRENT CONSUMPTION OF INDIVIDUAL UNITS

COMPONENT NAME	CURRENT CONSUMPTION (BY SUPPLY) (AMPERES)			
	+5V	+12V	-12V	+24V
SMS 0107 controller	5.0	-	-	-
5 1/4-inch Winchester drive (Range of typical values)	0.7 to 1.7	0.9 to 2.4	-	-
5 1/4-inch floppy	1.0	1.5	-	-
8-inch floppy	1.0	-	-	1.8
Streaming tape drive (Tandberg TDC 3309/3350)	3.1	1.0	-	-
File tape interface board	3.0	-	-	-
Cooling fan	-	-	-	0.3
KDF11-AA (LSI-11/23)	2.0	0.2	-	-
KDJ11-AB (LSI-11/73)	4.5	-	-	-
MSV11-LK (256KB)	3.45	-	-	-
MSV11-PL (512KB)	3.60	-	-	-
CMV-250 (256KB)	2.0	-	-	-
CMV-500 (512KB)	2.0	-	-	-

CMV-1000 (1024 KB)	2.8	-	-	-
CMV-254 (1024 KB)	2.0	-	-	-
CMV-504 (2048 KB)	2.0	-	-	-
DLV11-J (Serial line unit)	1.0	0.25	-	-
DZQ11 (Four-port MUX)	1.15	0.39	-	-
DHV11 (Eight-port MUX)	4.3	0.475	-	-

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

COMPONENT		CURRENT CONSUMPTION (BY SUPPLY) (AMPERES)			
NAME	QUAN-TITY	+5V	+12V	-12V	+24V
SMS 0107 CONTROLLER	1	5.0	-	-	-
COOLING	1	-	-	-	0.3

FAN					
WINCHESTER DRIVE	1	1.0	2.5	-	-
8-INCH FLOPPY	1	1.0	-	-	1.8
KDF11-AA (LSI-11/23)	1	2.0	0.2	-	-
MSV11-LK (256KB)	1	3.45	-	-	-
TOTAL CURRENT: (BY SUPPLY)		12.45	2.7	0.0	2.1
POWER (WATTS): (BY SUPPLY)		62	32	0	50
TOTAL POWER CONSUMPTION:		144 WATTS			

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

COMPONENT		CURRENT CONSUMPTION (BY SUPPLY) (AMPERES)			
NAME	QUAN-TITY	+5V	+12V	-12V	+24V
SMS 0107 CONTROLLER	1	5.0	-	-	-
COOLING FAN	1	-	-	-	0.3
WINCHESTER DRIVE	1	2.0	5.0	-	-
5 1/4-INCH	1	2.0	3.0	-	-

FLOPPY					
KDJ11-AA (LSI-11/73)	1	4.5	-	-	-
MSV11-PL (512KB)	2	7.2	-	-	-
DZQ11 (FOUR-PORT MUX)	1	1.1	0.4	-	-
TOTAL CURRENT: (BY SUPPLY)		21.9	8.4	0.0	0.3
POWER (WATTS): (BY SUPPLY)		109	98	0	7
TOTAL POWER CONSUMPTION:		214 WATTS			

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 to ground, when the line is in the high (i.e. undriven or unasserted) condition. The 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 a total of 20 dc loads and 35 ac loads.

TABLE 4-4
BUS LOADING OF INDIVIDUAL SMS 1000 MODEL 30 MODULES

MODULE DESIGNATION	A-C LOAD	D-C LOAD
SMS 0107 Controller	2.0	1
KDF11-AA (LSI-11/23)	2.0	1

KDJ11-AB (LSI-11/73)	3.4	1
MSV11-LK (256KB)	2.0	1
MSV11-PL (512KB)	2.0	1
CMV-1000 (1024KB)	2.0	1
CMV-504 (2048KB)	1.0	1
CMV-254 (1024KB)	1.0	1
CMV-250 (256KB)	1.0	1
CMV-500 (512KB)	1.0	1
DLV11-J	1.0	1
DZQ11	1.0	1
DZV11	4.1	1
DHV11	2.9	1
File-tape interface board	2.0	1

NOTE: For any configuration, the maximum bus loading must not exceed a total of 20 dc loads and 35 ac loads.

BUS PRIORITY

Refer back to Figure 3-2 for a diagram showing a layout of the Model 30 backplane and indicating the bus priority scheme, i.e. the priority path among the backplane sockets, that must be followed when inserting modules. Note the following points:

1. CONTROLLER. The SMS 0107 controller is always located in backplane slot J0, i.e. sockets J0A, J0B, J0C and J0D (see Figures 1-4 and 3-2). The controller has the second-highest priority (after the CPU).

2. CPU. The LSI-11/23 or LSI-11/73 CPU is always located in the backplane A-B slot made up of sockets J1A and J1B. As can be seen from Figure 3-2, this gives the CPU the highest priority.

3. USE OF BUS-GRANT CARD. Other modules such as memory boards, DLV11-J cards, etc. may be inserted in the backplane at any desired location. However, it is essential to

remember that the "S" shaped priority path through the backplane socket pairs (see Figure 3-2) must not be broken when adding or removing modules. This means that dual-width bus-grant continuity cards (part number AW 0004670 Rev. B) must be inserted in any socket pair (except the last) that is left open when quad-width and dual-width cards are intermixed in the backplane. For full instructions on use of the bus-grant cards, refer to the following paragraphs.

USING BUS-GRANT CONTINUITY CARD (Part No. AW 0004670 Rev. B)

If the priorities of the modules you insert in the backplane require a dual-width module to be located between two quad-width modules, you will have to insert a bus-grant continuity card (part number AW 0004670 Rev. B) 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 into the backplane in the following manner:

1. Only one connector of the card has contacts. When necessary to use the card, plug these contacts into ONLY the "A" connectors of the backplane, i.e. J1A, J3A, J5A, J7A, J2A, J4A, J6A, or J8A, as shown in Figures 1-4, 6-1, 6-2, 6-3, or 6-4.

2. The solder side of the bus-grant card must face AWAY FROM the power supply and peripherals.

3. Never plug the bus-grant card into the first slot of the backplane, i.e. J0A, J0B, J0C, and J0D. This slot is reserved for the SMS 0107 controller.

STRAPPING SMS 1000 Model 30 SYSTEM MODULES

GENERAL. The following instructions describe how to perform strapping, i.e. adding configuration jumpers, to various SMS 1000 Model 30 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 changes in such areas as baud rate, character format, vector assignments, channel configurations, etc. 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 DHV11 boards made by both DEC and Camintonn (Figures 4-9A and 4-9B).

10. SMS 0107 CONTROLLER. For instructions on how to configure the SMS 0107 controller refer to Appendix C, Section C2 (Figure C2-1).

11. Tandberg TDC 3309, TDC 3350 and File Tape Interface board. For strapping instructions on the TDC 3309 and TDC 3350, see the peripheral-device strapping instructions later in this section. For instructions on strapping the File Tape Interface board, see the File Tape portion of Section 5 (Figure 5-1).

ADDING 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 Model 30.

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 Model 30 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
STRAPPING JUMPERS W1 THROUGH W18
(See Figure 4-1)

JUMPER DESIGNATION	JUMPER FUNCTION	SMS-SHIPPED CONFIGURATION	ALTERNATE CONFIGURATION AND/OR REMARKS
W1	Enable master clock	IN	Do not remove (Manufacturing only)
W2	Reserved (Mfg. only)	REMOVED	Do not install
W3	Reserved (Mfg. only)	IN	Do not remove
W4	BEVENT line enable	REMOVED	
	BEVENT line disable		Jumper IN = disable BEVENT line
W5 W6	Power-up Mode 2. Execute boot.	W5 REMOVED W6 IN	

	Power-up Mode 0. PC@24, PS@26 (octal)		W5 REMOVED W6 REMOVED
	Power-up Mode 1. Enter ODT.		W5 IN W6 REMOVED
	Power-up Mode 3. Reserved (extended microcode)		W5 IN W6 IN
W7	Enter ODT on halt	REMOVED	
			Jumper IN = Trap to location 10 (octal) on halt
W8	Power-up bootstrap address = 173000 (octal)	IN	
			Jumper REMOVED = power-up bootstrap address is given by jumpers W9-W15
W9 W10 W11 W12 W13 W14 W15	Select the high seven bits of the bootstrap starting address	W9-W15 IN	This address disregarded when jumper W8 is IN
W16	Reserved (Mfg. only)	IN	Do not remove
W17	Reserved (Mfg. only)	IN	Do not remove
W18	Wake-up circuit disable	IN	
			Jumper REMOVED = enable wake-up circuit

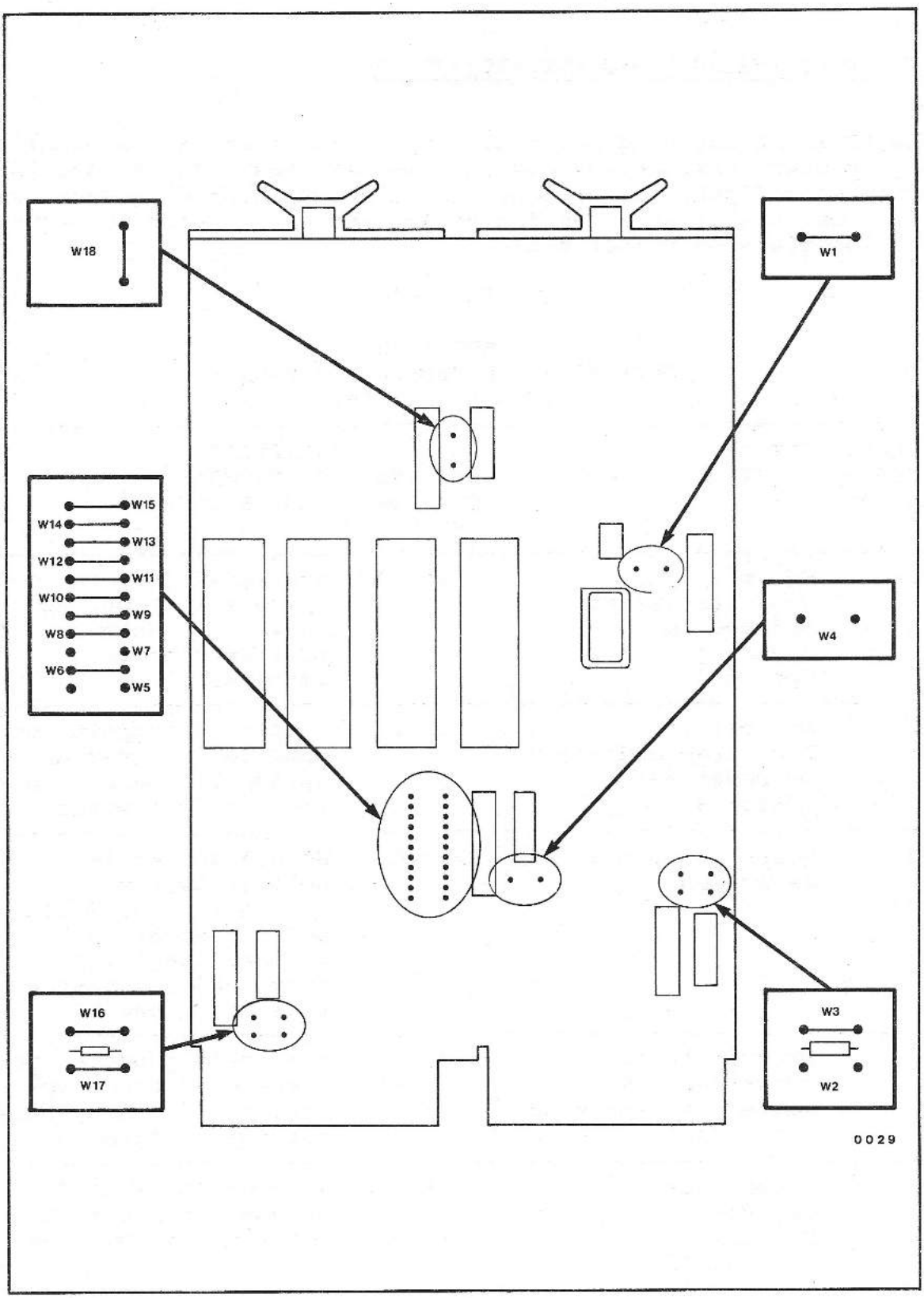

Fig. 4-1 Location of jumper pins on KDF11-AA (LSI-11/23)

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 4-6

KDJ11-AB
SETTING UP JUMPERS W1 THROUGH W9
(See Figure 4-2)

JUMPER DESIGNATION	JUMPER FUNCTION	SMS-SHIPPED CONFIGURATION	ALTERNATE CONFIGURATION AND/OR REMARKS
W1	Set bit 15 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.
W2	Set bit 14 of bootstrap address in Power-up Option 3.	IN	System is jumpered to operate in Power-up Option 2. Hence, this setting is ignored.
W3	Power-up option selection	REMOVED	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.
W4	Set bit 13 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.
W5	Determines processor response to a HALT.	IN	With W5 IN, a HALT causes processor to enter Micro-ODT mode.
			With W5 REMOVED, a HALT causes the pro-

			cessor to trap to location 4 and set bit 7 of CPU error register.
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,

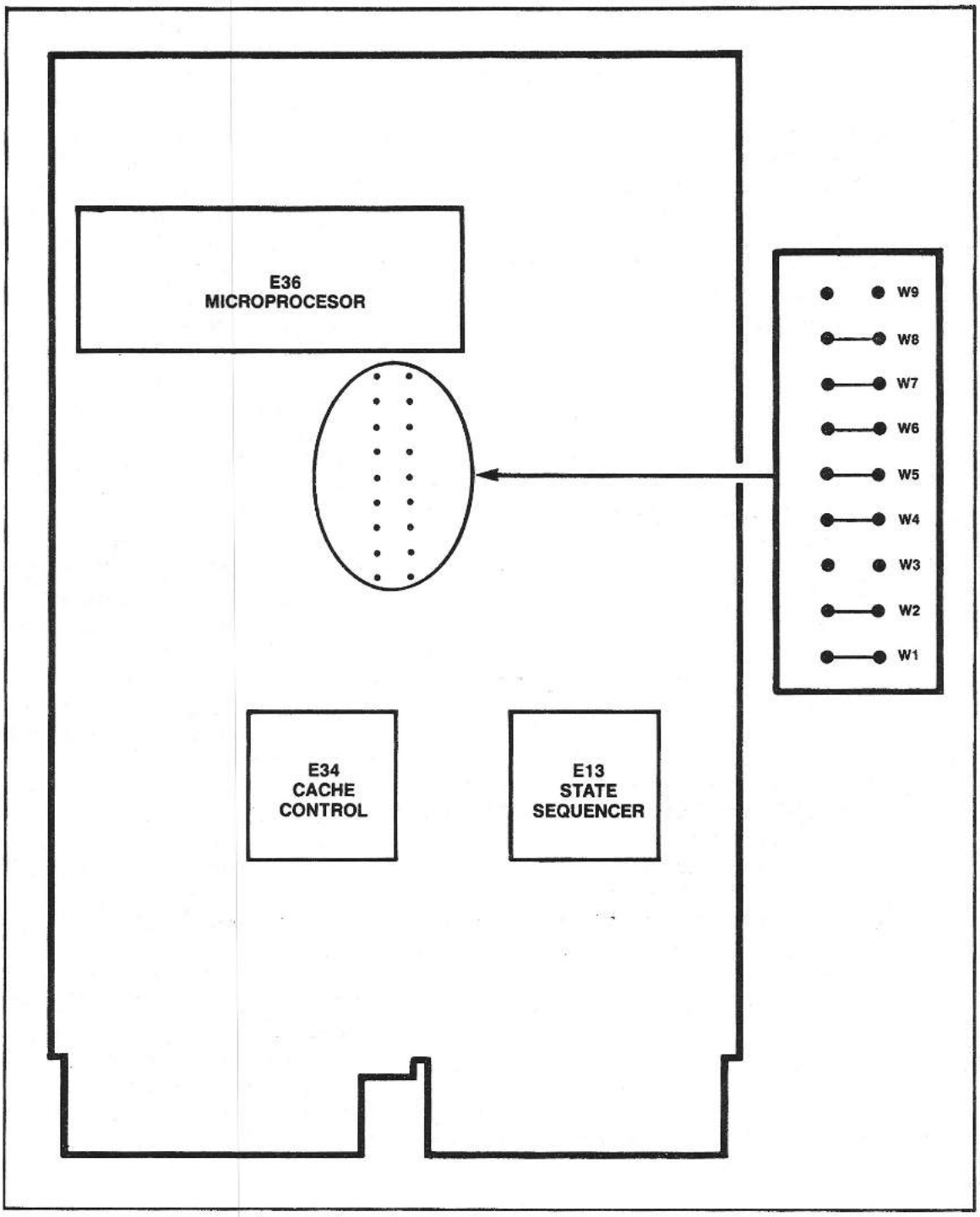

Fig. 4-2 Location of jumper pins on KDJ11-AB (LSI-11/73)

respectively. The processor then either services pending interupts 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 Model 30.

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 4-7

W3 AND W7 POWER-UP OPTION STRAPPING FOR THE KDJ11-AB

POWER-UP OPTION NO.	JUMPER W3	JUMPER W7	REMARKS
0	IN	IN	PC = 24 PS = 26
1	IN	REMOVED	Micro-ODT PS = 0
2	REMOVED	IN	PC = 173000 PS = 0
NOTE: This strapping is the SMS-shipped configuration.			
3	REMOVED	REMOVED	W1,W2,W4,W6 give bootstrap starting address. PS = 340.
NOTE: All addresses are in octal.			

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.

(See Figure 4-3)

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

PERIPHERAL PAGE SELECTION	
2K peripheral page	29 to 28
4K peripheral page	27 to 28
FULL OR ONE-HALF MEMORY SELECTION	
Half memory	32 to 33
Full memory	34 to 33
REMOVAL OF LOWER OR UPPER BANK (WITH A FAULT)	
Failed lower bank	17 to 16
Normal operation or failed upper bank	15 to 16
EXTENDED OR NORMAL MEMORY SELECTION	
128K words. (small system) Normal operation	R to T OUT
Greater than 128K words. (large system) Extended operation.	R to T IN

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 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 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:

PSA = MSA - 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.

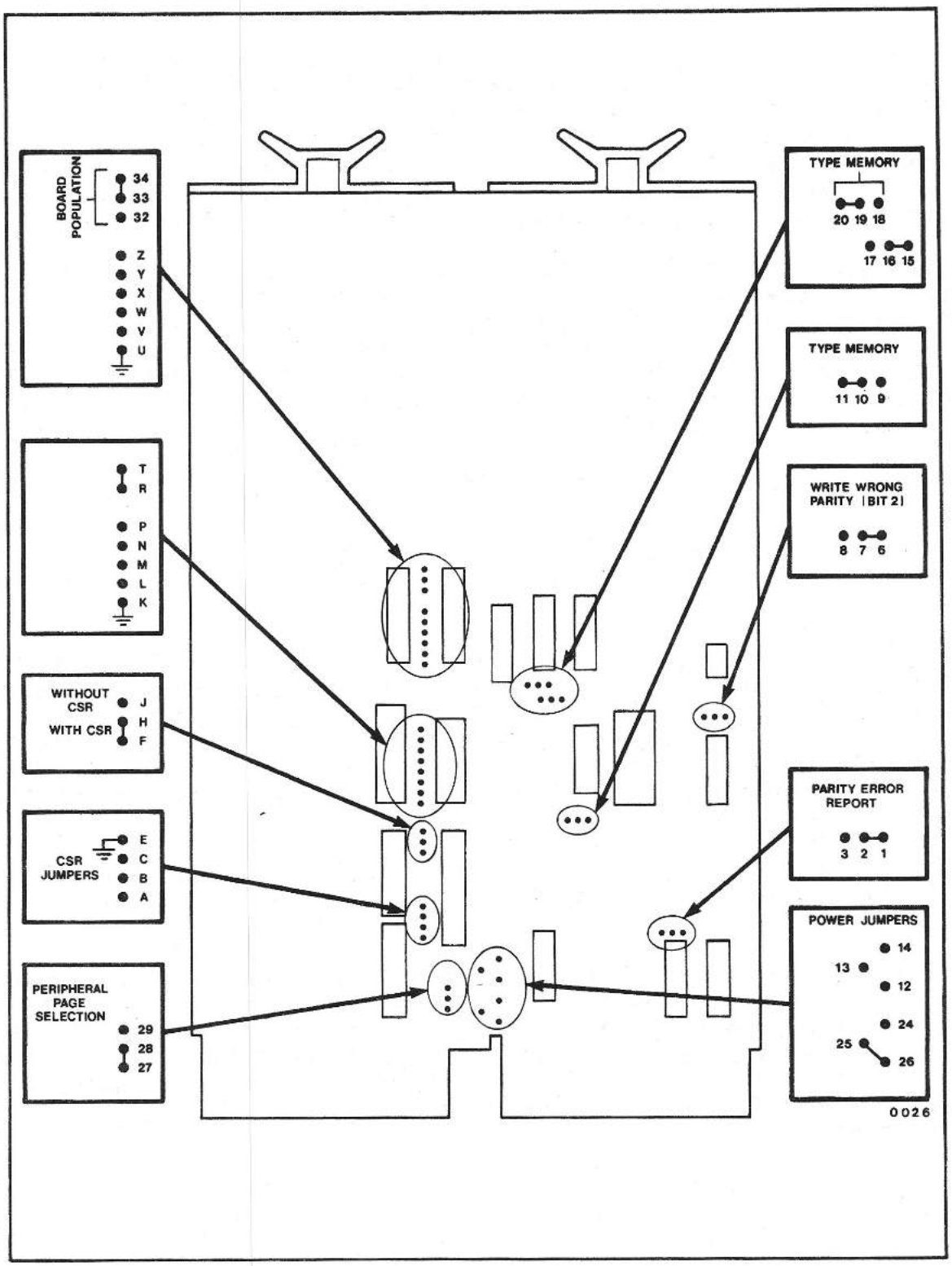

Fig. 4-3 Location of jumper pins on MSV11-LK

TABLE 4-9

MSV11-LK
DETERMINING FIRST ADDRESS RANGE (FAR) JUMPERS
(See Figure 4-3)

STARTING ADDRESS RANGE (MSA)		FAR VALUE	JUMPERS TO BE CONNECTED TO GROUND (PIN K)			
DECIMAL WORDS (K)	OCTAL		P ("X" = connect indicated pin to pin K)	N	M	L
000-124	00000000-00760000	0	NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED CONFIGURATION.			
128-252	01000000-01760000	128	-	-	-	X
256-380	02000000-02760000	256	-	-	X	-
384-508	03000000-03760000	384	-	-	X	X
512-636	04000000-04760000	512	-	X	-	-
640-764	05000000-05760000	640	-	X	-	X
768-892	06000000-06760000	768	-	X	X	-
896-1020	07000000-07760000	896	-	X	X	X
1024-1148	10000000-10760000	1024	X	-	-	-
1152-1276	11000000-11760000	1152	X	-	-	X
1280-1404	12000000-12760000	1280	X	-	X	-
1408-1532	13000000-13760000	1408	X	-	X	X

1536-1660	14000000-14760000	1536	X	X	-	-
1664-1788	15000000-15760000	1664	X	X	-	X
1792-1916	16000000-16760000	1792	X	X	X	-
1920-2044	17000000-17760000	1920	X	X	X	X

TABLE 4-10

MSV11-LK
DETERMINING PARTIAL STARTING ADDRESS (PSA) JUMPERS
(See Figure 4-3)

PARTIAL STARTING ADDRESS (PSA)		JUMPERS TO BE CONNECTED TO GROUND (PIN U)				
DECIMAL WORDS (K)	OCTAL	Z	Y	X	W	V
			("X" = connect indicated pin to pin U)			
0	00000000	NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED CONFIGURATION.				
4	00020000	-	-	-	-	X
8	00040000	-	-	-	X	-
12	00060000	-	-	-	X	X
16	00100000	-	-	X	-	-
20	00120000	-	-	X	-	X
24	00140000	-	-	X	X	-
28	00160000	-	-	X	X	X
32	00200000	-	X	-	-	-
36	00220000	-	X	-	-	X
40	00240000	-	X	-	X	-
44	00260000	-	X	-	X	X
48	00300000	-	X	X	-	-
52	00320000	-	X	X	-	X
56	00340000	-	X	X	X	-
60	00360000	-	X	X	X	X
64	00400000	X	-	-	-	-

68	00420000	X	-	-	-	X
72	00440000	X	-	-	X	-
76	00460000	X	-	-	X	X
80	00500000	X	-	X	-	-
84	00520000	X	-	X	-	X
88	00540000	X	-	X	X	-
92	00560000	X	-	X	X	X
96	00600000	X	X	-	-	-
100	00620000	X	X	-	-	X
104	00640000	X	X	-	X	-
108	00660000	X	X	-	X	X
112	00700000	X	X	X	-	-
116	00720000	X	X	X	-	X
120	00740000	X	X	X	X	-
124	00760000	X	X	X	X	X

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
(See Figure 4-3)

SEQUENCE OF MSV11 BOARDS IN THE SYSTEM	22-BIT CSR ADDRESS (OCTAL)	18-BIT CSR ADDRESS (OCTAL)	JUMPERS TO BE CONNECTED TO GROUND (PIN E) C B A ("X" = connect indicated pin to pin E)
First	17772100	772100	NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED

			CONFIGURATION.		
Second	17772102	772102	-	-	X
Third	17772104	772104	-	X	-
Fourth	17772106	772106	-	X	X
Fifth	17772110	772110	X	-	-
Sixth	17772112	772112	X	-	X
Seventh	17772114	772114	X	X	-
Eighth	17772116	772116	X	X	X

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 17772100, 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.

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:

PSA = MSA - 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: PSA = MSA - 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 4-12

MSV11-PL
DETERMINING FIRST ADDRESS RANGE (FAR) JUMPERS
(See Figure 4-4)

STARTING ADDRESS RANGE (MSA)		FAR VALUE	JUMPERS TO BE CONNECTED TO GROUND (PIN Y)		
DECIMAL WORDS (K)	OCTAL		X	W	V
			("X" = connect indicated pin to pin Y)		
000-248	00000000-01740000	0	NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED CONFIGURATION.		
256-504	02000000-03740000	256	-	-	X
512-760	04000000-05740000	512	-	X	-

768-1016	06000000-07740000	768	-	X	X
1024-1272	10000000 11740000	1024	X	-	-
1280-1528	12000000-13740000	1280	X	-	X
1526-1784	14000000-15740000	1526	X	X	-
1742-2040	16000000-17740000	1742	X	X	X

TABLE 4-13

MSV11-PL

DETERMINING PARTIAL STARTING ADDRESS (PSA) JUMPERS

PARTIAL STARTING ADDRESS (PSA)		JUMPERS TO BE CONNECTED TO GROUND (PIN R)				
DECIMAL WORDS (K)	OCTAL	P	N	M	L	T
			("X" = connect indicated pin to pin R)			
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	-
120	00740000	-	X	X	X	X
128	01000000	X	-	-	-	-
136	01040000	X	-	-	-	X
144	01100000	X	-	-	X	-
156	01140000	X	-	-	X	X
160	01200000	X	-	X	-	-
168	01240000	X	-	X	-	X
176	01300000	X	-	X	X	-
184	01340000	X	-	X	X	X
192	01400000	X	X	-	-	-
200	01440000	X	X	-	-	X
208	01500000	X	X	-	X	-
216	01540000	X	X	-	X	X
224	01600000	X	X	X	-	-
232	01640000	X	X	X	-	X
240	01700000	X	X	X	X	-
248	01740000	X	X	X	X	X

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.

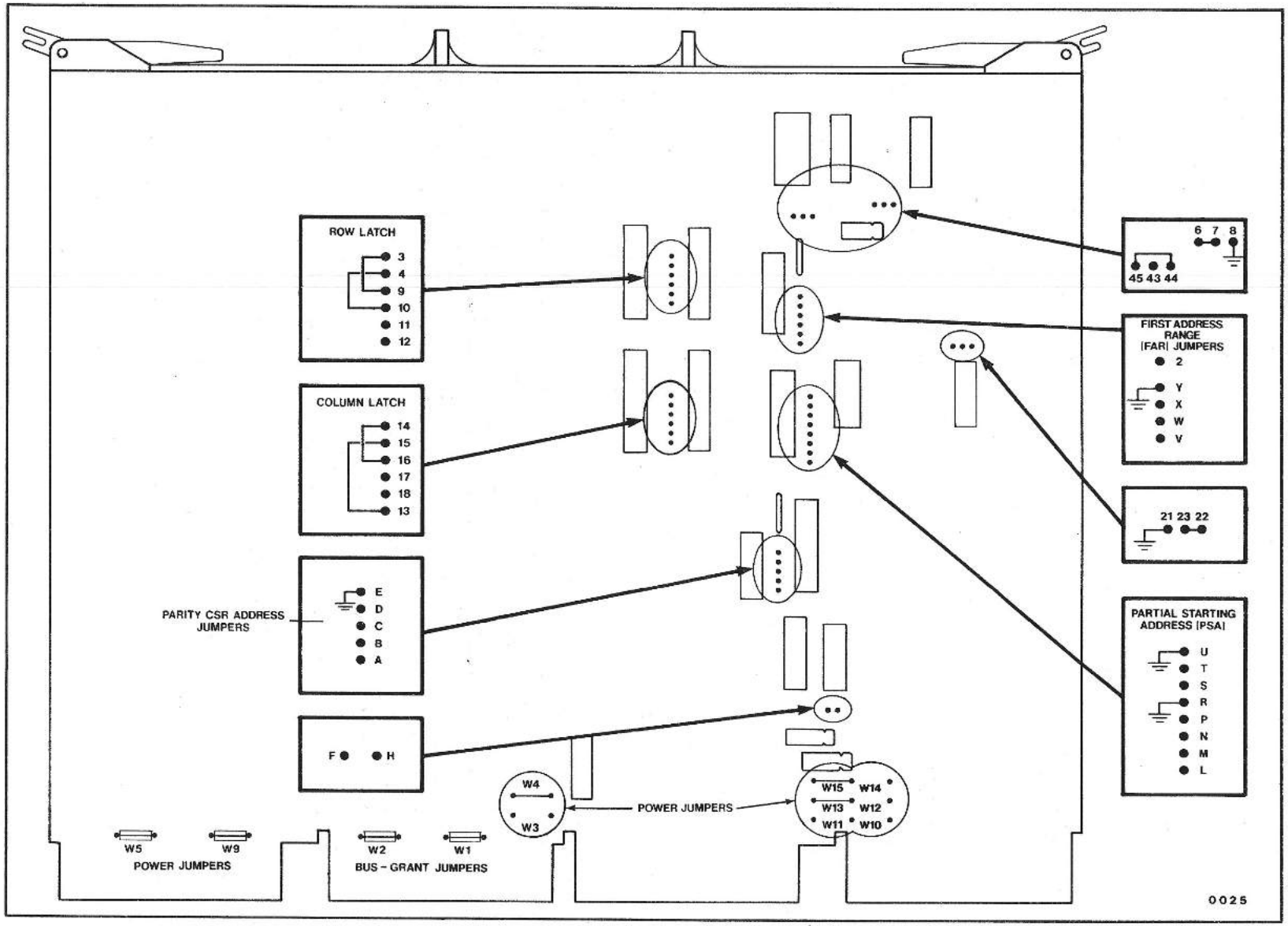

Fig. 4-4 Location of jumper pins on MSV11-PL

TABLE 4-14

MSV11-PL
DETERMINING THE STRAPPING OF CSR JUMPERS
(See Figure 4-4)

SEQUENCE OF MSV11 BOARDS IN THE SYSTEM	22-BIT CSR ADDRESS (OCTAL)	18-BIT CSR ADDRESS (OCTAL)	JUMPERS TO BE CONNECTED TO GROUND (PIN E) ("X" = connect indicated pin to pin E)			
			D	C	B	A
First	17772100	772100	NO JUMPERS CONNECTED. THIS IS THE SMS-SHIPPED CONFIGURATION.			
Second	17772102	772102	-	-	-	X
Third	17772104	772104	-	-	X	-
Fourth	17772106	772106	-	-	X	X
Fifth	17772110	772110	-	X	-	-
Sixth	17772112	772112	-	X	-	X
Seventh	17772114	772114	-	X	X	-
Eighth	17772116	772116	-	X	X	X
Ninth	17772120	772120	X	-	-	-
Tenth	17772122	772122	X	-	-	X
11th	17772124	772124	X	-	X	-
12th	17772126	772126	X	-	X	X
13th	17772130	772130	X	X	-	-
14th	17772132	772132	X	X	-	X
15th	17772134	772134	X	X	X	-
16th	17772136	772136	X	X	X	X

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

3. W9, W13, W15: JUMPERS IN for non battery-backup.
W12, W14: JUMPERS OUT for non battery-backup.
This is the SMS-shipped configuration.

4. W12, W14: JUMPERS IN for battery backup.
W9, W13, W15: JUMPERS OUT for battery backup.

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

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

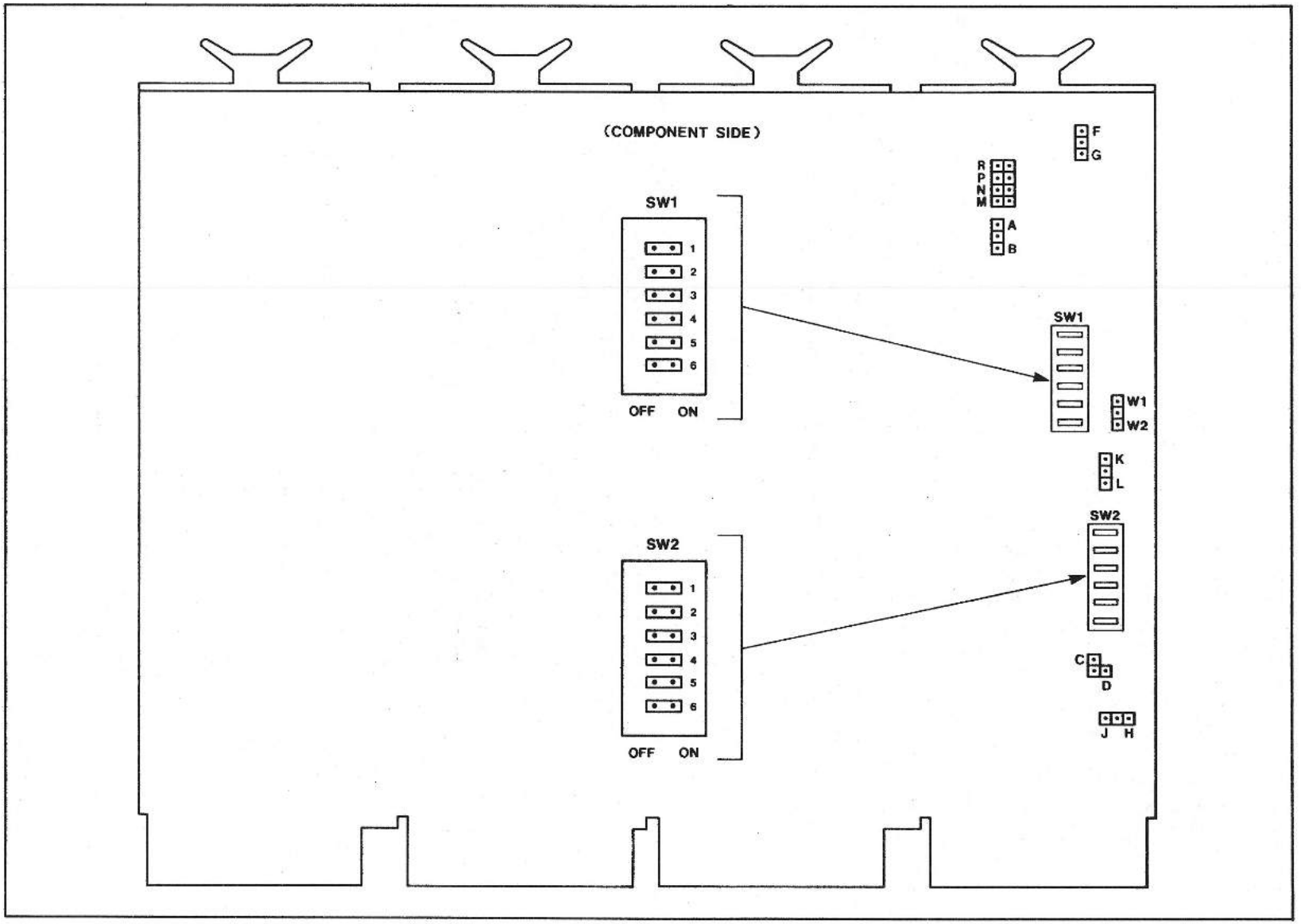

Fig. 4-5 Location of jumper pins on CMV-1000

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-SHIPPED CONFIGURATIONS FOR FIRST AND SECOND CMV-504 BOARDS.

FUNCTIONS OF JUMPERS

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

TABLE 4-15

FUNCTIONS OF CMV-504 JUMPERS

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

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:

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.

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

DESIRED STARTING ADDRESS (K BYTES)	STARTING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)										
	1	2	3	4	5	6	7	8	9	15	16
0	I	I	I	I	I	I	I	I	I	I	R
512	I	I	I	I	I	I	R	R	R	R	I
1024	I	I	I	I	I	I	I	R	R	R	I

1536	I	I	I	I	I	I	R	I	R	R	I
2048	I	I	I	I	I	I	I	I	R	R	I
2560	I	I	I	I	I	I	R	R	I	R	I
3072	I	I	I	I	I	I	I	R	I	R	I
3584	I	I	I	I	I	I	R	I	I	R	I

DESIRED ENDING ADDRESS (K BYTES)	ENDING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)				
	10	11	12	13	14
512	I	I	R	R	R
1024	I	I	I	R	R
1536	I	I	R	I	R
2048	I	I	I	I	R
2560	I	I	R	R	I
3072	I	I	I	R	I
3584	I	I	R	I	I
4096	I	I	I	I	I

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

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

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)

DESIRED STARTING ADDRESS (K BYTES)	STARTING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)										
	1	2	3	4	5	6	7	8	9	15	16
0	I	I	I	I	I	I	I	I	I	I	R
128	I	I	I	I	R	R	R	R	R	R	I
256	I	I	I	I	I	R	R	R	R	R	I
384	I	I	I	I	R	I	R	R	R	R	I
512	I	I	I	I	I	I	R	R	R	R	I
640	I	I	I	I	R	R	I	R	R	R	I
768	I	I	I	I	I	R	I	R	R	R	I
896	I	I	I	I	R	I	I	R	R	R	I
1024	I	I	I	I	I	I	I	R	R	R	I
1152	I	I	I	I	R	R	R	I	R	R	I
1280	I	I	I	I	I	R	R	I	R	R	I
1408	I	I	I	I	R	I	R	I	R	R	I
1536	I	I	I	I	I	I	R	I	R	R	I
1664	I	I	I	I	R	R	I	I	R	R	I
1792	I	I	I	I	I	R	I	I	R	R	I

1920	I	I	I	I	R	I	I	I	R	R	I
2048	I	I	I	I	I	I	I	I	R	R	I
2176	I	I	I	I	R	R	R	R	I	R	I
2304	I	I	I	I	I	R	R	R	I	R	I
2432	I	I	I	I	R	I	R	R	I	R	I
2560	I	I	I	I	I	I	R	R	I	R	I
2688	I	I	I	I	R	R	I	R	I	R	I
2816	I	I	I	I	I	R	I	R	I	R	I
2944	I	I	I	I	R	I	I	R	I	R	I
3072	I	I	I	I	I	I	I	R	I	R	I
3200	I	I	I	I	R	R	R	I	I	R	I
3328	I	I	I	I	I	R	R	I	I	R	I
3456	I	I	I	I	R	I	R	I	I	R	I
3584	I	I	I	I	I	I	R	I	I	R	I
3712	I	I	I	I	R	R	I	I	I	R	I
3840	I	I	I	I	I	R	I	I	I	R	I
3968	I	I	I	I	R	I	I	I	I	R	I
4096	I	I	I	I	I	I	I	I	I	R	I

DESIRED ENDING ADDRESS (K BYTES)	ENDING-ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)				
	10	11	12	13	14
128	R	R	R	R	R
256	I	R	R	R	R
384	R	I	R	R	R
512	I	I	R	R	R
640	R	R	I	R	R
768	I	R	I	R	R
896	R	I	I	R	R
1024	I	I	I	R	R
1152	R	R	R	I	R
1280	I	R	R	I	R
1408	R	I	R	I	R
1536	I	I	R	I	R

1664	R	R	I	I	R
1792	I	R	I	I	R
1920	R	I	I	I	R
2048	I	I	I	I	R
2176	R	R	R	R	I
2304	I	R	R	R	I
2432	R	I	R	R	I
2560	I	I	R	R	I
2688	R	R	I	R	I
2816	I	R	I	R	I
2944	R	I	I	R	I
3072	I	I	I	R	I
3200	R	R	R	I	I
3328	I	R	R	I	I
3456	R	I	R	I	I
3584	I	I	R	I	I
3712	R	R	I	I	I
3840	I	R	I	I	I
3968	R	I	I	I	I
4096	I	I	I	I	I

STARTING AND ENDING ADDRESS JUMPER CONNECTIONS
EXPRESSED IN 8K-BYTE INCREMENTS WITHIN A
256K-BYTE BOUNDARY (CMV-500 and CMV-250)

DESIRED STARTING ADDRESS (K BYTES)	STARTING ADDRESS JUMPER CONNECTIONS (SEE FIGURE 4-6)										
	1	2	3	4	5	6	7	8	9	15	16
0	I	I	I	I	I	I	I	I	I	I	R
8	R	R	R	R	R	R	R	R	R	R	I
16	I	R	R	R	R	R	R	R	R	R	I
24	R	I	R	R	R	R	R	R	R	R	I
32	I	I	R	R	R	R	R	R	R	R	I
40	R	R	I	R	R	R	I	R	R	R	I
48	I	R	I	R	R	R	R	R	R	R	I
56	R	I	I	R	R	R	R	R	R	R	I
64	I	I	I	R	R	R	R	R	R	R	I

72	R	R	R	I	R	R	R	R	R	R	I
80	I	R	R	I	R	R	R	R	R	R	I
88	R	I	R	I	R	R	R	R	R	R	I
96	I	I	R	I	R	R	R	R	R	R	I
104	R	R	I	I	R	R	R	R	R	R	I
112	I	R	I	I	R	R	R	R	R	R	I
120	R	I	I	I	R	R	R	R	R	R	I
128	I	I	I	I	R	R	R	R	R	R	I
136	R	R	R	R	I	R	R	R	R	R	I
144	I	R	R	R	I	R	R	R	R	R	I
152	R	I	R	R	I	R	R	R	R	R	I
160	I	I	R	R	I	R	R	R	R	R	I
168	R	R	I	R	I	R	R	R	R	R	I
176	I	R	I	R	I	R	R	R	R	R	I
184	R	I	I	R	I	R	R	R	R	R	I
192	I	I	I	R	I	R	R	R	R	R	I
200	R	R	R	I	I	R	R	R	R	R	I
208	I	R	R	I	I	R	R	R	R	R	I
216	R	I	R	I	I	R	R	R	R	R	I
224	I	I	R	I	I	R	R	R	R	R	I
232	R	R	I	I	I	R	R	R	R	R	I
240	I	R	I	I	I	R	R	R	R	R	I
248	R	I	I	I	I	R	R	R	R	R	I
256	I	I	I	I	I	R	R	R	R	R	I

LEGEND: I = INSTALLED
R = REMOVED

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

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

STRAPPING PROCEDURE FOR SECOND CMV-500

1. INSTALL the following jumpers:
B, C, G, H, K, T, 1, 2, 3, 4, 5,
10, 11 16

2. The following jumpers are REMOVED:
A, D, J, L, S, 6, 7, 8, 9, 12, 13, 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-500 module (see above).

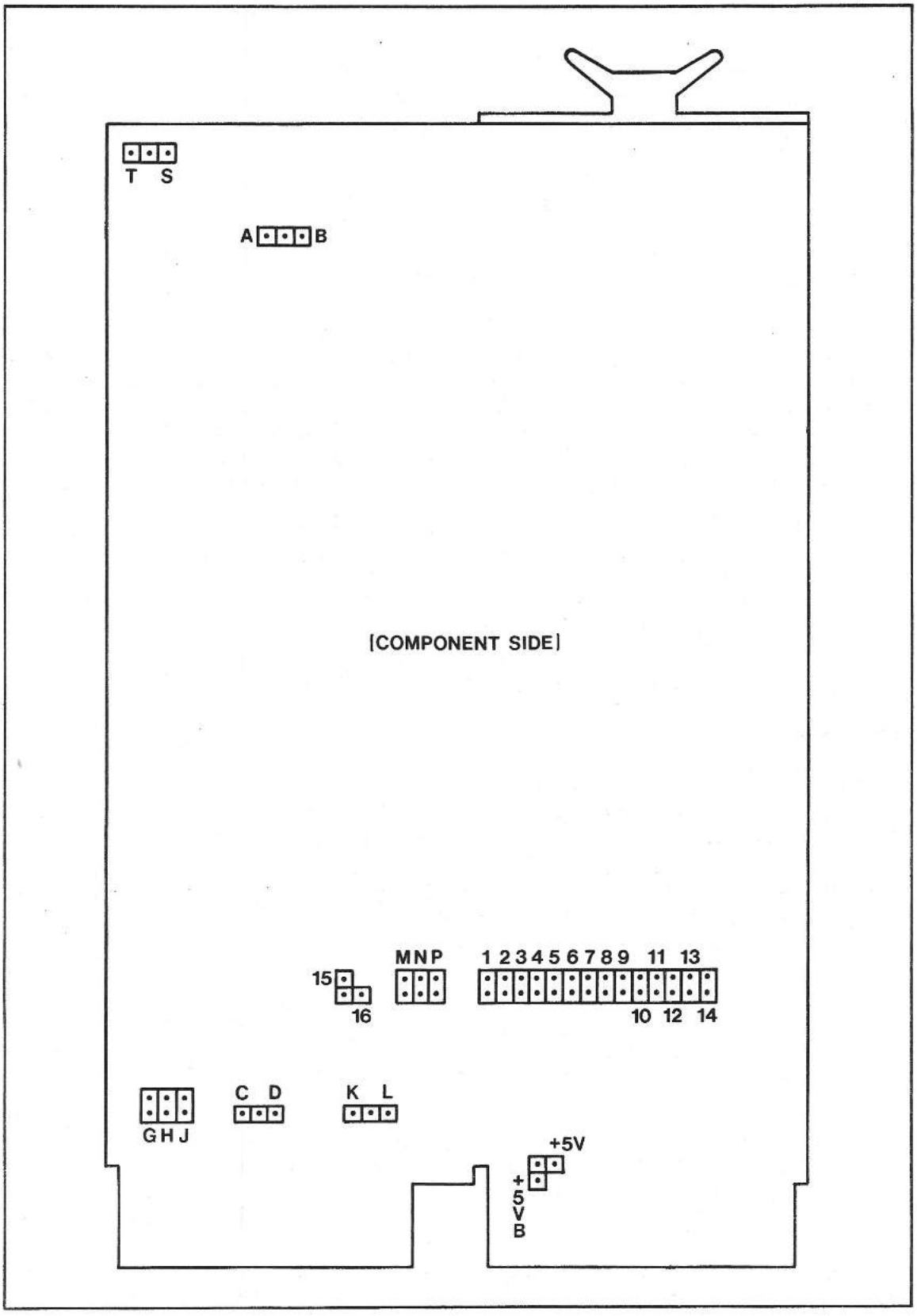

Fig. 4-6 Location of jumper pins on CMV-504, CMV-254, CMV-500 and CMV-250

STRAPPING THE DLV11-J FOUR-CHANNEL SERIAL LINE UNIT (MANUFACTURED BY DIGITAL EQUIPMENT CORPORATION OR CAMINTONN CORPORATION)

IMPORTANT

The DLV11-J boards provided with your SMS 1000 Model 30 may be supplied by two possible manufacturers: Digital Equipment Corporation (DEC) or Camintonn Corporation. These boards, although functionally identical, have somewhat different strapping instructions. The following strapping instructions will present DEC and Camintonn separately, as required for clarity.

The jumpering for the DLV11-J falls into five main categories:

1. Address and vector assignment for one or two DLV11-J's
2. Channel 3 break operation response
3. Communication line parameters
4. Baud rate selection
5. Channel 0-3 peripheral interface configurations

NOTE: DEC designates the four channels of this board as 0, 1, 2 and 3. Early versions of the Camintonn board designate these 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 (Camintonn) 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)

JUMPER DESIGNATION	SMS-SHIPPED CONFIGURATION	REMARKS
ADDRESS AND VECTOR JUMPERS FOR FIRST DLV11-J		
A5 (bit 5)	X to 0	This connection of jumpers A5 through A12 implements the (octal) device base-address assignment of 176500 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 at the end of this table.
A6	I	
A7	R	
A8	X to 1	
A9	X to 0	
A10	X to 1	
A11	X to 1	
A12 (bit 12)	X to 1	
V5 (bit 5) (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 (bit 6)	I	V6 and V7 set high-order bits in octal base-vector format.
V7 (bit 7)	I	
ADDRESS AND VECTOR JUMPERS FOR SECOND DLV11-J		
A5 (bit 5)	X to 1	This connection of jumpers A5 through A12 implements the (octal) device base-address assignment of 176540 for RCSR register of channel 0 (second DLV11-J). For a complete list of the register base-addresses for each channel see Table 4-17 at the end of this table.
A6	I	
A7	R	
A8	X to 1	
A9	X to 0	
A10	X to 1	
A11	X to 1	
A12 (bit 12)	X to 1	

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.

V5 (bit 5) (Second DLV11-J)	X to 1	Make the X to 1 connection to implement an interrupt base vector of 340 (combination of V5, V6, and V7) for the second DLV11-J. See Table 4-17.
V6 (bit 6)	I	V6 and V7 set high-order bits in octal base-vector format.
V7 (bit 7)	I	

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 and C2 configures channel 3 as a port (not a console).
C2	X to 0	

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 between adjacent characters.
P	X to 1	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.

0	0 to N	Sets Channel 0 to 9600 baud
1	1 to N	Sets Channel 1 to 9600 baud
2	2 to N	Sets Channel 2 to 9600 baud
3	3 to N	Sets Channel 3 to 9600 baud

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.

M0	X to 3	Chan. 0 XMIT(+): RS-232C/423
N0	X to 3	Chan. 0 XMIT(-): RS-232C/423
M1	X to 3	Chan. 1 XMIT(+): RS-232C/423
N1	X to 3	Chan. 1 XMIT(-): RS-232C/423
M2	X to 3	Chan. 2 XMIT(+): RS-232C/423
N2	X to 3	Chan. 2 XMIT(-): RS-232C/423
M3	X to 3	Chan. 3 XMIT(+): RS-232C/423
N3	X to 3	Chan. 3 XMIT(-): RS-232C/423

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.
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)

JUMPER DESIGNATION	SMS-SHIPPED CONFIGURATION	REMARKS
ADDRESS AND VECTOR JUMPERS FOR FIRST DLV11-J		
A12 (bit 12)	OUT	This connection of jumpers A12
A11	OUT	through A5 sets eight bits of
A10	OUT	the (octal) device base address.
A9	IN	The address selected is 176500
A8	OUT	for the RCSR register of
A7	IN	channel 0 (first DLV11-J). For
A6	OUT	a complete list of the
A5 (bit 5)	IN	register base-addresses for each channel see Table 4-17.
U20/6 (bit 5)	ON	An interrupt base vector of 300
U20/5 (bit 6)	OFF	is selected by setting sections
U20/4 (bit 7)	OFF	3, 4, 5 and 6 of DIP switch U20.
U20/3 (bit 8)	ON	These set bits V8, V7, V6 and V5,
U20/2	NOT USED	respectively, of the interrupt-
U20/1	NOT USED	vector base address.
ADDRESS AND VECTOR JUMPERS FOR SECOND DLV11-J		
A12 (bit 12)	OUT	This connection of jumpers
A11	OUT	A12 through A5 sets eight bits of
A10	OUT	the (octal) device base address.
A9	IN	The address selected is 176540
A8	OUT	for the RCSR register of channel
A7	IN	0 (second DLV11-J). For
A6	OUT	a complete list of the
A5 (bit 5)	OUT	register base-addresses for each channel see Table 4-17.
U20/6 (bit 5)	OFF	An interrupt base-vector of 340
U20/5 (bit 6)	OFF	is selected by making the indi-
U20/4 (bit 7)	OFF	cated settings of switches U20/3,

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

U20/3 (bit 8)	ON	U20/4, U20/5, and U20/6. These set bits V8, V7, V6 and V5, respectively, of the interrupt-vector base address.
U20/2	NOT USED	
U20/1	NOT USED	

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

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 a jumper means that Channel 3 makes no response in the presence of a received break signal.
E5	OUT	

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. 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.

CHAN 0/9600	IN	Sets Channel 0 to 9600 baud
CHAN 1/9600	IN	Sets Channel 1 to 9600 baud
CHAN 2/9600	IN	Sets Channel 2 to 9600 baud
CHAN 3/9600	IN	Sets Channel 3 to 9600 baud

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.)

J0/232	IN	Chan. 0 (Receive): RS-232C/423
J1/232	IN	Chan. 1 (Receive): RS-232C/423
J2/232	IN	Chan. 2 (Receive): RS-232C/423
J3/232	IN	Chan. 3 (Receive): RS-232C/423
J0/X1	IN	Chan. 0 (Transmit): RS-232C/423
J0/X2	IN	
J1/X1	IN	Chan. 1 (Transmit): RS-232C/423
J1/X2	IN	
J2/X1	IN	Chan. 2 (Transmit): RS-232C/423
J2/X2	IN	
J3/X1	IN	Chan. 3 (Transmit): RS-232C/423
J3/X2	IN	

OPTIONS FOR MASTER RESET OF THE UART

E3	OUT	If used, Master Reset is DCOKL
E2	IN	Master reset signal is INITH

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

E7	IN	Selects bus request (BR) level 4. Jumpers E6, E8, E9 and E11 are OUT. This is the SMS as-shipped (default) configuration.
E10	IN	
E12	IN	
E6		Selects bus request (BR) level 5. (If selected, jumpers E6, E8, E10 and E12 are IN, and E7, E9 and E11 are OUT.)
E8		
E10		
E12		

E6 E9 E11	Selects bus request (BR) level 6. (If selected, jumpers E6, E9 and E11 are IN, and E7, E8, E10 and E12 are OUT.)

LEGEND

IN = Jumper installed
OUT = Jumper removed

IMPORTANT

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

TABLE 4-17 (DEC and Camintonn)

CSR ADDRESSES AND VECTORS FOR FIRST AND SECOND DLV11-J

CSR ADDRESS (FIRST DLV11-J)	CSR ADDRESS (SECOND DLV11-J)	REGISTER	INTER-RUPT VECTOR (FIRST DLV11-J)	INTER-RUPT VECTOR (SECOND DLV11-J)
		CHANNEL 0		
176500	176540	RCSR		
176502	176542	RBUF	300	340
176504	176544	XCSR		
176506	176546	XBUF	304	344
		CHANNEL 1		
176510	176550	RCSR		
176512	176552	RBUF	310	350
176514	176554	XCSR		
176516	176556	XBUF	314	354
		CHANNEL 2		
176520	176560	RCSR		
176522	176562	RBUF	320	360
176524	176564	XCSR		
176526	176566	XBUF	324	364

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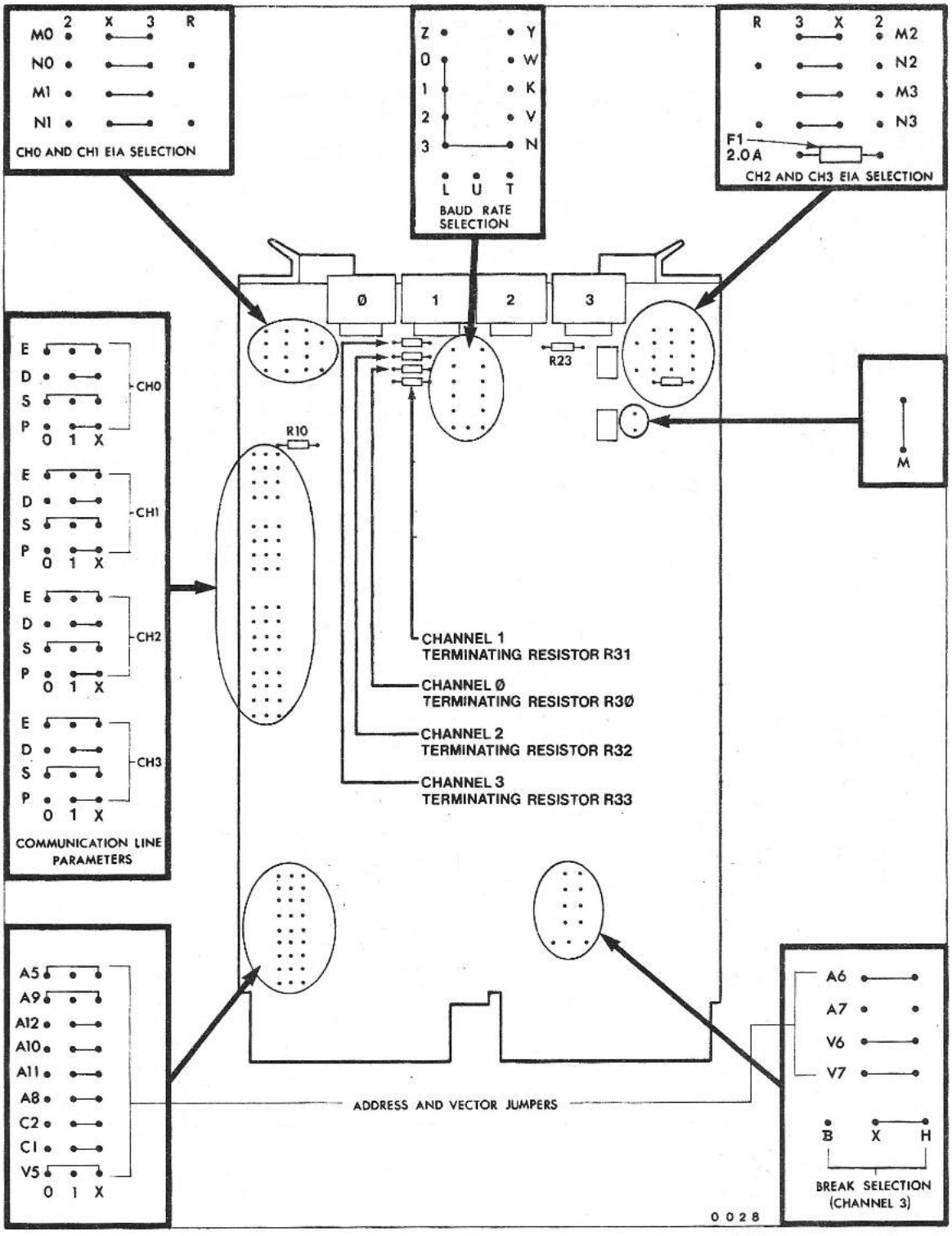

Fig. 4-7A Location of jumper pins on DLV11-J (DEC)

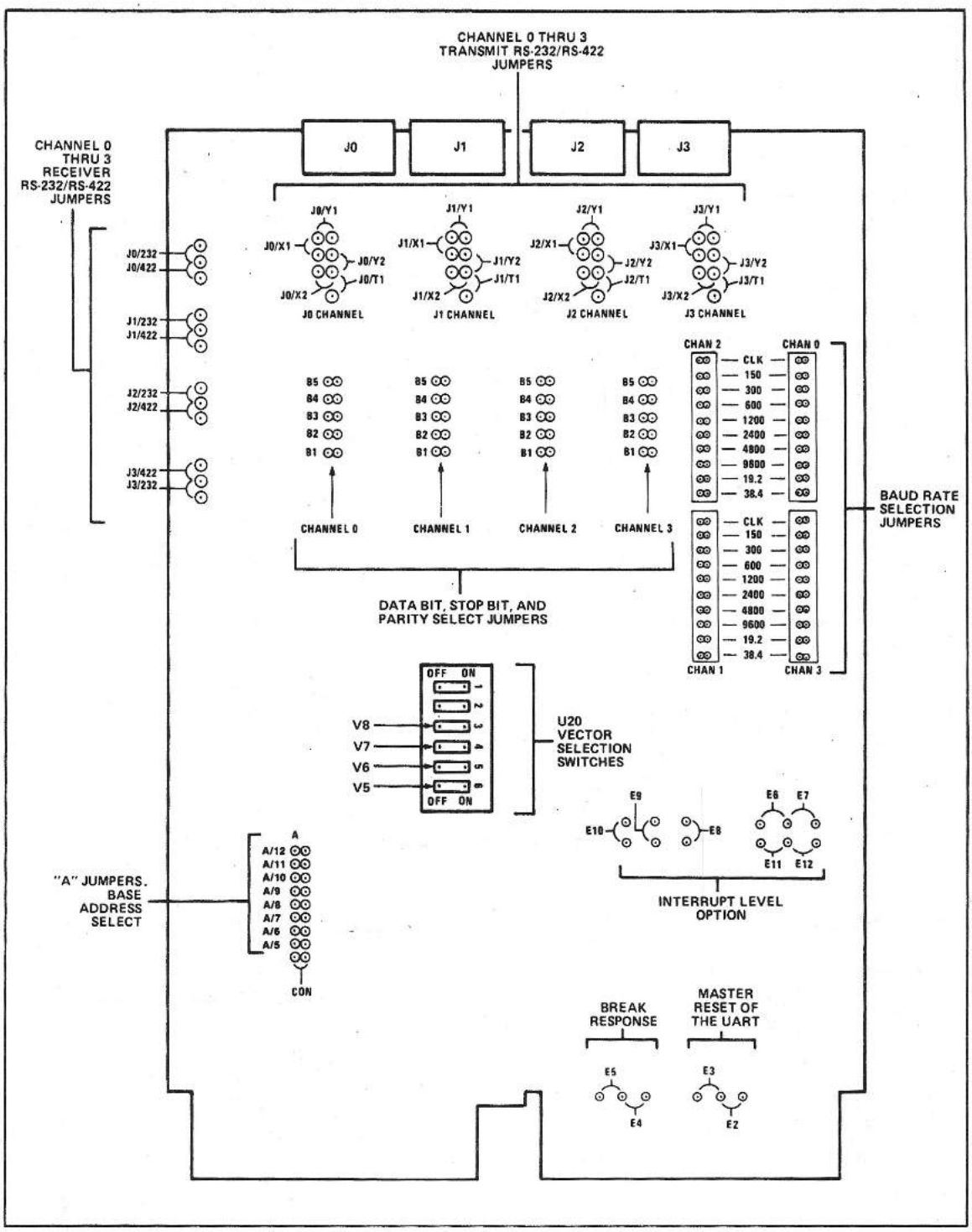

Fig. 4-7B Location of jumper pins on DLV11-J (Camintonn)

CHANNEL 3

176530	176570	RCSR		
176532	176572	RBUF	330	370
176534	176574	XCSR		
176536	176576	XBUF	334	374

TABLE 4-18A (DEC)

DLV11-J (DEC)
ALTERNATE CHARACTER-FORMAT CONFIGURATIONS
(See Figure 4-7A)

JUMPERS (EACH CHANNEL)	CHANNEL PARAMETER	RESULT OF X TO 0 CONNECTION	RESULT OF X TO 1 CONNECTION
E*	Parity	Odd parity expected	Even parity expected
D	Bits per character	7 bits	8 bits
S	Number of stop bits	1 bit	2 bits
P	Parity on/off	Parity on	Parity off

* - 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.

TABLE 4-18B (Camintonn)

DLV11-J (Camintonn)
ALTERNATE CHARACTER-FORMAT CONFIGURATIONS
(See Figure 4-7B.)

JUMPERS (EACH CHANNEL)	CHANNEL PARAMETER	REMARKS
B5 IN B1 IN	Parity	Odd parity expected
B5 OUT	Parity	Even parity expected

B1 IN		
B2 OUT	No. of stop bits	Two stop bits between adjacent characters
B3 IN B4 IN	No. of data bits in a character	Five data bits/char.
B3 IN B4 OUT	No. of data bits in a character	Six data bits/char.
B3 OUT B4 IN	No. of data bits in a character	Seven data bits/char.
E4 IN E5 OUT	Break response	Halt on Break.
E4 OUT E5 IN	Break response	Re-boot on Break.

TABLE 4-19 (DEC only)

DLV11-J (DEC)
BAUD RATE OPTIONS

CONNECTION FROM PINS 0, 1, 2, OR 3 TO PIN:	CORRESPONDING BAUD RATE
U	150
T	300
V	600
W	1200
Y	2400
L	4800
N	9600
K	19,200
Z	38,400

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)

JUMPER OR COMPONENT	PROTOCOL AND REQUIREMENTS		
	RS-232C/ RS-423	RS-422	20 mA CURRENT LOOP
M0, M1, M2, M3	X TO 3	X TO 2	X TO 3
N0, N1, N2, N3	X TO 3	X TO 2	X TO R (SEE NOTE 1)
TERMINATION RESISTORS R30: Chan. 0 R31: Chan. 1 R32: CHAN. 2 R33: Chan. 3	(RS-422 ONLY) Install each resistor as shown in Figure 4-7A. Each resistor is 100 ohms, 1/4 watt, non-wire wound and fusible.		
SLEW-RATE RESISTORS R10: Chan. 0 and Chan. 1 R23: Chan. 2 and Chan. 3	(RS-232C/RS-423 ONLY) Install R10 and R23 at locations shown in Fig. 4-7A. Each resistor is 22K, 1/4 watt and non wire-wound. See Table 4-21 for values of R10 and R23 that correspond to various baud rates. Note that each resistor sets slew rate for two channels. The 22K resistor 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)

JUMPERS (EACH CHANNEL)	JUMPER CONN-ECTION	CHANNEL PROTOCOL	REMARKS
J0/422	IN	RS-422	Receive
J1/422	IN		
J2/422	IN		
J3/422	IN		
J0/Y1	IN	RS-422	Transmit
J0/Y2	IN		
J1/Y1	IN		
J1/Y2	IN		
J2/Y1	IN		
J2/Y2	IN		
J3/Y1	IN		
J3/Y2	IN		
J0/T1	IN	20-mA current loop	Enables 20-mA current-loop operation.
J1/T1	IN		
J2/T1	IN		
J3/T1	IN		

TABLE 4-21 (DEC only)

DLV11-J (DEC)
SELECTION OF RS-232C/423 SLEW-RATE RESISTOR VALUES

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

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.

4. Setting the module's 13 configuration jumpers: W1 through W13.

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 4-22
FIRST DZQ11

SMS-SHIPPED CONFIGURATION
E28 SWITCH SETTINGS TO ASSIGN A CSR BASE-ADDRESS OF 160100
(See Figure 4-8)

BASE-ADDRESS BIT	SWITCH NUMBER ON E28	SWITCH SETTING	BIT VALUE
12 (MSB)	1	OFF	0
11	2	OFF	0
10	3	OFF	0
9	4	OFF	0
8	5	OFF	0

7	6	OFF	0
6	7	ON	1
5	8	OFF	0
4	9	OFF	0
3 (LSB)	10	OFF	0

TABLE 4-23
SECOND DZQ11

SMS-SHIPPED CONFIGURATION
E28 SWITCH SETTINGS TO ASSIGN A CSR BASE-ADDRESS OF 160110
(See Figure 4-8)

BASE-ADDRESS BIT	SWITCH NUMBER ON E28	SWITCH SETTING	BIT VALUE
12 (MSB)	1	OFF	0
11	2	OFF	0
10	3	OFF	0
9	4	OFF	0
8	5	OFF	0
7	6	OFF	0
6	7	ON	1
5	8	OFF	0
4	9	OFF	0
3 (LSB)	10	ON	1

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-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 4-24
FIRST DZQ11

SMS-SHIPPED CONFIGURATION
E13 SETTINGS TO ASSIGN INTERRUPT-VECTOR ADDRESS OF 400
(See Figure 4-8)

INTERRUPT-ADDRESS BIT	SWITCH NUMBER ON E13	SWITCH SETTING	BIT VALUE
8 (MSB)	1	ON	1
7	2	OFF	0
6	3	OFF	0
5	4	OFF	0
4	5	OFF	0
3 (LSB)	6	OFF	0

TABLE 4-25
SECOND DZQ11

SMS-SHIPPED CONFIGURATION
E13 SETTINGS TO ASSIGN INTERRUPT-VECTOR ADDRESS OF 410
(See Figure 4-8)

INTERRUPT-ADDRESS BIT	SWITCH NUMBER ON E13	SWITCH SETTING	BIT VALUE
8 (MSB)	1	ON	1
7	2	OFF	0
6	3	OFF	0
5	4	OFF	0
4	5	OFF	0
3 (LSB)	6	ON	1

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

These DIP switches are to be set as follows:

SWITCH NUMBER ON E13	SMS AS-SHIPPED SETTING	REMARKS
7	Either	NOT USED
8	ON	This is a test switch that disconnects the DZQ11 oscillator.
9	OFF	With 9 ON and 10 OFF, processor halts when a Break character is received. With 9 OFF and 10 ON, processor boots when a Break character is received.
10	OFF	

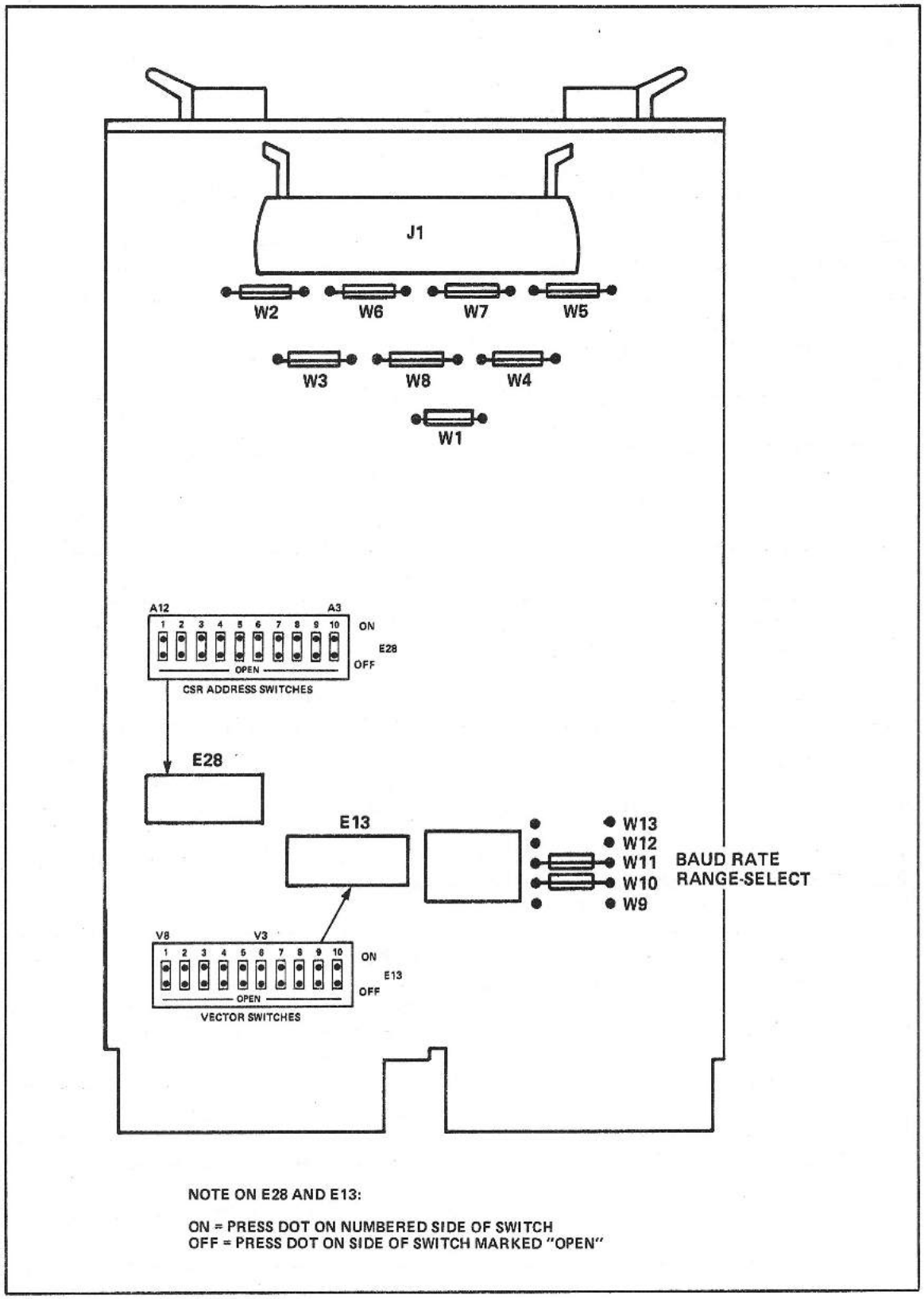

Fig. 4-8 Location of jumper pins on DZQ11

SETTINGS OF JUMPERS W1 THROUGH W16.

The following table describes the settings of the thirteen jumpers on the DZQ11. See Figure 4-8 for locations of jumpers.

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. See Figure 4-8)

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

BAUD-RATE SELECT JUMPERS

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 EQUIOPMENT CORPORATION OR CAMINTONN CORPORATION)

IMPORTANT

The DHV11 board provided with your SMS 1000 Model 30 may be supplied by two possible manufacturers: Digital Equipment Corporation (DEC) or Camintonn Corporation. These boards, although functionally identical, have somewhat different strapping instructions. 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 A13 through A16 are preset to 1's.

SETTING THE SWITCHES. Note that the DIP switches are numbered 1 through 8 (see Figure 4-9A). Switch section 1 of E43 and sectioms 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 4-27

DHV11 (DEC)
SMS-SHIPPED CONFIGURATION
E43 AND E58 SETTINGS TO ASSIGN A DEVICE ADDRESS OF 160440
(See Figure 4-9A)

DEVICE ADDRESS BIT	SWITCH NUMBER	SWITCH SETTING (AS SHIPPED)	CORRESPONDING BIT VALUE
A12	E58/1	OFF	0
A11	E58/2	OFF	0
A10	E58/3	OFF	0
A9	E58/4	OFF	0
A8	E58/5	ON	1
A7	E58/6	OFF	0
A6	E58/7	OFF	0
A5	E58/8	ON	1
A4	E43/1	OFF	0

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.

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 4-28

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

VECTOR ADDRESS BIT	SWITCH NUMBER	SWITCH SETTING (AS SHIPPED)	CORRESPONDING BIT VALUE
V8	E43/3	ON	1
V7	E43/4	OFF	0
V6	E43/5	OFF	0
V5	E43/6	OFF	0
V4	E43/7	ON	1
V3	E43/8	OFF	0

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 4-27A.

TABLE 4-27A

DHV11 (CAMINTONN)
SMS-SHIPPED CONFIGURATION
JUMPER SETTINGS TO ASSIGN A DEVICE ADDRESS OF 160440
(See Figure 4-9B)

DEVICE ADDRESS BIT	JUMPER DESIGNATION	JUMPER SETTING (AS SHIPPED)	CORRESPONDING BIT VALUE
A12	A12	OUT	0
A11	A10	OUT	0
A10	A10	OUT	0
A9	A9	OUT	0
A8	A8	IN	1
A7	A7	OUT	0
A6	A6	OUT	0
A5	A5	IN	1
A4	A4	OUT	0

NOTE: Remaining address jumpers are not used.

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 4-28A.

TABLE 4-28A

DHV11 (CAMINTONN)
SMS-SHIPPED CONFIGURATION
JUMPERS SETTINGS TO ASSIGN A VECTOR ADDRESS OF 420
(See Figure 4-9B)

VECTOR ADDRESS BIT	JUMPER DESIGNATION	JUMPER SETTING (AS SHIPPED)	CORRESPONDING BIT VALUE
V8	V8	IN	1
V7	V7	OUT	0
V6	V6	OUT	0
V5	V5	OUT	0
V4	V4	IN	1
V3	V3	OUT	0

NOTE: Remaining vector jumpers are not used.

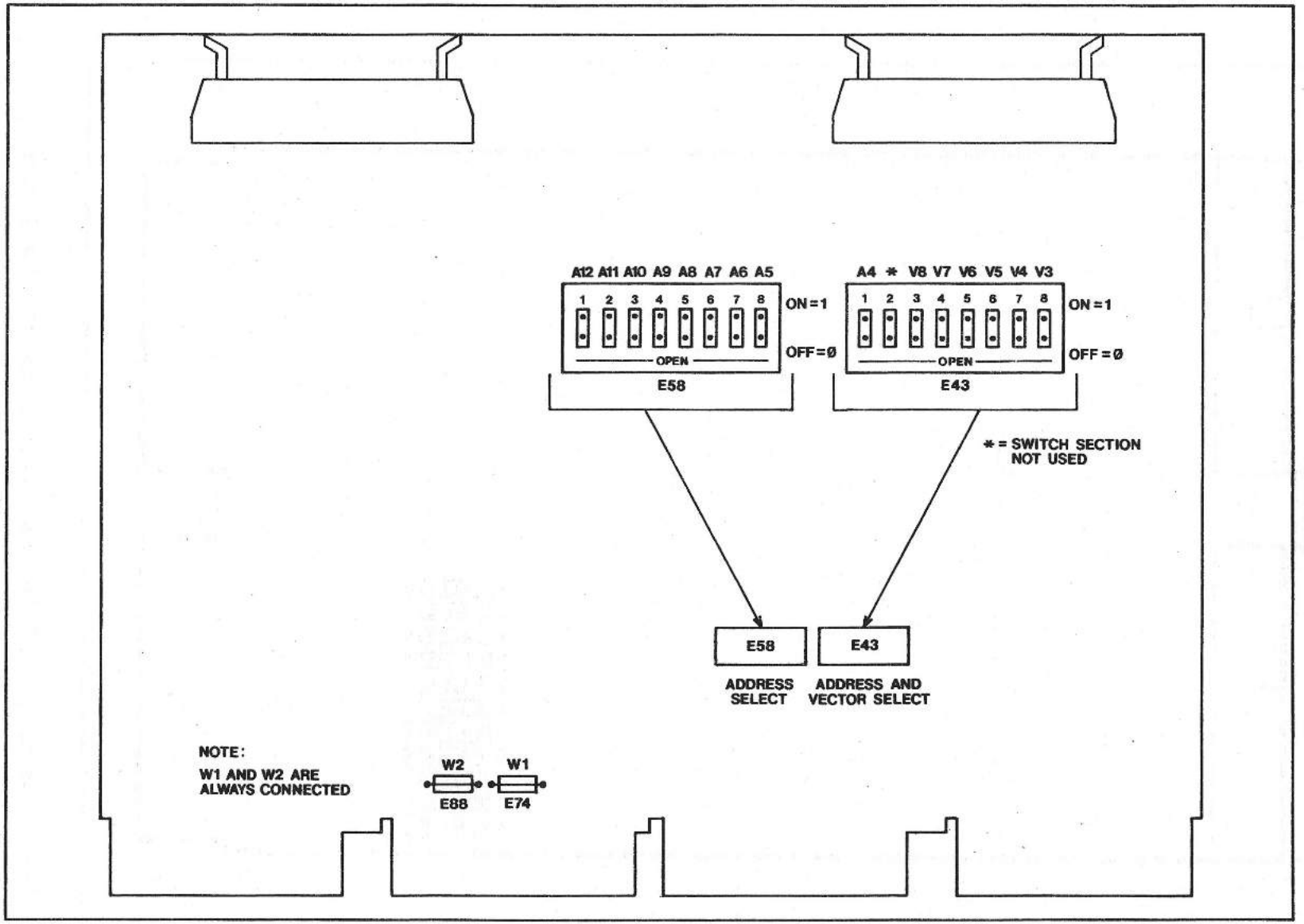

Fig. 4-9A Location of jumper pins on DHV11 (DEC)

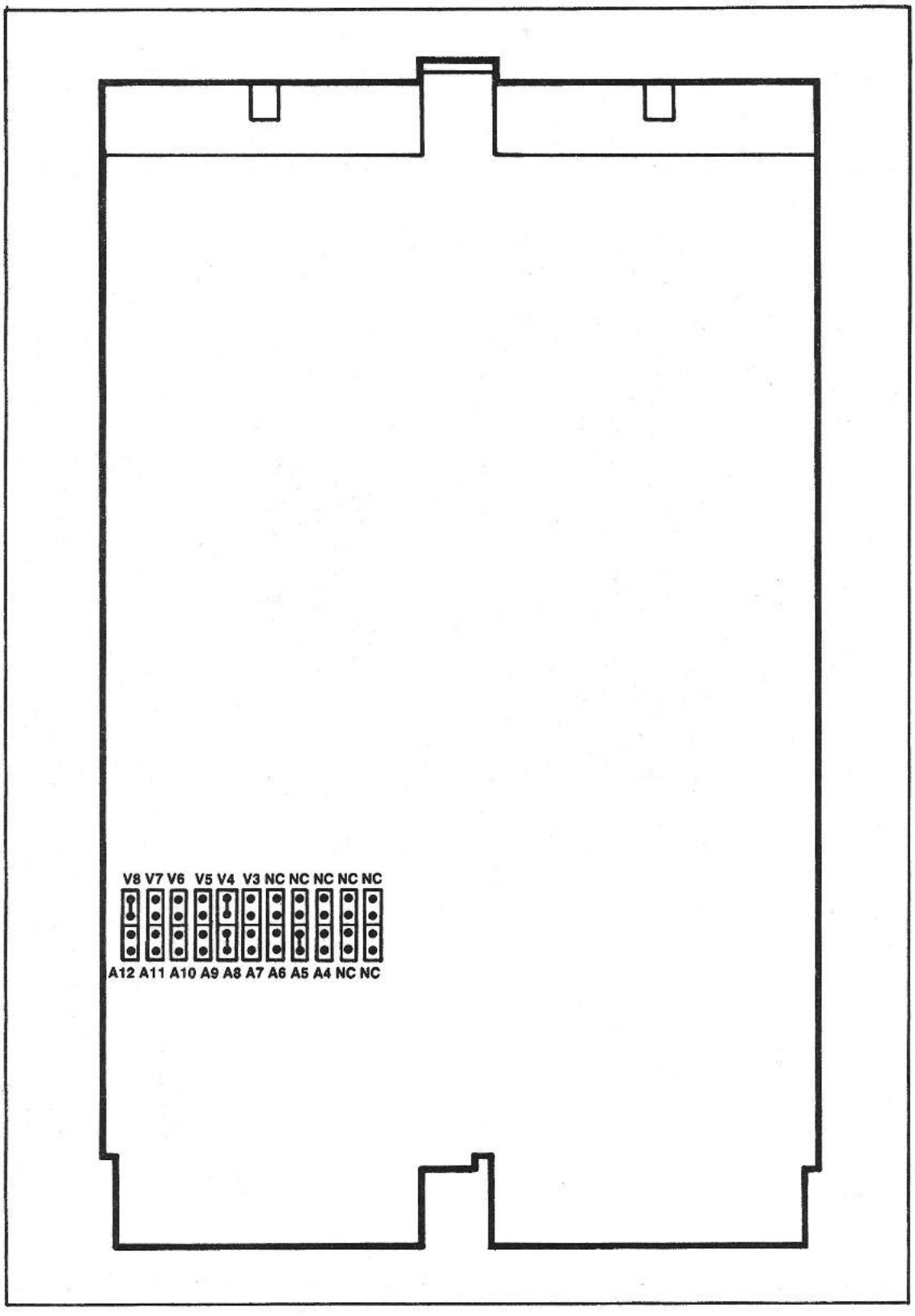

Fig. 4-9B Location of jumper pins on DHV11 (Camintonn)

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 Model 30 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).

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. 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.

TABLE 4-29

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

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	REMARKS
DS1	IN	Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selectable as floppy drive 1 (F0).
NOTE: The SMS 1000 Model 30 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 Model 30 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, RP1. 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 4-30

PANASONIC JU465
JUMPER CONNECTIONS
(See Figure 4-11)

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	REMARKS
DS1	IN	Drive Select 1: When this jumper is in and the other three are out, the drive is selected as floppy drive 1 (F0).
DS2	OUT	Drive Select 2: When this jumper is in and the other three are out, the drive is selected as floppy drive 2 (F1).
NOTE: The SMS 1000 Model 30 is configurable to include up to two 5 1/4" floppy drives. Hence, jumper pairs DS3 and DS4 are always open.		
MX	OUT	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.
DS	IN	The DS jumper allows only a selected drive-select line to activate the drive.
+WP	IN	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" diskettes.

-WP	OUT	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" diskettes the same write-protect convention as 8" diskettes.

CAUTION: Be sure that your JU465 has the +WP/-WP strapping 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 HL,IU	OUT	Not used: Always out.

STRAPPING THE SEAGATE ST213 AND ST225 WINCHESTER DRIVES

The Seagate ST225 is a double-disk half-height Winchester drive with a 26-megabyte unformatted capacity. The Seagate ST213 is a single-disk half-height Winchester drive with a 12.81-megabyte unformatted capacity. For either drive, drive-selection strapping is accomplished by adding jumper plugs to pins of a 16-pin connector (J7) located 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 located at the connector end of the circuit board. The following paragraphs describe the strapping procedure for both the ST213 and the ST225.

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:

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

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.

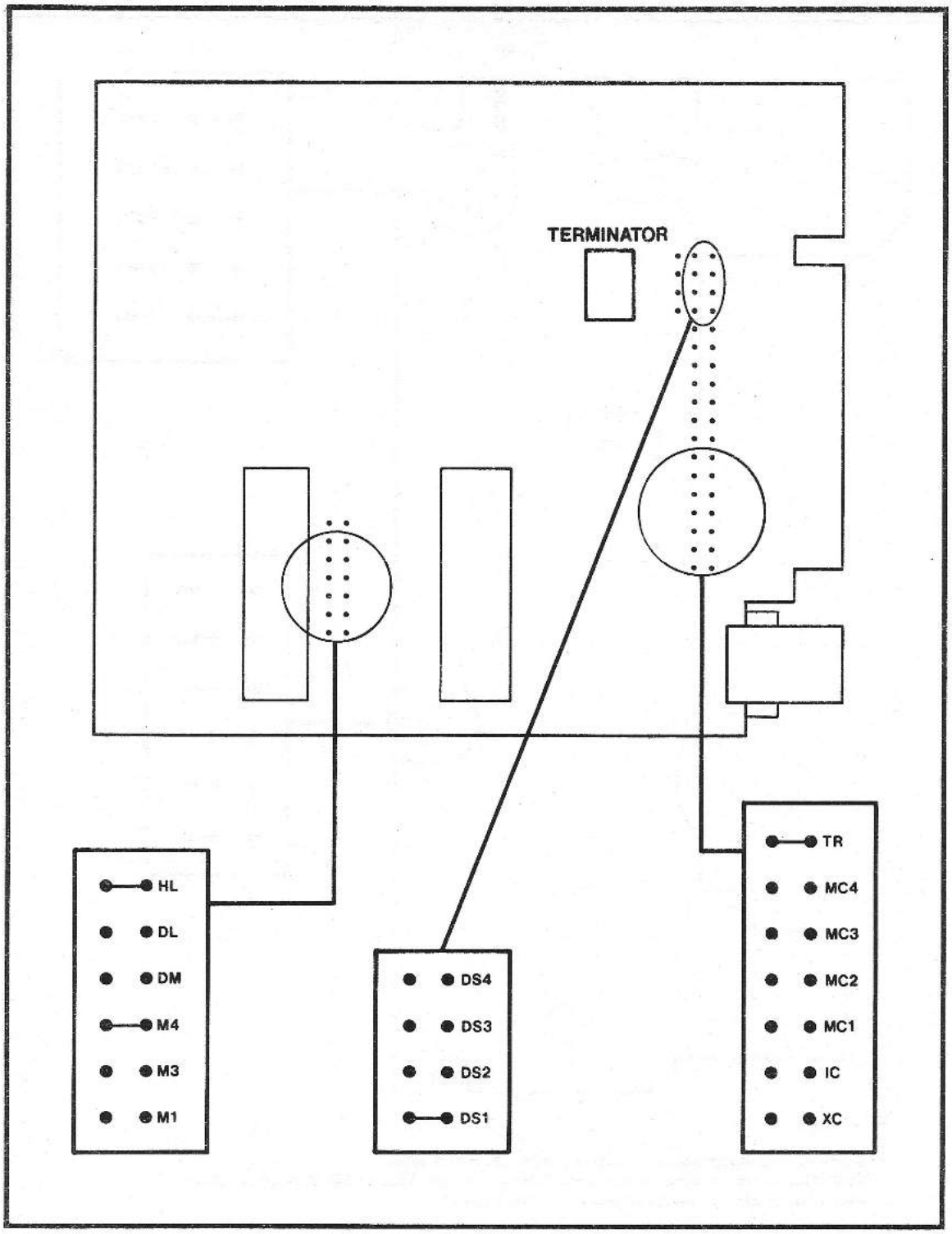

Fig. 4-10 Location of jumpers on Tandon TM848-2E

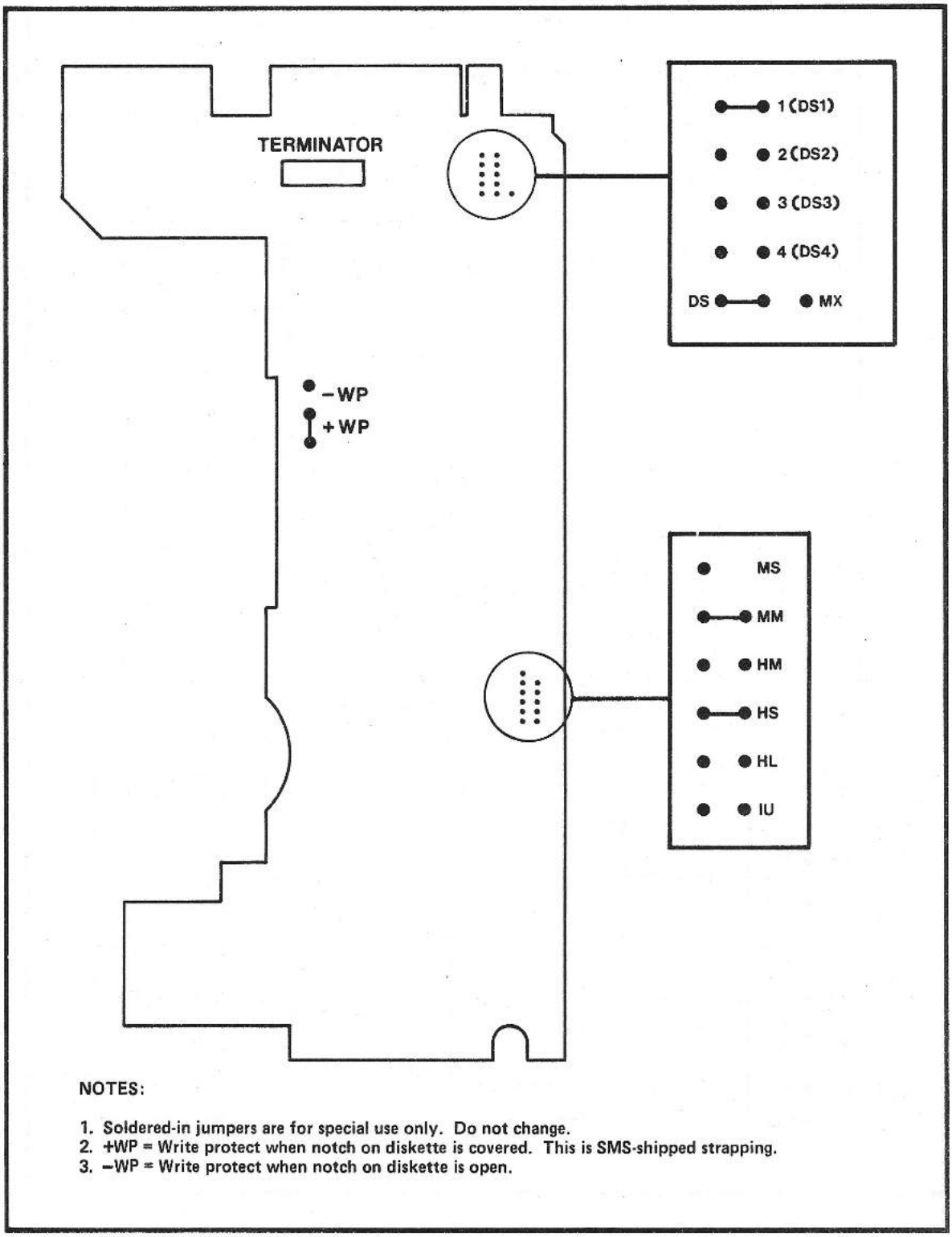

Fig. 4-11 Location of jumpers on Panasonic JU465

(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.

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 and P2 connectors on the circuit board. This pack must be removed from the other drives in the chain.

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 4-31 describes the options, and Figure 4-12 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 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 in the string must not be terminated.

TABLE 4-31

QUANTUM Q540
JUMPER CONNECTIONS
(See Figure 4-12)

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	REMARKS
DS1	IN	Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).
DS2	OUT	Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).
NOTE: Since the SMS 1000 Model 30 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 MAXTOR XT-1140 AND XT-1085 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 4-32 describes the jumpers, and Figure 4-13 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 4-32

MAXTOR XT-1140 AND XT-1085
JUMPER CONNECTIONS
(See Figure 4-13)

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	REMARKS
DS0 (5,6)	IN	Drive Select 0: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 1 (W0).
DS1 (4,5)	OUT	Drive Select 1: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 2 (W1).
NOTE: Since the SMS 1000 Model 30 is configurable to include up to two Winchester drives, DS2 and DS3 are always open.		
DS2 (2,3)	OUT	Drive Select 2: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 3.
DS3 (1,2)	OUT	Drive Select 3: When this jumper is in and the other three DS jumpers are out, the drive is selected as drive 4.

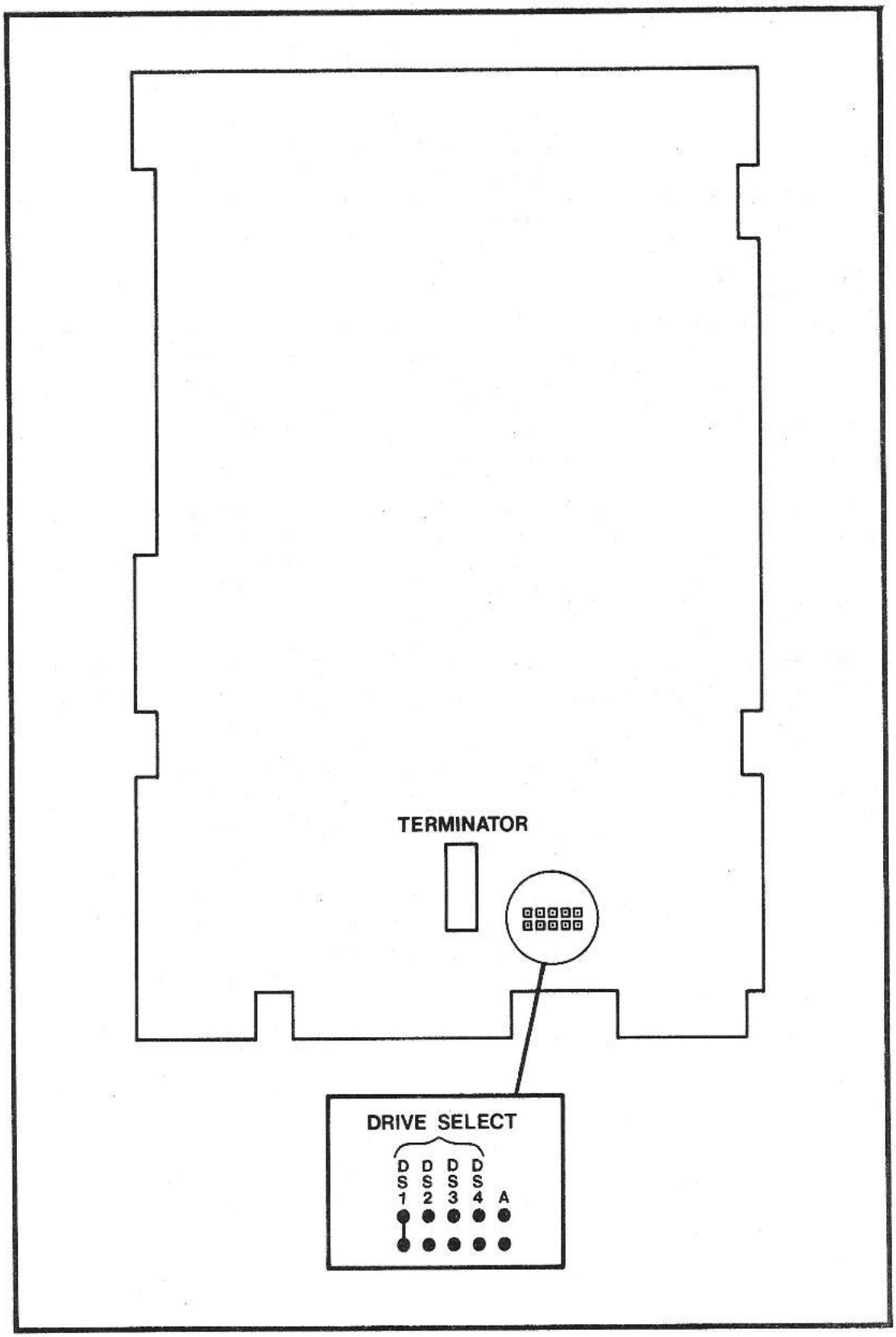

Fig. 4-12 Location of jumpers on Quantum Q540

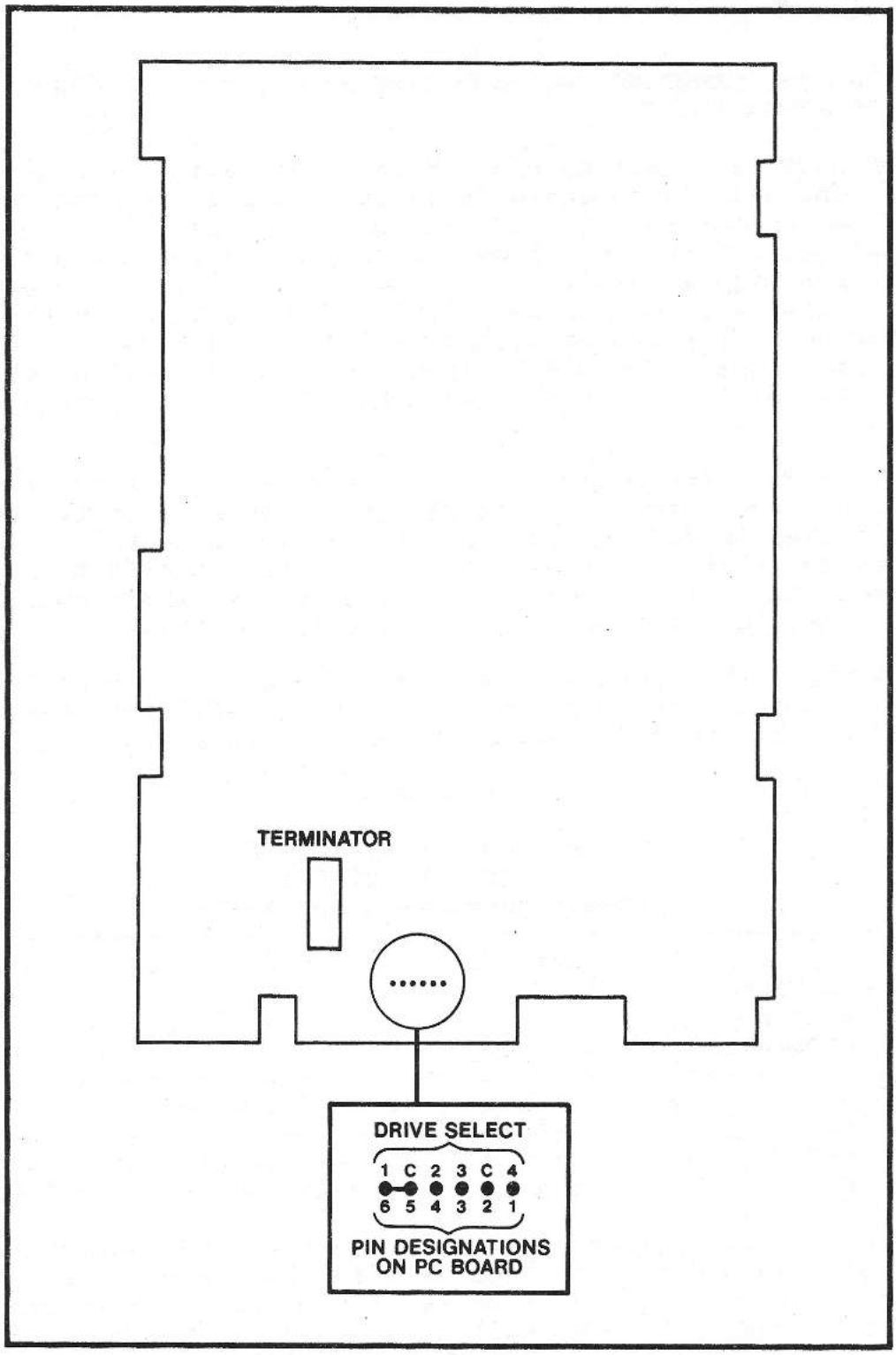

Fig. 4-13 Location of jumpers on Maxtor XT-1140 and XT-1085

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

The TDC 3309 is a half-height 1/4-inch, streaming, cartridge-tape drive. The drive's separate formatter board is the TDC 3350. 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 4-14). In the SMS 1000 Model 30 system the TDC 3309 is always set as drive 1 (T0). Table 4-33 describes the use of these hook-type connectors JP1 and JP2, and Figure 4-14 shows their locations. Table 4-33 also includes information on jumpering the TDC 3350 formatter board. The TDC 3350 jumpers are shown in Figure 4-15.

In Table 4-33, 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 4-14 shows both connectors in their default, or unhooked (OUT), position.

TERMINATORS. The terminating resistor pack (Figure 4-14) is located behind the d-c power connector J2. This pack must be plugged in its socket in all single-drive systems.

TABLE 4-33

TANDBERG TDC 3309/3350
JUMPER CONNECTIONS
(See Figures 4-14 and 4-15)

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	REMARKS
		TDC 3309 DRIVE (see Figure 4-14)
JP1 JP2	OUT OUT	When both JP1 and JP2 are unhooked (OUT) the drive is selected as drive 1 (T0).
		NOTE: The following alternate connections are NOT used on the SMS 1000 Model 30 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	Each time these jumper pins are shorted, a self-test cycle is actuated.

TDC 3350 FORMATTER BOARD (see Figure 4-15)

JP1 OUT pins 1 and 2	When this jumper is in, a self-test of the formatter board can be performed.
JP1 OUT pins 3 and 4	When this jumper is in, the formatter-board self test is activated.
JP2 OUT pins 1 and 2	When this jumper is in, parity checking on the TDC 3350 board is enabled.
JP2 OUT pins 3 and 4	Not used
JP2 IN pins 5 and 6	Enables a buffer size of 8K. This requires that an 8K RAM chip be inserted in socket U74 with U73 left open. An 8K buffer size is the default (as shipped) size. The default jumper connections given in this table permit expansion to 16K by the simple addition of an extra 8K RAM chip in the U73 socket; i.e. with no further jumper strapping needed. When JP2 pins 5 and 6 are open, JP3 pins 1 and 2 are shorted, and JP4 pins 2 and 3 are shorted, the formatter is configured to operate with a 4K buffer. This requires 2K RAM chips in U73 and in U74.
JP2 OUT pins 7 and 8	Not used
JP2 OUT pins 9 and 10	When this jumper is in, the formatter operates in QIC-11 mode. See Note 1.
JP2 OUT pins 11 and 12	When this jumper is in, and JP2, pins 1 and 2 are also shorted, the formatter checks for even parity. See Note 1.
JP2 OUT pins 13 and 14	When this jumper is in, and JP2, pins 1 and 2 are also shorted, the formatter checks for odd parity. See Note 1.
JP3 IN pins 2 and 3	Permits use of an 8K or 16K buffer when pins 2 and 3 are shorted. When pins 1 and 2 are shorted (along with JP4 pins 2 and 3) a 4K buffer can be used.

JP4 pins 1 and 2	IN	Permits use of an 8K or 16K buffer when pins 1 and 2 are shorted. When pins 2 and 3 are shorted (along with JP3 pins 1 and 2) a 4K buffer can be used.

FILE TAPE INTERFACE BOARD: Strapping of the file tape interface board used with the TDC 3309/3350 is described in Section 5 of this manual as part of the general discussion of how to use the file tape facility.

NOTE
1. These jumpers may not be present on all TDC 3350 boards.

STRAPPING THE SYQUEST SQ312RD CARTRIDGE-TYPE WINCHESTER DRIVE

The SyQuest SQ312RD cartridge-type Winchester drive has an unformatted capacity of 12 megabytes. The default (as shipped) jumper strapping for this drive is given in the following table (Table 4-34). Both the jumpers and the terminating resistor pack location are shown in Figure 4-16.

TABLE 4-34

SYQUEST SQ312RD
JUMPER CONNECTIONS
(See Figure 4-16)

JUMPER DESIGNATION/ PIN NO.	SMS FACTORY-SHIPPED CONNECTION	JUMPER FUNCTION AND REMARKS
W1	IN	Write data termination
W2	IN	Read data termination
W3	IN	Change-cartridge option
W4	IN	Fault-latch option
W5	OUT	Factory use only
W6	OUT	Factory use only
W7	OUT	Factory use only
W8	IN	Recovery option

W9	IN	Recalibrate option
W10	OUT	De-select auto-recovery mode

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 4-16). To select the drive as DS2, change the jumper to pins 2 and 3; for DS3, short pins 4 and 5 only; for DS4, short 5 and 6 only.

TERMINATION-RESISTOR PACK: All drives are shipped with a termination-resistor IC plugged into the drive's termination-resistance socket. See Figure 4-16.

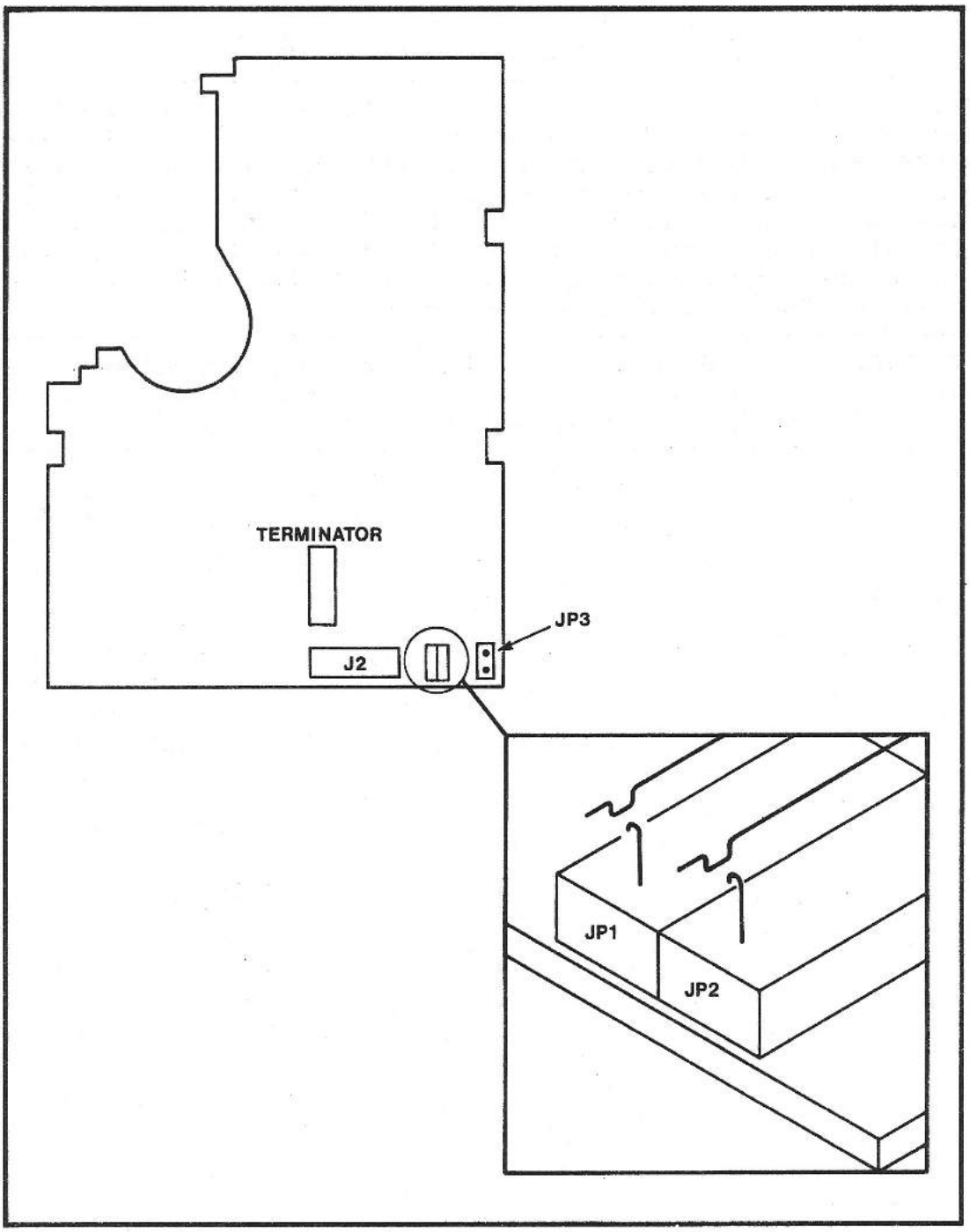

Fig. 4-14 Location of jumpers on Tandberg TDC 3309

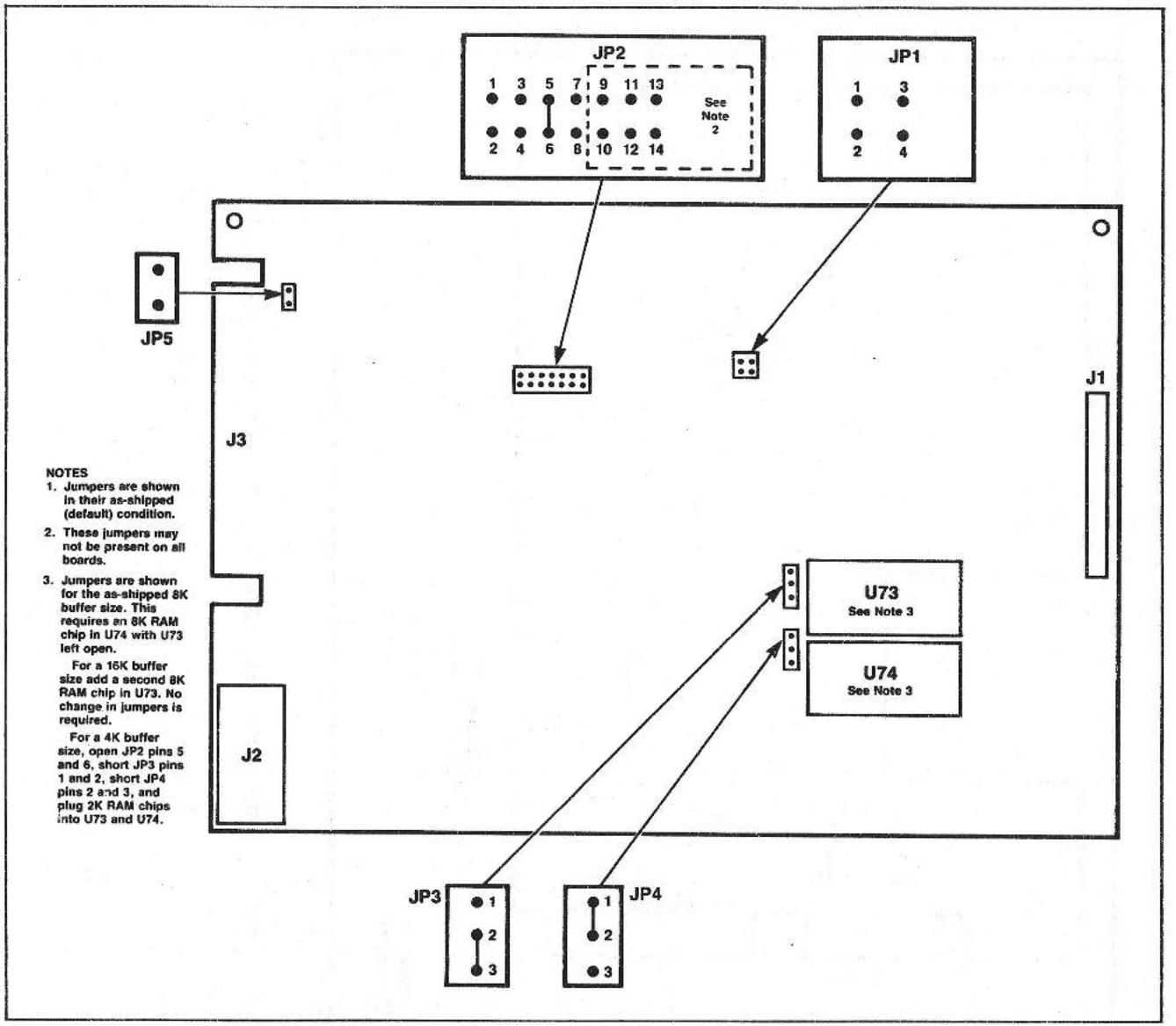

Fig. 4-15 Location of jumpers on Tandberg TDC 3350

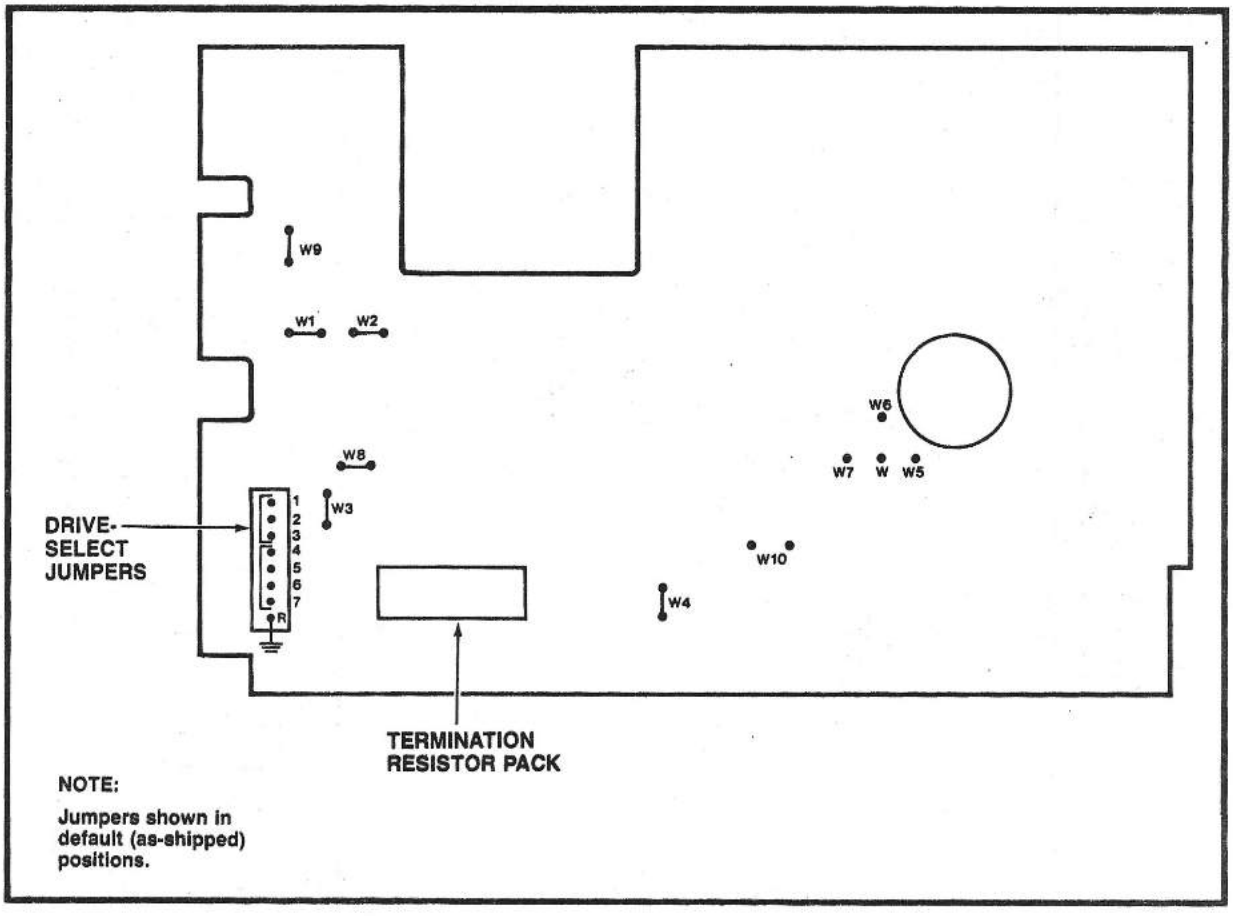

Fig. 4-16 Location of jumpers on SyQuest SQ312RD

SECTION 5

OPERATION

INTRODUCTION

SMS 1000 Model 30 operating information is located at two places in this manual. First, the present section contains a basic description of Model 30 controls and indicators; basic instructions on use and write protection of the SyQuest SQ312RD removable-cartridge Winchester drive and the Tandberg TDC 3309 tape drive; and full instructions on the use, functioning and operation of the file tape facility. Second, full instructions on operating the SMS 1000 Model 30 by making use of the SENSE monitor facilities that are part of the SMS 0107 controller, are to be found in Appendix C. This appendix also contains a complete description of the SMS 0107 controller itself.

FRONT PANEL CONTROLS AND INDICATORS

The following table (Table 5-1) identifies the front-panel controls and indicators of the SMS 1000 Model 30.

TABLE 5-1

FRONT PANEL CONTROL AND INDICATOR FUNCTIONS
(See Figures 1-4 and 3-1)

CONTROL OR INDICATOR	FUNCTION(S)
WRT PROT switch	Enables write protection of the fixed-disk Winchester drive. This switch can be used at any time regardless of the run state of the CPU. When this switch is in the OFF position, both reading and writing are permitted.
RUN lamp	This light is on when the CPU is running. It is off when the CPU is halted or executing the WAIT instruction.
PWR lamp	When illuminated, this light indicates that power is applied to your SMS 1000 Model 30.
RESET switch	This is a momentary switch. When pushed to its

	ON position (up) it stops all current host activity and reboots the system. It causes a system-wide reset by activating the signal BPOK.

NOTE: The following controls and indicators are located behind the front-panel access door.

TEST 1 switch	When in the ON position, this switch allows normal system operation. When in the OFF position this switch starts a Random Read test of Winchester and floppy drives. The test continues until an error is found or the switch is returned to the ON position. CAUTION: Do not throw this switch to the OFF position while the CPU is running.
TEST 2 switch	Not used
RUN/HALT switch	When in the RUN position, this switch allows normal system operation. When in the HALT position, the bus signal BHALTL is activated and the CPU halts until the switch is returned to the RUN position.
LINE TIME CLOCK switch	When this switch is in the ON position, clock pulses are supplied to the system every 1/60 second (16.66 ms), as generated from the a-c line frequency. If this signal is to be received from some other source such as, for example, a clock on a backplane module, then this switch should be thrown to the OFF position.
ERROR 1 lamp ERROR 2 lamp ERROR 3 lamp	These three lamps operate in parallel with the three SMS 0107 controller LEDs (CR1, CR2, and CR3). These lamps light in various patterns to indicate the results of self-test sequences at initial power-on or system reset (see Appendix C); or as a result of the random-read exercise, if initiated by the TEST 1 switch (see Section 6).

FILE TAPE BACKUP USING THE TANDBERG TDC 3309 TAPE DRIVE

GENERAL

The file-tape facility provides the SMS 1000 Model 30 with the capability of backing up files individually. This function is also referred to as a file-oriented archive tape facility.

This facility incorporates the Tandberg TDC 3309 9-track streaming tape drive, the Tandberg TDC 3350 formatter board and the file-tape interface board. Tape load and unload access to the tape drive is provided at the SMS 1000 Model 30 front panel. A procedure for inserting and write-protecting tape cartridges is given later in this section. Strapping information for the file-tape interface board is included in this section. Strapping information for the Tandberg TDC 3309 drive and the TDC 3350 formatter board is supplied Section 4 of this manual.

As shown in Figure 6-4, the file tape option includes the TDC 3309 streaming tape drive (designated T0), the TDC 3350 QIC-02 controller/formatter board and the file tape interface module, which is located in slots J2A and J2B of the backplane.

As shown in Figure 5-1, the dual-width file tape interface module is plugged into one of the A-B backplane slots, and the host interrupt scheme must be configured accordingly. Since the interface module is a dual-width board, a bus-grant continuity card (part number AW 0004670 Rev. B) will generally need to be installed in any remaining unused backplane slots in its row, in accordance with the backplane's serpentine priority order (see Figure 3-2). Also, note that if the file tape interface module is removed from the host backplane, it must be replaced with a bus-grant continuity card. Table 5-2 lists the components of the file tape option.

TABLE 5-2
SMS 1000 Model 30 FILE TAPE OPTION COMPONENTS

PART NUMBER	DESCRIPTION
9001315-0001	Tandberg TDC 3309 9-track streaming tape drive with TDC 3350 QIC-02 formatter board
9001425-0001	File tape interface module.

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 QIC-02 streaming tape drives to an LSI-11 Q-bus. The interface 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 file-oriented tape peripheral controller. A set of built-in diagnostics is included to verify proper operation of the module whenever it is initialized.

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. Use of specific utility commands to operate the SMS 1000 Model 30 file-tape facility is described later in this section. When using these commands, the tape drive is accessed by specifying device type "MS".

CONFIGURING THE FILE TAPE INTERFACE MODULE

The file-tape interface module is configured for normal operation when the SMS 1000 Model 30 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 changed to include a device address or interrupt vector different from the default values given in the following tables.

Figure 5-1 shows the jumper pin locations on the interface module. Table 5-3 summarizes the jumper options available. The as-shipped default jumper configuration is noted in the "DEFAULT SETTINGS" column of the table and in Figure 5-1. Tables 5-3 through 5-9 indicate jumper setup details for available strapping options.

TABLE 5-3

FILE TAPE INTERFACE MODULE
JUMPER OPTION SUMMARY
(See Figure 5-1)

JUMPER PINS	USED FOR:	DEFAULT SETTINGS
E1-E2	Not used	OUT
E5-E6	Not used	OUT
E7-E8	Diagnostic loop enable	OUT
E9-E10	Device address select Bit 0	IN
E11-E12	Device address select Bit 1	IN

E9-E12 are used as follows:

E9-E10	E11-E12	= Address(octal)
IN	IN	= 172520 (default)
IN	OUT	= 172524
OUT	IN	= 172530
OUT	OUT	= 172534

E13-E14	Drive configuration (Bit 2) (refer to Table 5-8)	IN
E15-E16	Extended Features Enable	IN
E17-E18	Drive configuration (Bit 1) (refer to Table 5-8)	OUT
E19-E20	Drive configuration (Bit 0) (refer to Table 5-8)	OUT
E21-E22	Interrupt vector Bit 7	OUT
E23-E24	Interrupt vector Bit 6	IN
E25-E26	Interrupt vector Bit 5	IN
E27-E28	Interrupt vector Bit 4	OUT
E29-E30	Interrupt vector Bit 3	IN
E31-E32	Interrupt vector Bit 2 (for interrupt-vector bit definitions, refer to Table 5-5)	OUT
E33-E34	Interrupt priority level 5	IN
E35-E36	Interrupt priority level 4	OUT
E37-E38	DMA block mode enable	OUT (disabled)

When strapping options are to be changed, jumper plugs (such as BERG 76264-101, or equivalent) are added or removed from the appropriate pin location(s) shown in Figure 5-5. If jumper plugs 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 5-3 through 5-5. Factory-preset default values are 172520 (octal) for the device address, and 224 (octal) for the interrupt vector. As shown in Table 5-4, three alternate device-address assignments are available, namely: 172524, 172530, and 172534 (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 5-5. 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 5-4 and 5-5.

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 5-4. 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 010001XX (for bits 7 through 2 of the vector address byte, respectively). In turn, Table 5-5 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.

TABLE 5-4

FILE TAPE INTERFACE MODULE
DEVICE ADDRESS CONFIGURATION
(See Figure 5-1 and Table 5-3)

ADDRESS OPTION (octal)	JUMPER SETTINGS E11-E12	E9-E10
* Default standard address - 172520	IN	IN
1st alternate address - 172524	OUT	IN
2nd alternate address - 172530	IN	OUT
3rd alternate address - 172534	OUT	OUT

* = Factory-preset default

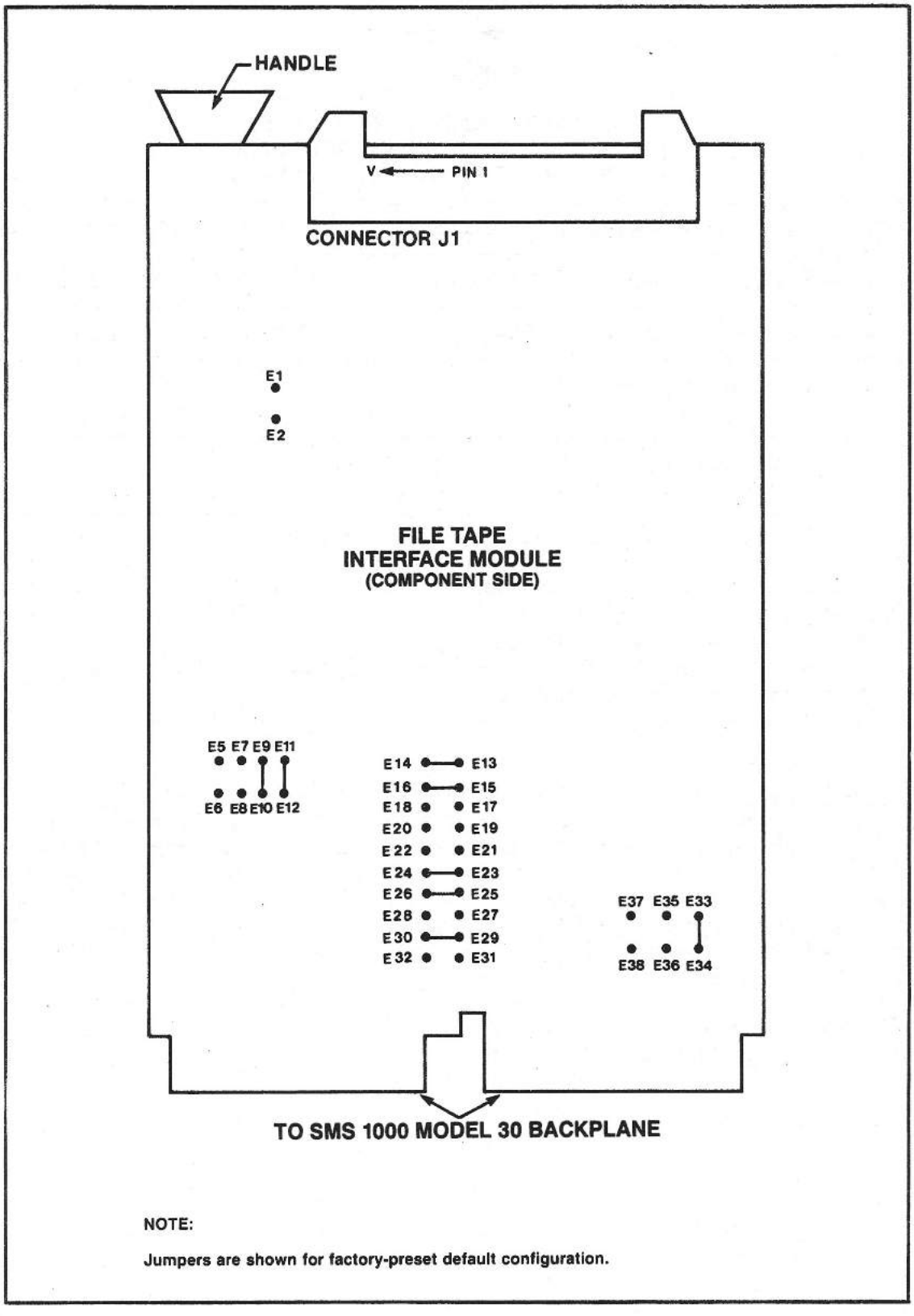

Fig. 5-1 Location of jumpers on file tape interface board

TABLE 5-5

FILE TAPE INTERFACE MODULE
INTERRUPT VECTOR CONFIGURATION
(See Figure 5-1 and Table 5-3)

VECTOR (octal)	VECTOR ADDRESS BYTE-SELECTION BITS & JUMPER SETTINGS						
	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	**
RANGE: 0-374	E21-E22	E23-E24	E25-E26	E27-E28	E29-E30	E31-E32	
	Octal values:						
* 224	2		2		4		
	Binary equivalent:						
	1	0	0	1	0	1	
	Factory-shipped jumper settings:						
	OUT	IN	IN	OUT	IN	OUT	

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 5-6. 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 5-6.

TABLE 5-6

FILE TAPE INTERFACE MODULE
INTERRUPT PRIORITY LEVEL CONFIGURATION
(See Figure 5-1 and Table 5-3)

PRIORITY LEVEL	JUMPER SETTINGS E33-E34	JUMPER SETTINGS E35-E36
* Interrupt priority level 5	IN	OUT
Interrupt priority level 4	OUT	IN

* = Factory-preset default

The EXTENDED FEATURES mode of operation is selected by installing a jumper on pins E15-E16, as shown in Table 5-7. The interface module extended features option is normally enabled in the file-tape option, 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 5-7

FILE TAPE INTERFACE MODULE
EXTENDED FEATURES CONFIGURATION
(See Figure 5-1 and Table 5-3)

EXTENDED FEATURES	JUMPER SETTINGS FOR E15-E16
* Enabled	IN
Disabled	OUT

* = Factory-preset default

The DRIVE TYPE option is configured by jumpering pins E13-E14, E19-E20, and E17-E18, as shown in Table 5-8. The interface

module can be configured to interface with a number of different tape drive units. In the SMS 1000 Model 30, 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 accomodate any QIC-02 standard, QIC-24 format 9-track tape drive. As given in Table 5-8, the default drive type has been set up by installation of a 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 5-8. 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 5-8, for the applicable device type.

TABLE 5-8

FILE TAPE INTERFACE MODULE
DRIVE TYPE CONFIGURATION
(See Figure 5-1 and Table 5-3)

DRIVE TYPE	JUMPER PINS E13-E14	E19-E20	E17-E18
* Cartridge 9-track	IN	OUT	OUT
Cartridge 4-track	IN	OUT	IN
Cartridge reserved (not used)	IN	IN	OUT
Cartridge 12-track	IN	IN	IN
Reserved (not used)	OUT	OUT	OUT
Rosscomp 190 MB	OUT	OUT	IN
Reserved (not used)	OUT	IN	OUT
Cassette 20 MB	OUT	IN	IN

* = 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 5-9. 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 Model 30 system, power up or reinitialization causes the internal diagnostics to be executed. A comprehensive sequence of six internal self tests is 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 host 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 5-9. 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 constant rate. If a failure is encountered, the LED will not light, and the self test that failed will be re-executed continuosly. 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 the intermittent-failure rate.

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 system is resumed. Keeping loop diagnostic mode enabled will preclude normal operation of the file tape device.

TABLE 5-9

FILE TAPE INTERFACE MODULE
DIAGNOSTIC-ENABLE CONFIGURATION

(See Figure 5-1 and Table 5-3)

DIAGNOSTIC ENABLE	JUMPER SETTINGS FOR E7-E8
* Disabled	OUT
Enabled	IN

* = Factory-preset default

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 Model 30 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 Model 30 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. Note that the TDC 3350 controller/formatter board must be used with the TDC 3309 tape drive. Strapping instructions for the 3350 formatter board are also given in Section 4 of this manual.

TAPE DRIVE CABLING INTERFACE

Table 5-10 defines the QIC-02 interface signals associated with pin assignments of interface module connector J1. See Figure 5-2 for a diagram of the cabling interface.

TABLE 5-10

FILE TAPE INTERFACE MODULE
CONNECTOR J1 I/O PIN ASSIGNMENTS

PIN	MNEMONIC	DESCRIPTION
2, 4 6, 8		Not used
10	BBP	HOST BUS ODD PARITY - reserved for optional odd bus parity
12	BB7	HOST BUS BIT 7 - MSB of 8-bit bi-directional data bus
14	BB6	HOST BUS BIT 6
16	BB5	HOST BUS BIT 5
18	BB4	HOST BUS BIT 4
20	BB3	HOST BUS BIT 3
22	BB2	HOST BUS BIT 2
24	BB1	HOST BUS BIT 1
26	BB0	HOST BUS BIT 0 - LSB of 8-bit bi-directional data bus
28	ONL	ON LINE - This signal is grounded by the interface module to indicate that it is always on-line.
30	REQ	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.
32	RST	RESET - Signal generated by interface module to reset the connected tape drive unit.
34	XFR	TRANSFER - Signal generated by interface module indicating that write data have been placed on, or read data have been taken from, the host bus.
36	ACK	ACKNOWLEDGE - Signal generated by tape drive indicating that it has taken write data from, or placed read data on, the host bus.

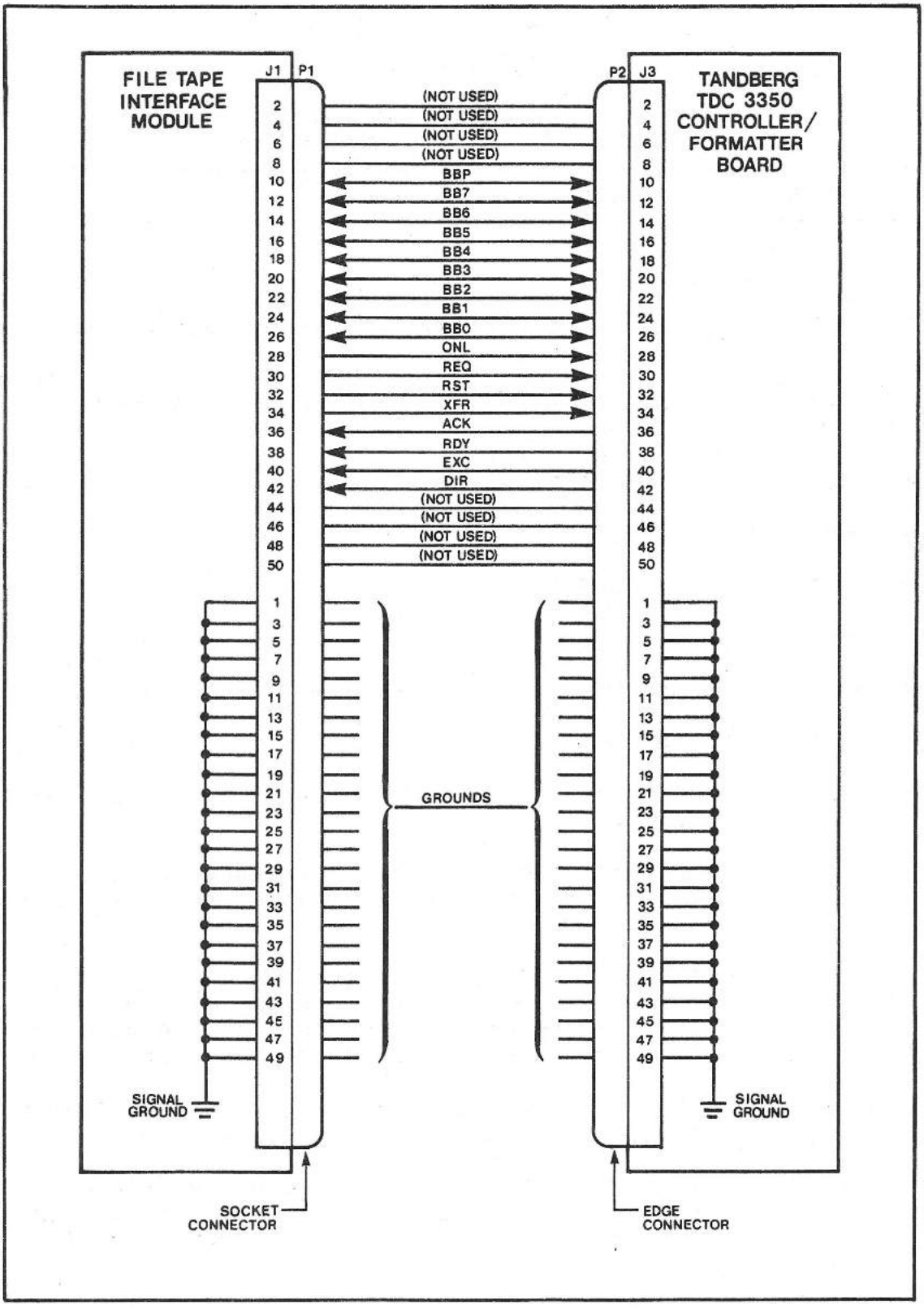

Fig. 5-2 File tape interface signals

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.

44, 46, 48, 50: Not used

NOTE: All odd pins of connector J1 are grounded.

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. The following paragraphs describe those limitations and points out some typical procedures for operation of the file tape facility. Note that although some host systems support 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 "Pip-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	CSI
Backing up a device from tape:	
.BACKUP/DEVICE DU: MS:	.RUN BUP *MS:=DU:/I
Restoring the device from tape:	
.BACKUP/DEVICE/RESTORE MS: DU:	.RUN BUP *DU:=MS:/I/X
Backup of a file:	
.BACKUP DU:FILENAME.EXT MS:	.RUN BUP *MS:=DU:FILENAME.EXT

Restoring a file:

```
.BACKUP/RESTORE MS:FILENAME.EXT DU:
```

```
.RUN BUP
*DU:=MS:FILENAME.EXT/X
```

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:

Keyboard	CSI
Initializing the tape:	
.INITIALIZE MS:	.RUN DUP *MS:/Z
Copying a device to a file:	
.COPY/DEVICE/FILE DU: MS:DU.DSK	.RUN DUP *MS:DU.DSK=DU:*.*/I/F
Restoring a device from a file:	
.COPY/DEVICE/FILE DU: MS:DU.DSK DU:	.RUN DUP *DU:*.*=MS:DU.DSK/I/F
Initialize bootable tape:	
.INITIALIZE/FILE:MBOT16.BOT MS:	.RUN DUP *MS:=DU:MBOT16.BOT/Z

An alternative to BUP for storing multi-volumes on tape:

```
                                        .RUN DUP
.COPY/DEVICE/FILE DU0: MS:DU0.DSK       *MS:DU0.DSK=DU0:*.*/I/F
.COPY/DEVICE/FILE DU1: MS:DU1.DSK       *MS:DU1.DSK=DU1:*.*/I/F
.COPY/DEVICE/FILE DY1: MS:DY1.DSK       *MS:DY1.DSK=DY1:*.*/I/F
```

Restoration of multi-volumes can be selective:

```
                                        .RUN DUP
.INITIALIZE/NOQUERY DU:                 *DU:/Z/Y
.COPY/DEVICE/FILE MS:DY1.DSK DU:        *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 CSI

Copying all MAC files to tape:

```
                                        .RUN PIP
.COPY DU:*.MAC MS:/POS:-1               *MS:/M:-1=DU:*.MAC
```

Copying entire tape to disk:

```
                                        .RUN PIP
.COPY MS:*.*/POS:0 DU:*.*               *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

CSI

Verification of ASCII files:

```
.DIFF MS:*.MAC DU:*.MAC
```

```
.RUN SRCCOM
*TT:=MS:*.MAC,DU:*.MAC
```

Verification of binary files:

```
.DIFF/BINARY MS:*.SAV DU:*.SAV
```

```
.RUN BINCOM
*TT:=MS:*.SAV,DU:*.SAV
```

CREATING BOOTABLE RT-11 TAPES. Creating bootable RT-11 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 sample 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.

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
!
INITIALIZE/NOQUERY/VOLUMEID/FILE:DIS:MBOT16.BOT TAP:
RTV5
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
!
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 stand-alone RT-11 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 Stand-alone Programs

```
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
```

```
!
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 stand-alone 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:

```
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 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       xxxxxx      xxxxxx+2
 000000       000042       xxxxxx      <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 currently 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/APPEND 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:

```
>ALL MS0:                                ;Allocate MS0:
>INIT MS0:XXX                            ;Initiate volume XXX
>MOU MS0:XXX                             ;Mount volume XXX
>PIP                                     ;Invoke PIP
PIP>MS0:=DU0:[*,*]*.*;*                  ;Copy all files to tape

MTAACP - MOUNT NEXT VOLUME ON MS0: ;This message only
                                   ;appears if another
                                   ;tape is required to
                                   ;complete the file
                                   ;transfer.
PIP>                               ;Normal termination
```

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:

Backing up the system device:

```
>BRU/REWIND/MOUNT/VERIFY SY: 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 MS: 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>
```

CREATING A STANDALONE BRU TAPE. The following example assumes that stand-alone 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                                ;Invoke VMR
ENTER FILENAME:  BRU64K             ;Create a bootable image
VMR>SAV MS:BRU64K                   ;Save image on tape
VMR><CTRL>Z                         ;Exit VMR
>FLX                                ;Invoke FLX
FLX>MS:[*,*]/DO/LI                  ;Directory of MS0:
```

```
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 *.LAL;* BRU64K,SAV/AB      ;Give the file a name
>ZAP                               ;Invoke ZAP
ZAP>DU0:[1,51]BRU64K.SAV/AB        ;Open the file
_0/                                ;Dump location zero
000: 000000/  000410               ;It contains a BR+20
_240                               ;Change loc. 0 to 240
_407                               ;Change loc. 2 to 407
_X                                 ;Exit ZAP
>FLX                               ;Invoke FLX
FLX>MS:/ZE/DO                      ;Initialize the tape
FLX>MS:/IM/DO=DU0:[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 instructions. 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 compress 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 programs 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 facility. An example of SAV/RES operation is as follows:

```
Option: SAVRES <CR>

SAV/RES Function: SAVE <CR>

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 back up 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 approxiamately 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

*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

%Please type the device name and      ;New, initialized
%unit number of the drive where       ;tape must be
%the next volume may be found?        ;inserted
MS0:
*                                     ;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 back up 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.

GENERAL INSTRUCTIONS FOR USING THE TANDBERG TDC 3309 CARTRIDGE TAPE DRIVE

HOW TO INSERT AND REMOVE TAPE 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: While the drive is running, a cartridge can be removed without physical damage to the cartridge or drive. However, doing so may terminate a 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 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 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, indicat-

ing 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. Slide the cartridge to be loaded into the drive. Position cartridge so that: (1) The round metal armature plate on the bottom of the cartridge faces the door, i.e. down; and (2) the sliding black locking mechanism at one end of of the cartridge is inserted into the drive first.

Now 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 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 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.

The system can access a diskette only when it is inserted into the drive correctly. Notice that at one side the diskette has a rounded oblong opening to admit the read/write heads. As shown in Figure 5-3, insert the diskette with this opening first. The side of the diskette with the label must face toward the door latch handle.

WRITE PROTECTION OF DISKETTES.

Notice that diskettes have a large notch on the forward edge (eight-inch diskettes) or on one side (5-1/4 inch diskettes) (see Figure 5-3). This notch controls 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 write protected.

EIGHT-INCH DISKETTES. With eight-inch diskettes, write protection is in effect when the notch is UNCOVERED. Covering the notch allows the system to both read and write on the diskette.

5-1/4 INCH DISKETTES. Your 5-1/4 inch diskettes follow the opposite procedure: COVERING the notch provides write protection. Leaving the notch uncovered allows the system to both read and write on the diskette.

NOTE: If you cover a write-protect notch, always use the self-sticking tabs provided by the diskette manufacturer.

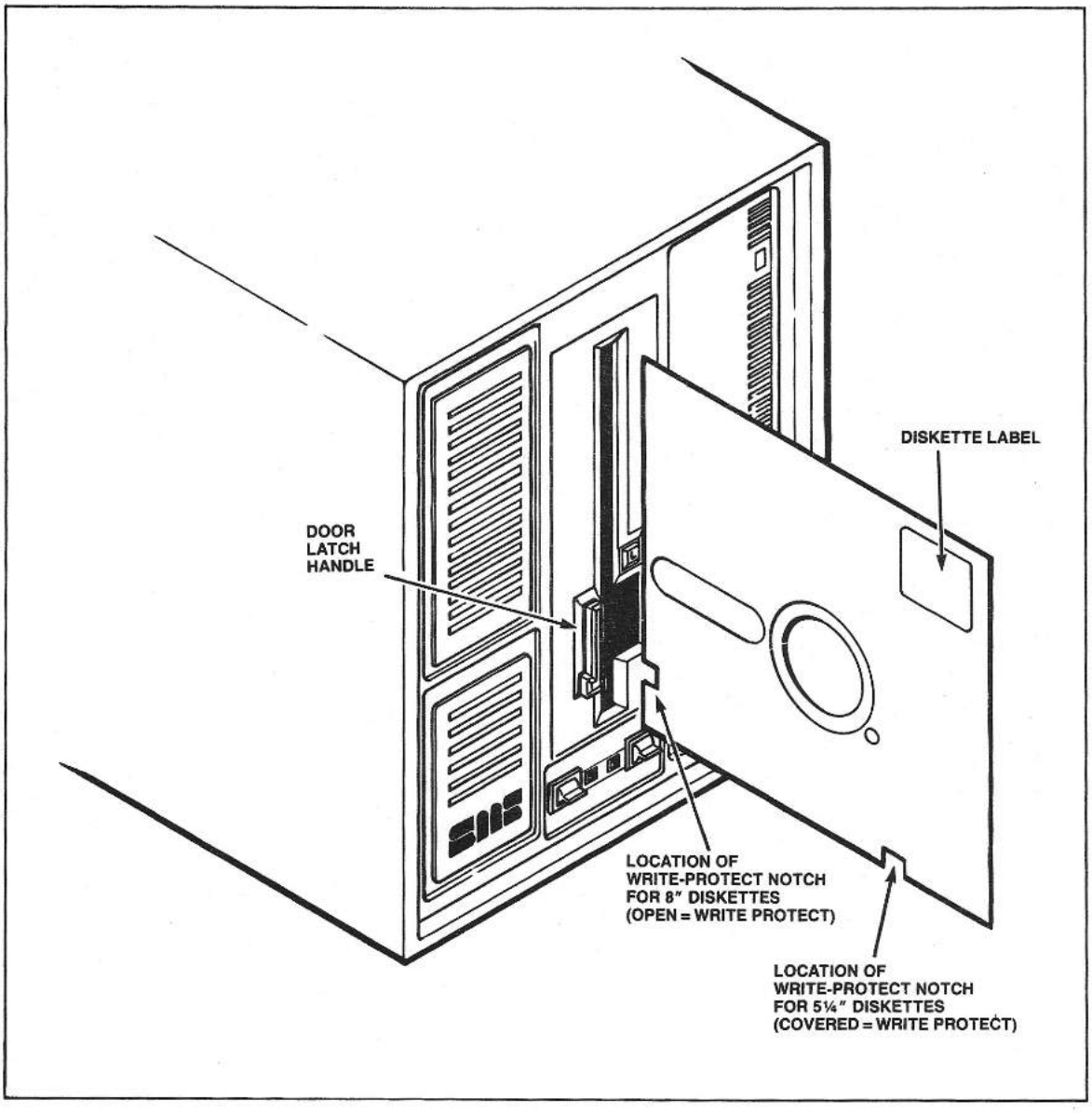

Fig. 5-3 Inserting diskettes

SECTION 6

MAINTENANCE

RANDOM-READ EXERCISE OF WINCHESTER DRIVES

If you experience read or write errors with any regularity, or have other system problems that could be attributed to possible malfunctions in your system's Winchester or floppy drives, it may be possible to isolate the problem by running a rapid version of the SENSE Random Read test. This test can be initiated by throwing the TEST 1 switch, located behind the front panel access door, to the OFF position (see Figure 1-4). CAUTION: Do not perform this test while the CPU is running. Note the following points:

1. FLOPPY DRIVES. This test can be performed only when the floppy drive to be tested has been configured under SENSE. Also, it must contain a disk whose format has been configured under SENSE. See the DEVICE PARAMETERS and FLOPPY FORMATS portions of the CONFIGURATION menus in Appendix C, Section C4.

2. WINCHESTER DRIVES. This test can be performed on a Winchester drive only when the drive has been configured under SENSE. See the DEVICE PARAMETERS portion of the CONFIGURATION menus in Appendix C, Section C4.

3. STARTING THE RANDOM READ TEST. First, be sure that no application is running on your system; then throw the TEST 1 switch (behind the front-panel access door) to OFF. Next, reset the system by pressing up on the front-panel RESET switch. The system now starts the Random Read test.

4. TEST RESULTS. The Random Read test will continue until an error is found or until the TEST 1 switch is returned to the ON position and the system is reset. If an error is found, the three ERROR lamps (behind the access door) will light in a pattern that indicates which device is at fault, as shown in Table 6-1. Note that this test is a subset of the full Random Read test that can be invoked under SENSE from your video terminal. At the end of testing, the TEST 1 switch must be returned to the ON (i.e. normal operation) position. For a complete description of the Random Read test see the DISK EXERCISES portion of the EVALUATION menus in Appendix C, Section C4.

TABLE 6-1

SMS 0107 DISK-CONTROLLER
AND FRONT-PANEL ACCESS-DOOR
ERROR-LAMP (LED) INDICATIONS
AS A RESULT OF RUNNING A RANDOM-READ TEST
(see Figures C2-1 and 1-4)

LAMP DESIGNATIONS AND RANDOM-READ TEST RESULTS (for both SMS 0107 LEDs and front-panel access-door LEDs)			
CR1 and ERROR 1	CR2 and ERROR 2	CR3 and ERROR 3	MEANING
OFF	OFF	OFF	No error
OFF	OFF	ON	Reserved
OFF	ON	OFF	W1 error (see Note 2)
OFF	ON	ON	W0 or C0 error (see Note 3)
ON	OFF	OFF	Reserved
ON	OFF	ON	No drives are ready
ON	ON	OFF	Reserved
ON	ON	ON	F0 error (see Note 4)

NOTE 1: Viewing fron left to right in Figure C2-1, error-indicator LEDs are designated CR1, CR2, and CR3. Viewing from left to right at the open front-panel access door (refer to Figure 1-4), the LEDs are designated ERROR 1, ERROR 2 and ERROR 3.

NOTE 2: This is a test of the Fixed-disk Winchester drive when a cartridge Winchester drive is also present in the system. The fixed-disk Winchester drive is then designated W1 (instead of W0) and the removable-cartridge Winchester drive is designated C0.

NOTE 3: This is a test of the removable-cartridge Winchester drive (C0), if one is present in your system. If your system does not include a removable-cartridge Winchester, then this is a test of the fixed-disk Winchester drive (W0).

NOTE 4: F0 = either 8" or 5 1/4" floppy drive, depending upon configuration.

PREVENTIVE MAINTENANCE

The SMS 1000 Model 30 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.

TROUBLESHOOTING

To be supplied.

SMS 1000 Model 30 DISASSEMBLY SEQUENCE

Follow the disassembly sequence given here when it is necessary to remove or replace a component of the SMS 1000 Model 30 system. See Figure 1-2 for a full disassembly view of the Model 30. Proceed as follows:

1. REMOVAL OF COVER. The Model 30 uses a wraparound cover held to the bottom of the Model 30 housing by friction catches. To remove the cover, reach under the housing and simply pull it to

each side until the catches come loose. Then, with the bottom of the cover held open, lift it up and away from the case.

2. REMOVAL OF FRONT AND REAR PANELS. The front panel and rear panel are each held to the system case with eight flat-head screws. After removal of the rear panel screws, pull the panel partially away from the case in order to be able to reach and disconnect the wiring harness from its connectors. Also, after removal of its mounting screws, the front panel can be pulled directly away from the case, being careful no to damage the indicator lights and switches on the backplane.

3. POWER SUPPLY. The power supply is held to the side panel of the Model 30 housing by four flat-head screws. After removing these screws, disconnect the wiring harness and the grounding strap from the power-supply terminal strip. The power supply can now be slid out of its housing and removed.

4. FIXED-DISK WINCHESTER DRIVE. The fixed-disk Winchester drive is held to the side panel of the Model 30 housing by four flat-head screws. To remove the drive, first remove its d-c power connector and the two ribon connectors, and then remove the four mounting screws while holding the drive to keep it from falling.

5. REMOVING TAPE DRIVE, 5 1/4" FLOPPY OR 8" FLOPPY. Each of these three peripherals is secured at the bottom by means of two lips on the lower part of the cardcage supporting structure. The upper part of each drive is held to the cardcage supporting structure by two flat-head screws. Screwdriver access to these fasteners is through holes in the side of the case. Be sure to unplug all connectors from a drive before attempting to remove it.

6. CARDCAGE. Remove the peripheral devices (see the two previous steps), as well as all modules from the backplane before attempting to remove the cardcage. The cardcage and its supporting structure are held in place by six screws to the side of the Model 30 housing and three screws to the bottom of the housing. When these screws are removed, the cardcage can be lifted directly up and out of the housing.

7. BACKPLANE. To take out the backplane, first remove the cardcage (see previous step). Next, remove the wiring harness connections and grounding strap from the backplane terminal strip. Then, remove the 11 screws that hold the backplane to the bottom of the case. The backplane is removed by pulling it straight back in order to free the lamps and switches (at one end of the backplane) from their openings in the front panel.

INTERCONNECTION WIRING DIAGRAMS

Figures 6-1 through 6-4 show the interconnection of SMS 1000 Model 30 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 B.

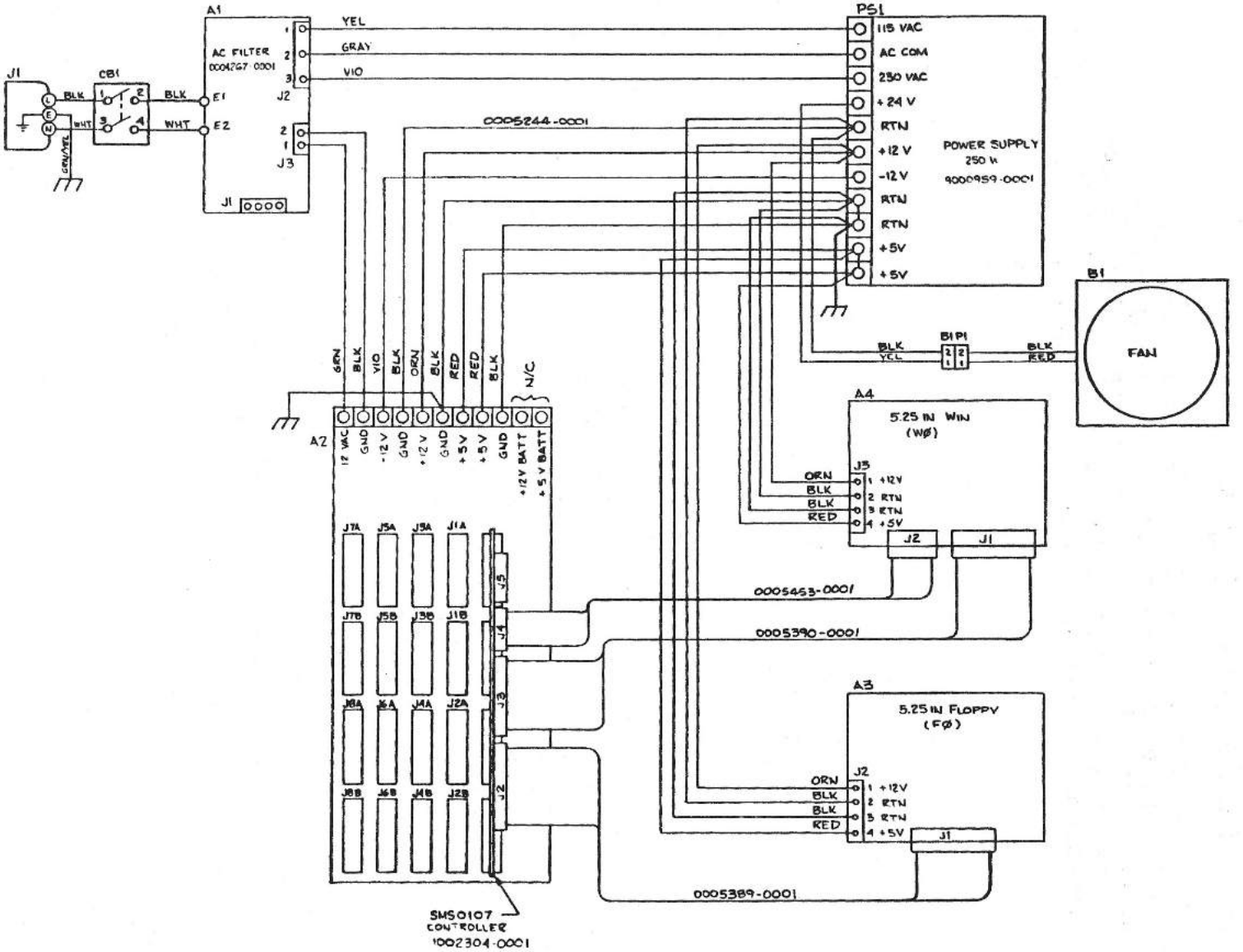

Fig. 6-1 SMS 1000 Model 30 cabling diagram. Single Winchester and 5 1/4" floppy configuration (1002520).

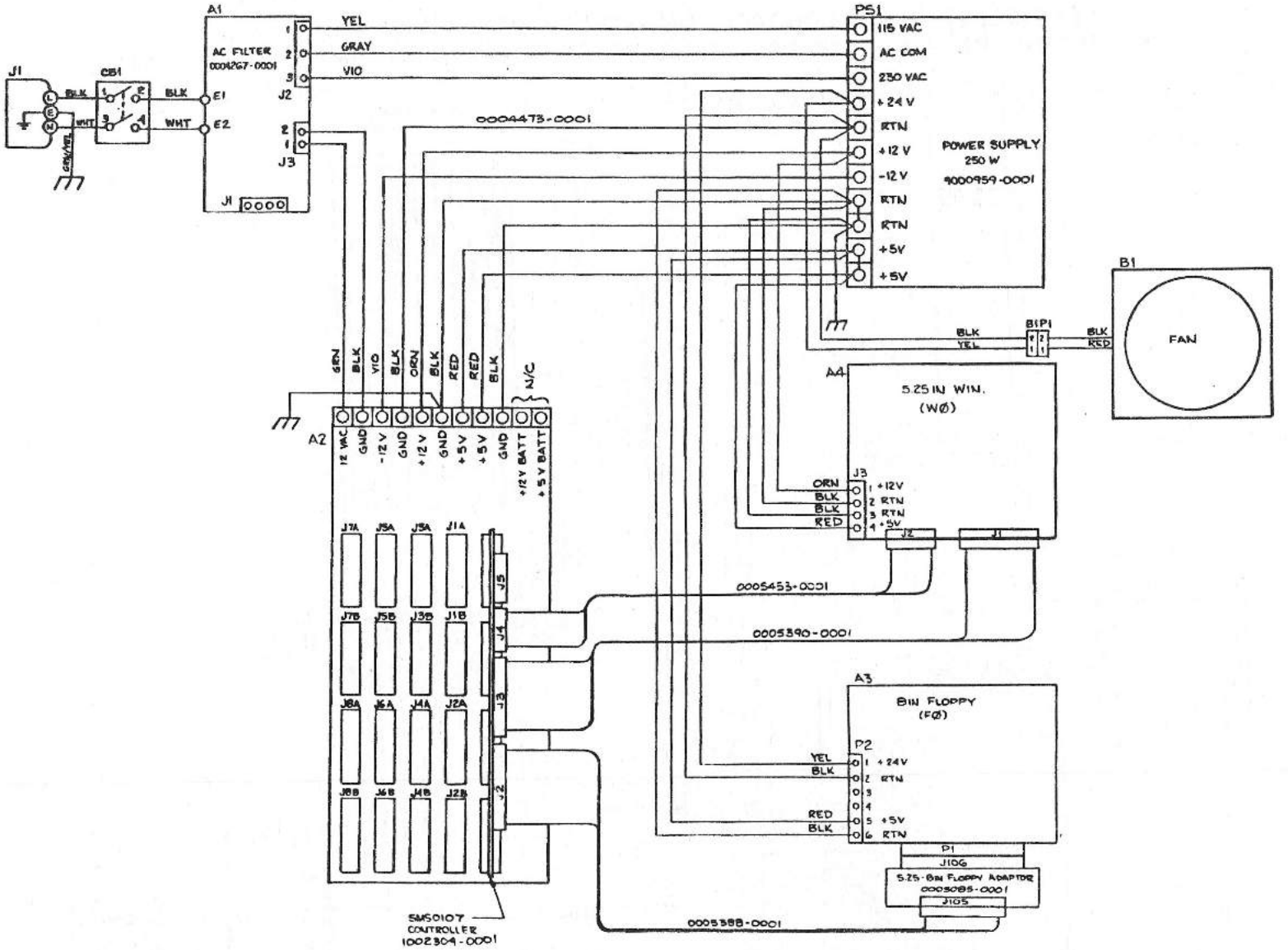

Fig. 6-2 SMS 1000 Model 30 cabling diagram. Single Winchester and 8" floppy configuration (1002519).

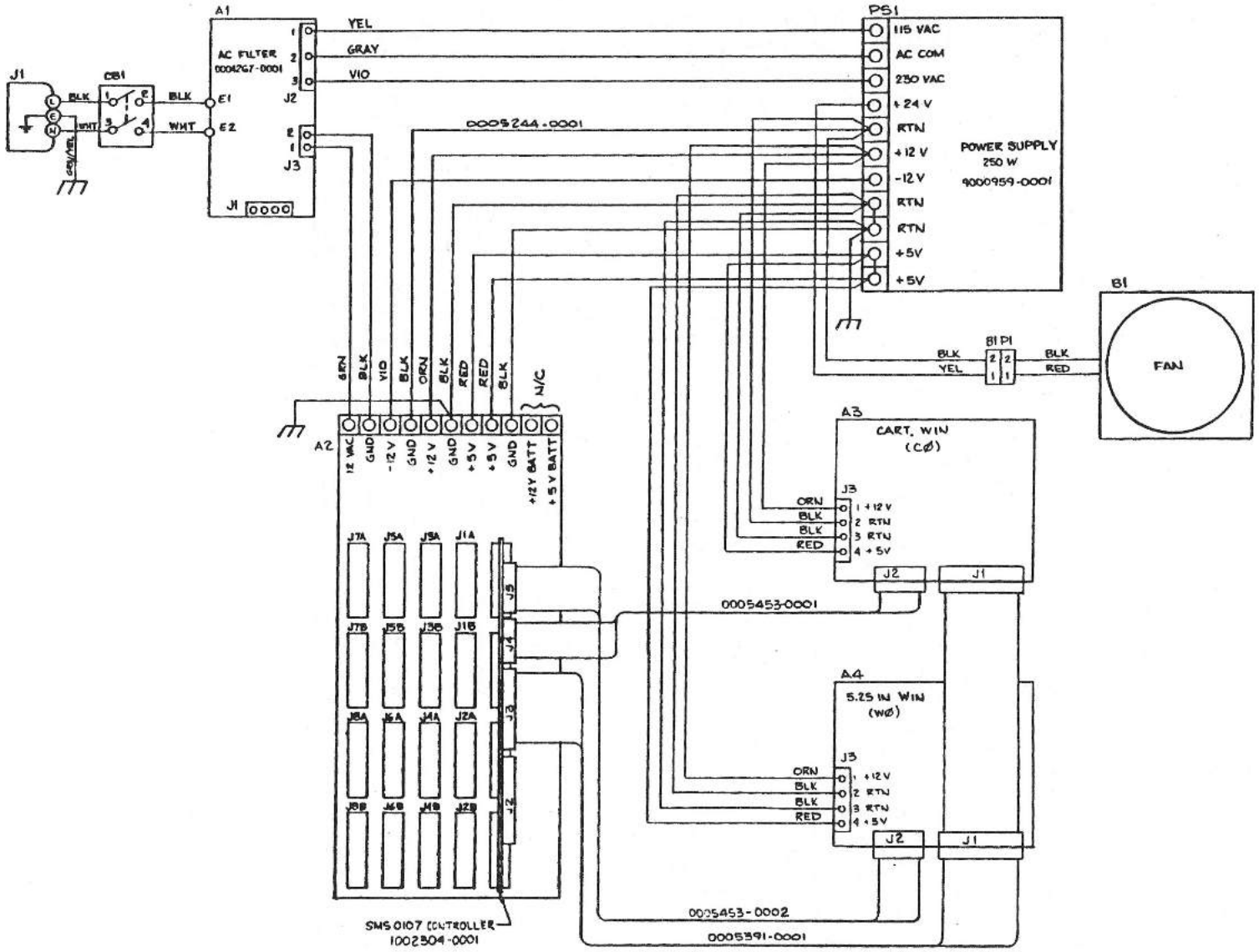

Fig. 6-3 SMS 1000 Model 30 cabling diagram. Single Winchester and cartridge Winchester configuration (1002522).

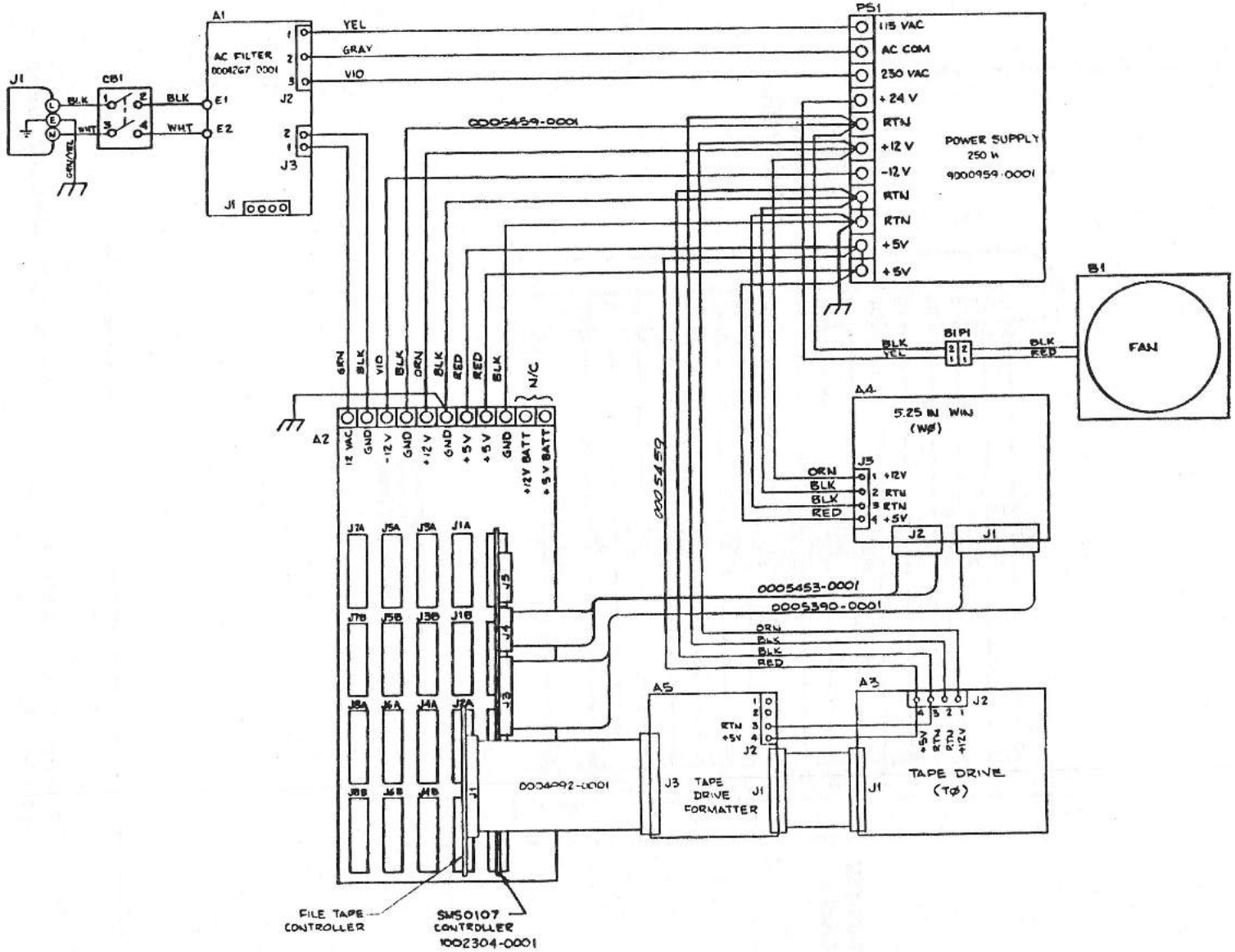

Fig. 6-4 SMS 1000 Model 30 cabling diagram. Single Winchester and file tape configuration (1002521).

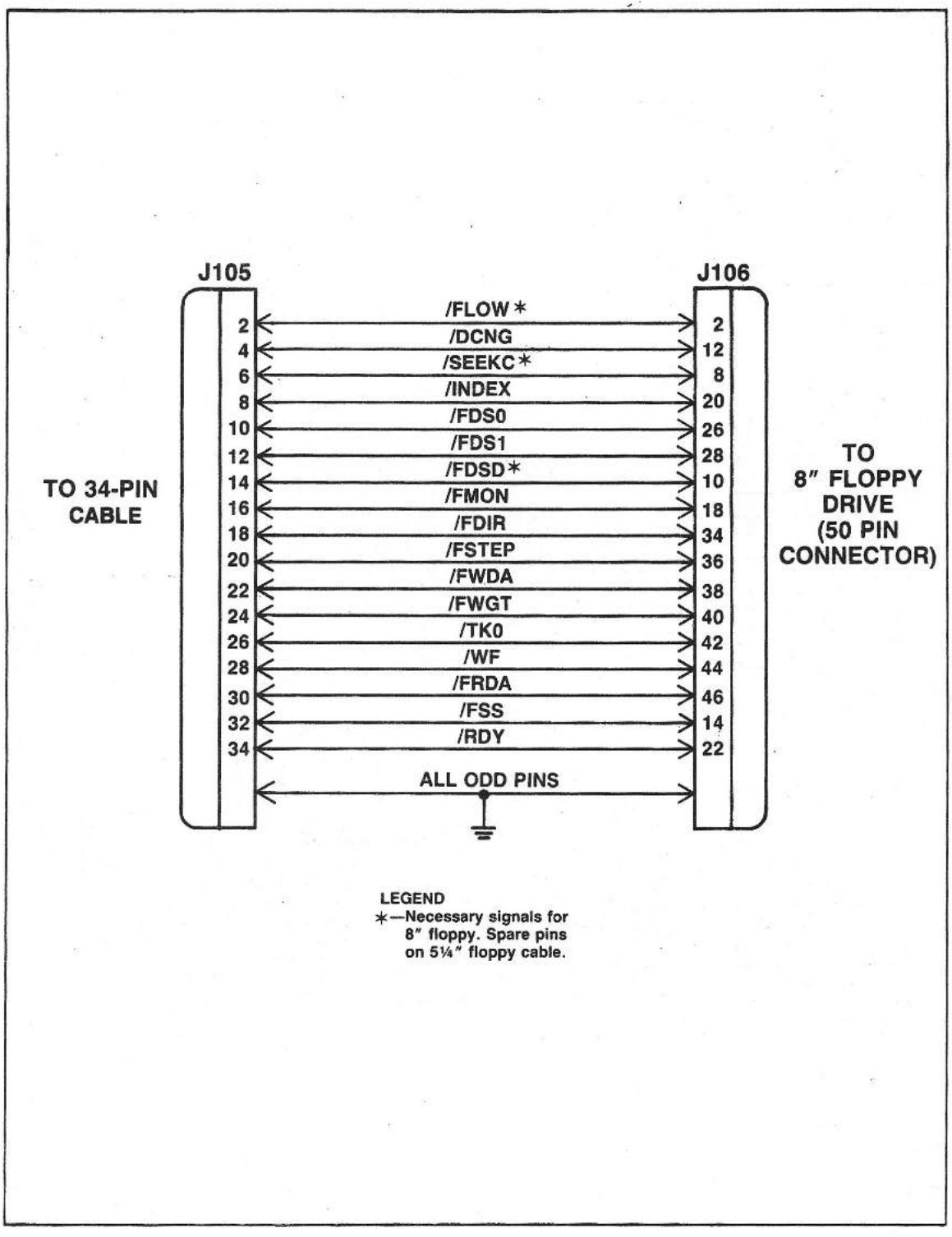

Fig. 6-5 Schematic diagram of 50-pin-to-34-pin adapter used with 8" floppy drives

APPENDIX A

SPECIFICATIONS FOR PERIPHERAL UNITS USED WITH SMS 1000 MODEL 30 MICROCOMPUTER SYSTEM

TABLE A-1
5 1/4-INCH WINCHESTER DRIVES

DRIVE TYPE	UNFORMATTED CAPACITY (MB)	FORMATTED CAPACITY (MB)	AVG. ACCESS TIME (MS)	MAX. XFER RATE (KB/SEC)	NO. OF HDS	NO. OF CYL	SECTORS PER TRACK	BYTES/SECTOR (MAX)	BYTES/TRACK (FORMATTED)	ROTATIONAL LATENCY (MS)
ST213 (SEAGATE) (588 TPI) NOTE: PRECOMP ENABLED	12	11.28	65	625	2	615	18	512	9216*	8.33
ST225 (SEAGATE) (580 TPI) NOTE: PRECOMP ENABLED	25	22.65	85	625	4	615	18	512	9216*	8.33
Q540 (QUANTUM) (591 TPI) NOTE: PRECOMP ENABLED	42	37.75	45	625	8	512	18	512	9216*	8.33
XT-1085 (MAXTOR) (980 TPI) NOTE: PRECOMP DISABLED	85	75.5	30	625	8	1024	18	512	9216*	8.33

TABLE A-1

5 1/4-INCH WINCHESTER DRIVES (continued)

DRIVE TYPE	UN-FOR-MAT-TED CAP-ACI-TY (MB)	FOR-MAT-TED CAP-ACI-TY (MB) (MAX)	AVG. AC-CESS TIME (MS)	MAX. XFER RATE (KB/ SEC)	NO. OF HDS	NO. OF CYL	SEC-TORS PER TRACK	BYTES/ SEC-TOR (MAX)	BYTES/ TRACK (FOR-MAT-TED)	ROTAT-ION-AL LAT-EN-CY (MS)
XT-1140 (MAXTOR) (980 TPI) NOTE: PRECOMP DISABLED	140	126.9	30	625	15	918	18	512	9216*	8.33
SYQUEST TECHNOLOGY MODEL SQ312RD REMOVABLE-CARTRIDGE TYPE WINCHESTER DRIVE (741 TPI) NOTE: PRECOMP DISABLED	12.7	11.28	135	625	2	615	18	512	9216*	8.46

LEGEND:
KB = 1024 bytes (i.e. kilobyte)
MB = 1,048,576 bytes (i.e. megabyte)
* - 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.

TABLE A-2
1/4-INCH-CARTRIDGE STREAMING TAPE DRIVE

TYPE	RECORDING DENSITY (BPI)	NO. OF TRACKS	NORMAL TAPE SPEED (IPS)	FAST TAPE SPEED (IPS)	DATA XFER RATE (KB/SEC)	CAPACITY PER CARTRIDGE (MB)
TANDBERG TDC 3309	8000	9	90	90	90	60

WITH TDC3350 CONTROLLER/FORMATTER BOARD (QIC-02 interface).

MEDIA TYPES (all media types are QIC-24 compatible): (1) 3M DC300XL or DC300XL+ (450-foot); (2) DC600A (600-foot); (3) DEI 137 m (450-foot); (4) DEI 169 m (555-foot); or equivalent.

LEGEND

BPI = Bits Per Inch
IPS = Inches Per Second
m = metre

TABLE A-3

STANDARD 5 1/4" DISKETTE FORMATS

FORMAT and DENSITY	SECTORS/ TRACK	NO. OF HDS.	BYTES/ SECTOR	FORMATTED CAPACITY (MB)	TRACKS/ INCH (TPI)	NO. OF CYL
DEC RX50	10	1	512	0.4	96	80
DEC RX50/DS	10	2	512	0.8	96	80

TABLE A-4

STANDARD 8" DISKETTE FORMATS

FORMAT and DENSITY	SECTORS/ TRACK	NO. OF HEADS	BYTES/ SECTOR	FORMATTED CAPACITY (MB)	NO. OF CYL.
DEC RX01	26	1	128	0.25	77
DEC RX02	26	1	256	0.5	77
DEC RX03	26	2	256	1.0	77
IBM SINGLE	26	1	128	0.25	77
IBM SINGLE	26	2	128	0.5	77
IBM DOUBLE	16	1	512	0.6	77
IBM DOUBLE	16	2	512	1.2	77
IBM DOUBLE	15	2	512	1.1	77

LEGEND

KB = 1024 bytes (i.e. kilobyte)
MB = 1,048,576 bytes (i.e. megabyte)

APPENDIX B

SMS 1000 MODEL 30
TABLE OF MAJOR SYSTEM COMPONENTS

PART NUMBER	DESCRIPTION
9001385-0001	12MB Winchester. ST213 or equivalent.
9001336-0001	25MB Winchester. ST225 or equivalent.
9001081-0001	42MB Winchester. Q540 or equivalent.
9001331-0001	85MB Winchester. XT1085 or equivalent.
9001136-0001	140MB Winchester. XT1140 or equivalent.
9001315-0001	60MB-capacity 1/4" streaming tape drive for file tape backup. TDC 3309/3350 or equivalent.
9001425-0001	File tape interface module (dual width) used with TDC 3309/3350 streaming tape drive.
9001258-0001	1MB 8" floppy drive. TM848-2E or equivalent.
9001256-0001	0.7MB 5 1/4" floppy drive (96 TPI). JU465 or equivalent.
9001524-0001	12MB Removable-cartridge Winchester drive. SyQuest Model SQ312RD, or equivalent.
9001525-0001	SyQuest Model SQ200 cartridge for use with the SyQuest SQ312RD removable-cartridge Winchester drive.
1002304-0001	SMS 0107 MSCP controller (quad width).
9000959-0001	250-watt power supply.
0004683-0001	Fan assembly.
0004315-0001	SMS 1000 Model 30 five-slot backplane
0004267-0001	A-C line-filter assembly

APPENDIX C

DESCRIPTION OF SMS 0107

DISK CONTROLLER

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APPENDIX C: SMS 0107 DISK-CONTROLLER OVERVIEW

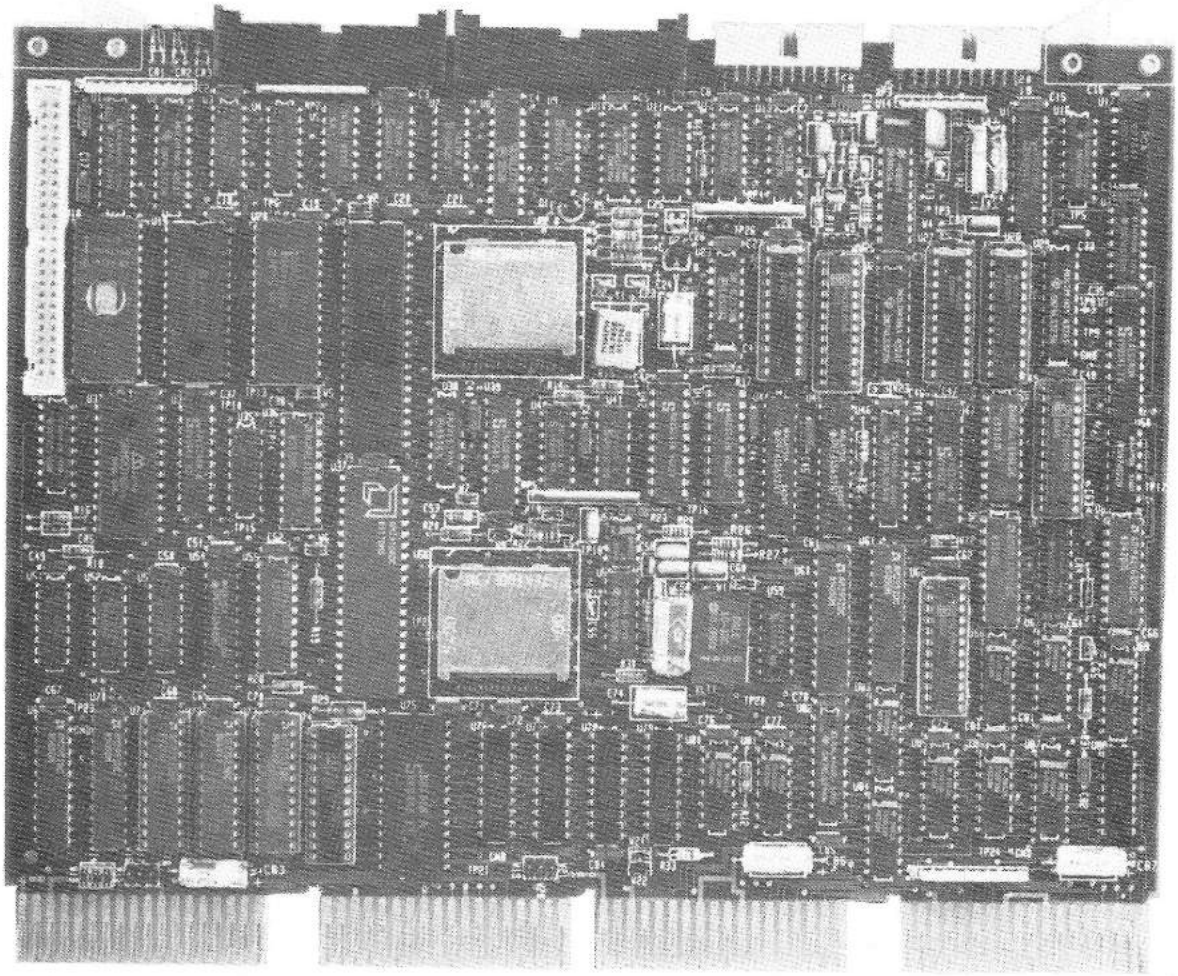


Fig. C1-1 SMS 0107 Disk Controller

SECTION C1

SMS 0107 OVERVIEW

INTRODUCTION

This appendix describes capabilities and features, installation, and user operation of the SMS 0107 Disk Controller (SMS Part Number 1002304). In this and subsequent sections of the appendix, the SMS 0107 Disk Controller is usually referred to as the "disk controller".

PURPOSE AND USE

The SMS 0107 Disk Controller accommodates up to two ST506/ST412 standard 5 1/4-inch fixed Winchester disk drives and up to two standard SA465 5 1/4-inch or SA860 8-inch floppy disk drives. One removable-cartridge Winchester drive can be accommodated in lieu of the first fixed-disk Winchester. The disk controller performs non-interleaved disk read/write transfers with a full 32-bit ECC, which provides 16-bit error detection and 6-bit correction, and supports LSI-11 CPUs. The controller supports all disk-related functions of the Micro VMS, RSX-11M-Plus, RSX-11M, RSTS/E, or RT-11 operating systems. Virtually all disk drives adhering to the ST506/ST412 or SA465/SA860 standards can be accomodated.

GENERAL DESCRIPTION

The SMS 0107 Disk Controller (Figure C1-1) is a low cost, high performance Q-bus disk controller. All components of the disk controller are contained on a single quad-width Q-bus board. The disk controller operates from standard bus power, and has no special wiring or cooling requirements.

APPENDIX C: SMS 0107 DISK-CONTROLLER OVERVIEW

CAPABILITIES AND FEATURES

DISK HANDLING. The high data transfer rates achieved by the disk controller allow operation without sector interleaving. Full 32-bit error detection with automatic retry, and 6-bit error correction are provided using an internally-generated error correction code (ECC). Both non-block and block-mode DMA transfers are supported.

COMPATIBILITY. The disk controller uses an enhanced MSCP (Mass Storage Control Protocol) protocol, and operates efficiently with LSI-11 CPUs. CPU communication with the disk controller is provided through the standard DU device handler/driver in Micro VMS, RSX-11M-Plus, RSX-11M, RSTS/E, or RT-11 operating systems. These operating systems are fully supported without modification. The disk controller also provides command queueing for up to eight I/O commands to maximize I/O response under heavy system loading.

OFFLINE UTILITIES. The disk controller contains an interactive menu-driven set of utilities accessible at boot time from the host system console terminal. This set of utilities is called the SENSE Monitor.

SENSE MONITOR FEATURES. SENSE allows interactive setup of drive configuration and parameters, selection of bus addresses, execution of Winchester and floppy disk read/write test diagnostics, formatting of Winchester and floppy disks, and setup of Winchester disk automatic flaw mapping/management. Floppy disk formats supported for 5 1/4-inch drives include RX50, RX50 double-sided, and IBM PC. Formats for 8-inch drives include RX01, RX02, RX03, IBM 1D, and IBM 2D. SENSE also allows selection of controller Q-bus burst rates to optimize system device contention for the bus bandwidth. If needed, a long duration between bursts can be selected to prevent high speed disk controller DMA transfers from locking out slower devices from the Q-bus.

INVOKING THE SENSE MONITOR. At power-up, or when the host system is reset, the user has the option of entering the SENSE Monitor to perform offline controller functions, or booting the host CPU and operating system to place the disk controller and the system into online mode. When SENSE has been entered and all functions or parameter changes have been completed, the user exits SENSE. After SENSE is exited, the host system must be restarted (i.e. reset) to store the disk controller parameter changes. After reset, the user again has the option of entering SENSE or booting the host CPU.

ON-BOARD CPU BOOT CODE. When the system is to be placed online, the host CPU operating system software is booted from

boot code contained on the disk controller board. In the case of an LSI-11 CPU, the CPU is booted entirely by the disk controller-resident boot code.

DIAGNOSTIC SELF-TEST. The disk controller contains a high performance 8-bit microprocessor that controls all internal functions for self-test, disk, and SENSE operations. When the disk controller is powered up or reset, an extensive self-test routine is executed by the microprocessor. The self-test checks all major components of the disk controller. Three onboard error-indicator LEDs show self-test completion status. When the self-test completes successfully, the indicators remain unlit. When an error is encountered, the LEDs display a pattern indicating the type of error that occurred.

SETUP FEATURES. Configuration of the controller is handled in two ways: through SENSE and by installation of jumpers. When the disk controller is initially installed, certain jumper settings are made to define controller features and host system configuration details. For example, certain jumpers enable or disable the SENSE function, the onboard CPU boot code PROM, or the write protection features of SENSE. Other jumpers are installed to indicate the type of CPU in the host system. All other setup parameters are established or modified using SENSE functions. These include setup of drive configurations and parameters, selection of disk controller bus addresses, and setup of Winchester disk automatic flaw mapping and management. Peripheral configuration is described in detail in the Installation section of this appendix.

FUNCTIONAL DESCRIPTION

Figure C1-2 is a functional block diagram of the disk controller. The disk controller has two basic purposes: to access a specific location on the disk, read data from that location and transfer it to the host system memory. It may also transfer data from the host system memory and write the data at a specific location on the disk. All functions within the disk controller are under the control of the 80188 microprocessor using instructions stored in the control firmware.

For the purpose of this discussion we will divide the overall function of the controller board into read functions and write functions.

READ. In order to execute a READ command and transfer data from the disk to the host memory the following sequence takes place:

The host places the READ command packet into host memory. The command packet consists of the logical block number of the data

to be read, the command code, the number of bytes to be transferred and the destination address in the host memory where the data is to be placed.

The controller microprocessor is alerted to the presence of the command by the Device I/O Register. This register is selected by the Device Address Decoder which receives the address from the host. The Device Address Decoder also is responsible for selection of the resident boot code. If this boot code is not used the host can be booted by its own code.

The command is placed in the Local Memory by the DMA Transfer and Control Logic under the control of the controller microprocessor.

The controller microprocessor decodes and verifies the command packet. The disk address is converted from a logical address to a physical disk address (cylinder, head, and sector). The head is positioned to the desired track by sending control signals through the Drive Interface. The Bit Processing and Control Logic is set up by the controller microprocessor to read data from the desired track.

The data to be read from the selected location on the disk is converted from a serial to parallel format by the Bit Processing and Control Logic. The read data is sent to the DMA Transfer and Control Logic through the Data Memory. The DMA Transfer and Control Logic transfers the read data to host memory.

After a command has been executed, a response packet is generated by the controller and sent back to the host memory by way of the Local Memory and DMA Transfer and Control Logic. This response provides the host with command execution status.

WRITE. The implementation of the WRITE command and the transfer of data from the host memory to the disk is accomplished in the following manner:

The WRITE command and the logical block number on the disk where the data is to be written are placed into the host memory by the host CPU. The command packet consists of the logical block number on the disk where the data is to be written, the command code, the byte count of the data to be transferred, and the address in host memory of the data to be written to the disk.

The controller microprocessor is alerted to the presence of the command by the Device I/O Register. This register is selected by the Device Address Decoder which receives the address from the host. The command is placed in the Local Memory by the

DMA Transfer and Control Logic under the control of the controller microprocessor.

The controller microprocessor decodes and verifies the command packet. The disk address is converted from a logical address to a physical disk address (cylinder, head and sector). The head is positioned to the desired track by sending control signals through the Drive Interface. The Bit Processing and Control Logic is set up by the controller microprocessor to write data at the desired location.

The data to be written to the selected location on the disk is transferred from the host memory by the DMA Transfer and Control Logic and buffered through the Data Memory. The data is converted from a parallel to serial format by the Bit Processing and Control Logic and sent through the Drive Interface to the disk.

After a command has been executed, a response packet is generated by the controller and sent back to the host memory by way of the Local Memory and DMA Transfer and Control Logic. This response provides the host with command execution status.

The Sense Parameter Memory EEPROM stores the configuration parameters related to the controller and the disk drives. The EEPROM also contains parameters related to the Sense functions. When data is entered by the user at the host terminal, the Device I/O Register is used to transfer the data to the Sense Parameter Memory. Any of the configuration parameters or the drive parameters can be altered. When the data has been entered, however, the controller must be reset to copy the EEPROM image into Local Memory for use during normal operations.

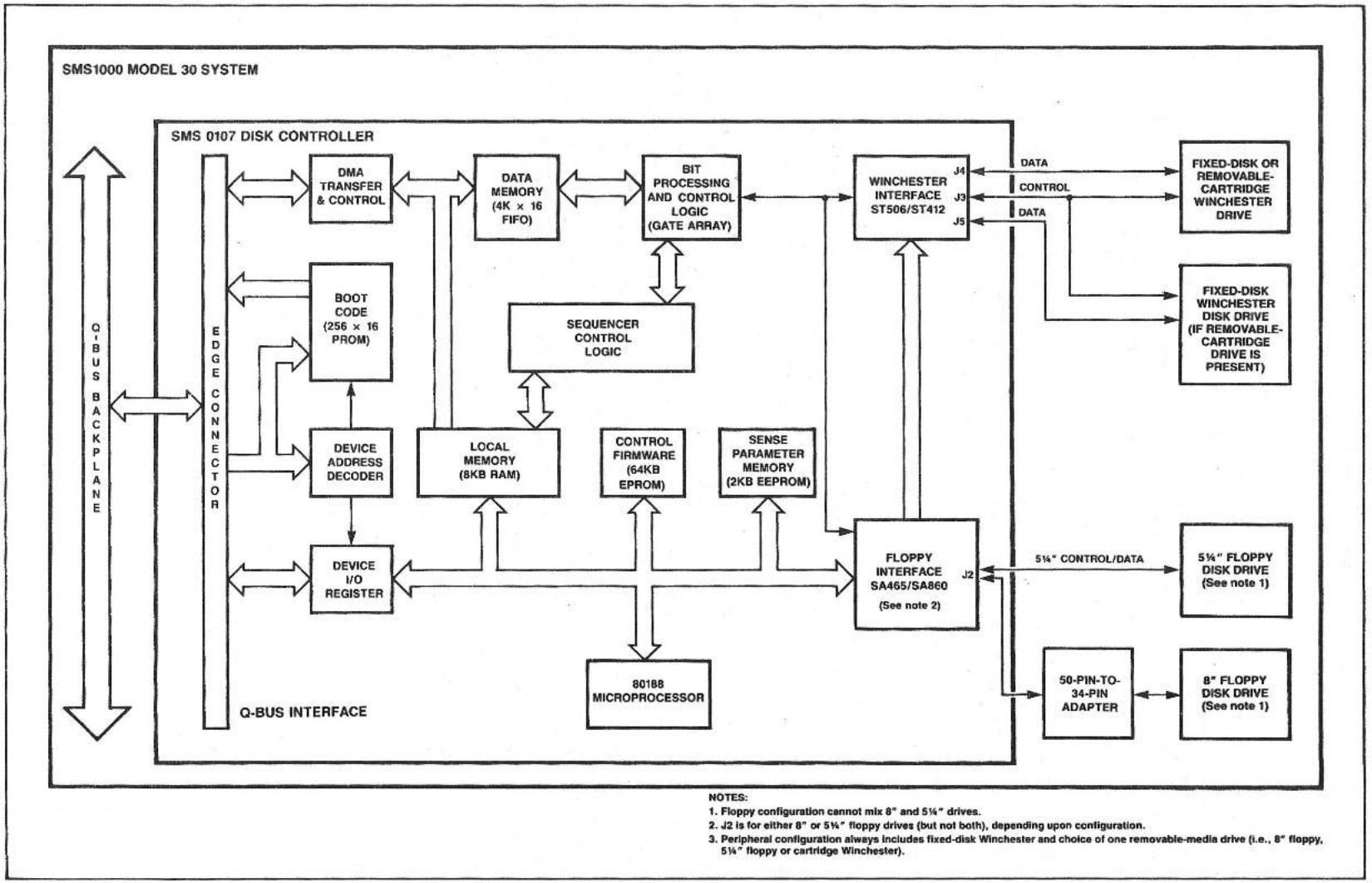


Fig. C1-2 SMS 0107 Disk Controller Functional Block Diagram

SMS 0107 DISK CONTROLLER SPECIFICATIONS

Mechanical

Size: Quad-width, standard height module.

Connectors: Standard Q-22 bus edge connector using A through D rows.

J1: 50-pin connector located at the handle end of controller board for connection to monitor for lab testing purposes only.

J2: 34-pin right angle flat cable connector located at the handle end of controller board for interface to industry standard SA465 5 1/4-inch or SA860 8-inch floppy disk drives. Connection to industry standard SA860 8" drives requires use of a 50-pin-to-34-pin adapter (SMS Part Number 0005085).

J3: 34-pin right angle flat cable connector located at the handle end of controller board for control signal interface to industry standard ST506/ST412 5 1/4-inch Winchester disk drive.

J4: 20-pin right angle flat cable connector located at the handle end of controller board for data signal interface to industry standard ST506/ST412 5 1/4-inch Winchester disk drive or removable cartridge Winchester drive connected to disk controller.

J5: 20-pin right angle flat cable connector located at the handle end of controller board for data signal interface to industry standard ST506/ST412 5 1/4-inch Winchester disk drive connected to disk controller.

Jumpers: Jumpers are provided to enable/disable SENSE, to enable/disable Winchester write protection by SENSE, to enable/disable CPU

Boot code PROM and to select boot PROM addresses. Jumpers are also provided to select host CPU-type. Other jumpers are provided for lab testing purposes only.

Indicators: Three red LEDs are used to indicate that controller passed internal diagnostics performed during re-initialization or power up of host system. If an error is encountered, the LEDs display a pattern to indicate the type of fault that occurred.

Electrical

Power requirements: +5VDC +/-5% at 5.0A max.
Ripple: less than 100mV p-p
(Power received from Q-bus backplane)

LSI-11 bus loading: 1 DC bus load
2 AC bus loads

Bus interface: Adheres to Q-22 specification.

Receives the following Q-bus signals:

BDAL0L-BDAL15L & BDAL21L, BDINL, BDOUTL, BDMRL, BSYNCL, BRPLYL, BBS7L, BIRQ4L-BIRQ6L, BIAKIL, BDMGIL, BINITL, BREFL, BDCOKH, BPOKH

Drives the following Q-bus signals:

BDAL0L-BDAL21L, BDINL, BDOUTL, BSYNCL, BRPLYL, BWTBTL, BBS7L, BDMRL, BPOKH, BIAKOL, BDMGOL, BIRQ4L-BIRQ6L, BSACKL

Does not interface with the following Q-bus signals:

BHALTL, BEVENTL

Typical DMA Cycle Time:	Block Mode DMA: 600ns/word max. 800ns/word typical
Winchester Drive interface:	Adheres to ST506/ST412 interface standard for 5 1/4-inch Winchester disk drives. Transmitter: Signal assertion = 0.0VDC to 0.4VDC (logical low) Minimum drive capability = 48mA sink at 0.40VDC Signal type: open collector Receiver: Signal assertion = 0.0VDC to 0.8VDC (logical low) Input load (max.) = -1.6mA at 0.4VDC Signal non-assertion = 2.0VDC to 5.25VDC (logical high)
Transfer rate:	625 kB/s maximum
Floppy disk drive interface:	Adheres to SA465/SA860 interface standard for 5 1/4-inch and 8-inch floppy disk drives. 50-pin-to-34-pin adapter (Part No. 0005085) must be used when 8-inch drive is connected. Transmitter: Signal assertion = 0.0VDC to 0.4VDC (logical low) Minimum drive capability = 48mA sink at 0.40VDC Signal type: open collector Receiver: Signal assertion = 0.0VDC to 0.8VDC (logical low) Input load (max.) = -1.6mA at 0.4VDC Signal non-assertion = 2.0VDC to 5.25VDC (logical high)

Data transfer rate: 62.50 kB/s 8" MFM
31.25 kB/s 5 1/4" MFM and 8" FM

Environmental

Operating Temperature:	0 to 50 degrees C 32 to 122 degrees F
Storage Temperature:	-65 to 70 degrees C -85 to 158 degrees F
Relative Humidity:	10 to 90% non-condensing

*** IMPORTANT ***

Extreme operating temperatures may require forced air cooling if free convection is limited. As a guide, 50 degrees C ambient temperature requires 100 linear feet/minute airflow over component side of the disk controller board in a typical card cage application.

SECTION C2

CONFIGURING THE SMS 0107 CONTROLLER

INTRODUCTION

This section provides the user with information on the jumper strapping necessary to configure the SMS 0107 disk controller for use with the SMS 1000 Model 30.

CONFIGURING SMS 0107 DISK CONTROLLER JUMPERS

Configuration of the disk controller is performed mainly through the SENSE Monitor facility. However, jumpers must be installed or removed on the SMS 0107 board to establish basic hardware conditions necessary for SENSE operation. Setup of these jumpers requires decisions involving basic functional parameters which are summarized in Table C2-1.

Six jumpers are used to select normal or test mode and Winchester write protection. Only three of these jumpers can be used at the same time. The first three are for on-board selection of these functions while the second three are for remote selection of the same functions.

Three other jumpers enable remote display of the self-test LED indicators. These jumpers place the remote LEDs in parallel with the on-board LEDs. The remote LEDs are located behind the access door on the Model 30 front panel.

Another twelve jumpers are provided on the disk controller board for lab testing and development purposes only. These jumpers do not require any setup aside from verifying that jumper plugs are installed or absent on the proper jumper pins.

Figure C2-1 shows the jumper pin locations on the disk controller. Table C2-1 summarizes the jumper options available. The default jumper configuration is noted in the "DEFAULT SETTINGS" column of the table and in Figure C2-1. The following paragraphs describe the use and installation of jumpers on the controller.

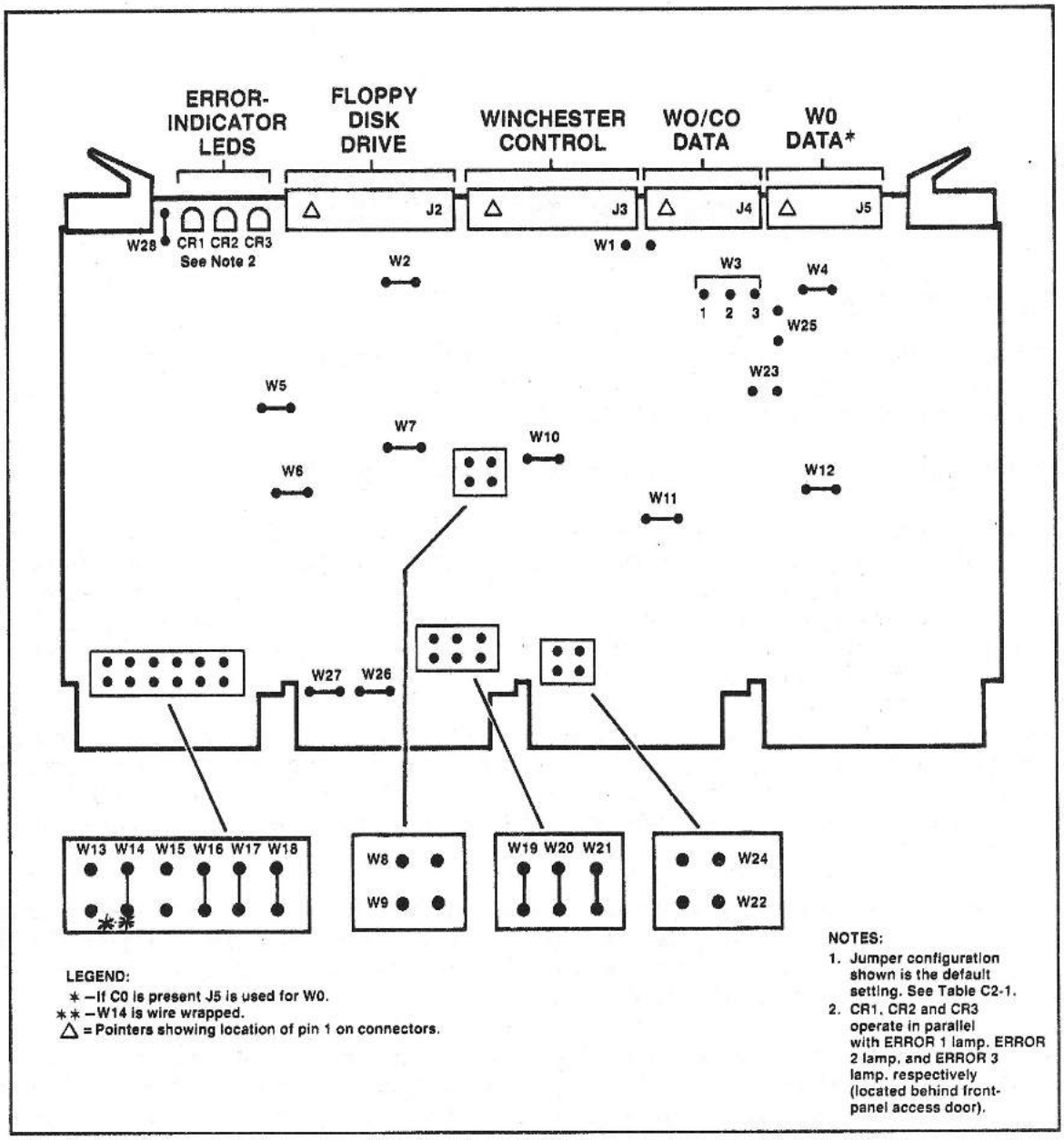


Fig. C2-1 SMS 0107 Disk Controller Jumper Locations

TABLE C2-1

SMS 0107 DISK CONTROLLER
JUMPER OPTION SUMMARY
(See Figure C2-1)

JUMPER	USED FOR:	DEFAULT (AS-SHIPPED) SETTING
W2	SENSE EEPROM Write Enable/Disable IN = Enabled OUT = Disabled	IN (enabled)
W13	Allows TEST 1 switch (behind access door on front panel) to initiate a random-read exercise on W0 and C0, when TEST 1 switch is in OFF position. When TEST 1 switch is in ON position, system is in normal-operation mode.	OUT
W14	Factory use only. Locks out TEST 2 switch (behind access door on front panel). Do not remove wire wrap.	IN (this jumper is wire wrapped)
W15	Winchester Write Protect Using SENSE Monitor or front-panel WRT PROT switch. IN = SENSE is used to write protect Winchester. OUT = Enable front-panel WRT PROT switch.	OUT(use front-panel WRT PROT switch)
W16	Enable front-panel TEST 1 switch:	IN (TEST 1 enabled)
W17	IN= TEST 1 switch enabled	IN (TEST 1 enabled)
W18	OUT= TEST 1 switch disabled	IN (TEST 1 enabled)
W19 W20 W21	Enables the ERROR 1 lamp, the ERROR 2 lamp, and the ERROR 3 lamp (located behind the front-panel access door) to operate in parallel with the SMS 0107 LEDs CR1, CR2, and CR3, respectively. This facility is disabled if the jumpers are OUT.	IN (Front-panel LEDs operate in parallel with SMS 0107 LEDs.)

NOTE: TEST 1 switch is located behind front-panel access door. Normal system operation takes place when the TEST 1 switch is in the ON position. In OFF position TEST 1 actuates RANDOM READ exercise. See Section 6. CAUTION: TEST 1 switch must NOT be thrown to OFF position while CPU is running.

W22	Boot PROM Enable/Disable OUT = Enabled IN = Disabled	OUT (enabled)
W23	CPU Type Definition OUT = LSI-11 IN = MicroVAX II	OUT (LSI-11)
W24	Enable/Disable SENSE OUT = Enabled IN = Disabled	OUT (enabled)
W25	Boot PROM Address Selection Out= 17773000 Octal In= 17766000 Octal	OUT (17773000)
W26	Q-bus BIAKOL Continuity IN= Enable Continuity OUT= Disable Continuity	IN (Enable)
W27	Q-bus BDMGOL Continuity IN= Enable Continuity OUT= Disable Continuity	IN (Enable)

THE FOLLOWING JUMPERS ARE USED FOR LAB DEVELOPMENT PURPOSES ONLY, AND MUST BE SET TO DEFAULT SETTINGS AS FOLLOWS:

W1	Lab Testing	OUT
W3	Pins 1-2: Lab Testing	OUT
W3	Pins 2-3: Lab Testing	OUT
W4	Lab Testing	IN
W5	Lab Testing	IN
W6	Lab Testing	IN
W7	Lab Testing	IN
W8	Lab Testing	OUT
W9	Lab Testing	OUT
W10	Lab Testing	IN
W11	Lab Testing	IN
W12	Lab Testing	IN
W28	Lab Testing	IN

REMARKS

When jumper options are to be changed, standard jumper plugs (such as BERG 76264-101, or equivalent) are added or removed from the

appropriate jumper location(s) shown in Figure C2-1. If these or similar jumpers are not available, use standard number 30 wire wrap between jumper pins.

SENSE PARAMETER MEMORY OPTIONS. Jumper W2 controls write enable/disable of the SENSE parameter memory (EEPROM - electrically erasable PROM), which stores currently active configuration parameter settings for the disk controller. The default setting of jumper W2 is to write enable the EEPROM, by installing a jumper plug.

Note that when the disk controller is first configured using SENSE, the EEPROM will initially contain default parameters obtained from the control firmware EPROM on the controller board. After initial configuration setup has been performed and SENSE is exited, the parameters entered by the user will be stored for later retrieval.

With jumper W2 installed (IN), which is the default setting, all disk controller configuration parameters entered using SENSE will be saved when SENSE is exited. These parameters will be utilized by the disk controller each time the host system is powered up or reset. It should be noted that the jumper must be installed to modify any SENSE-controlled parameter settings currently held in the EEPROM. This applies whether the parameter was previously established through default or through user-entered settings.

With jumper W2 absent (OUT), the EEPROM is write protected, meaning that disk controller configuration parameters can not be altered from their current setup. Should the EEPROM require reloading at some later stage, due to a soft error or to facilitate a necessary parameter change, the jumper must be installed (or re-installed) to perform the reloading task.

*** IMPORTANT ***

> Jumper W2 must be installed (IN) initially for the disk controller to function. After parameter settings have been initially established, by default or user entry via SENSE, the jumper can be removed if desired. However, any later modification of parameter settings will necessitate re-installing the jumper, if only temporarily. Failure to do so will prevent parameter settings from being saved when SENSE is exited.

W13 AND W14. W13 and W14 permit the use of switches external to the SMS 0107 board to perform special tests. These switches are located behind the front-panel access door. In the case of the Model 30, the switches are designated TEST 1 and TEST 2. The TEST 2 switch is not used and its corresponding jumper, W14, is kept wire-wrapped closed (IN). Jumper W13 is kept OPEN

so that the TEST 1 switch can be used when required to perform a Random Read test on peripherals (see Section 6 of this manual).

REMOTE/ON-BOARD WINCHESTER WRITE PROTECT JUMPER OPTIONS. Jumper W15 is used to write protect the Winchester disk drives through SENSE or through hardware. When write protection is implemented through hardware (W15 NOT installed) SENSE can not change the write protection status. If a system is to use SENSE for invoking write protection, W15 should be installed. Jumper W16, when installed, permits write protection to be controlled only from the front-panel WRITE PROTECT switch. Note that when W16 is used W15 must be removed.

REMOTE/ON-BOARD DIAGNOSTIC LED INDICATOR JUMPER OPTIONS. When jumpers W19 through W21 are installed (IN), the SMS 0107 on-board LEDs CR1, CR2, and CR3 are connected in parallel with the ERROR 1, ERROR 2, and ERROR 3 lamps, respectively (located behind the front-panel access door). Therefore, with these three jumpers in place, the three SMS 0107 LEDs always operate in parallel with the three front-panel LEDs.

BOOT PROM ENABLE/DISABLE JUMPER OPTION. Jumper W22 enables or disables the boot PROM located on the disk controller board. As its name implies, the boot PROM contains boot code for the host system CPU. The boot PROM contains all the required boot code for the LSI-11 CPU.

The default setting for jumper W22 is with the jumper plug absent (OUT), thereby enabling the boot PROM. Conversely, with a jumper plug installed (IN) at W22, the boot PROM is disabled. Note, however, that if the boot PROM is disabled (W22 IN), SENSE cannot be activated. Therefore unless there is an overwhelming reason to disable the boot PROM, a W22 jumper should not be installed.

CPU TYPE JUMPER OPTION. Jumper W23 defines the CPU-type installed in the host system. The default setting is with a jumper plug absent (OUT). This setting supports the LSI-11 CPU.

SENSE MONITOR ENABLE/DISABLE JUMPER OPTION. Jumper W24 is used to enable or disable the SENSE Monitor. The default setting is with a jumper plug absent (OUT). This enables SENSE. To disable SENSE, a jumper plug would be installed (IN) at W24.

LAB TESTING JUMPER OPTIONS. The remaining jumpers on the disk controller board are used for laboratory testing and development purposes only. These jumpers are: W1, W3 through W12, and W28. To ensure normal operation of the disk controller, it is imperative that these jumpers be set to their default confi-

gurations. Therefore, verify that the jumpers are set as listed in Table C2-1 before installing the disk controller into the host system.

*** WARNING ***

Jumpers W1, W3 through W12 and W28 must be set as shown in Table C2-1 for the disk controller to function properly. Ensure that these jumpers are properly set up before installing the controller in the host system. Failure to do so may render the disk controller inoperable.

Q-BUS CONNECTOR TYPE JUMPER OPTION. Jumpers W26 and W27 provide continuity for Q-bus signals BIAKIL and BDMGIL respectively when the controller is plugged into an ordinary Q-bus slot. W26 shorts BIAKIL to BIAKOL at Q-bus connector C, W27 shorts BDMGIL to BDMGOL at Q-bus connector C. The jumpers therefore pass continuity for these signals to the next module on the bus.

ELECTRICAL INTERFACE

Tables C2-3 through C2-7 describe the interface connector pin assignments for the host interface and the disk drive interface.
The function of these connectors was described in the specifications in Section C1.

TABLE C2-3

WINCHESTER DRIVE INTERFACE CONNECTOR, J3,
PIN ASSIGNMENTS

J3 PIN NO.	SIGNAL NAME	SIGNAL DESCRIPTION
6	WRITE GATE	When active (low) this signal enables write data to be written on the disk. When inactive (high) it enables data to be transferred from the disk.
8	SEEK COMPLETE	This signal goes low when the read/write heads have settled on the target track at the end of a seek.

10	TRACK 0	This signal is true (low) when the drive read/write heads are positioned at cylinder 0 (the outermost track).
12	WRITE FAULT	This signal when true (low) inhibits writing or stepping the heads. This line can be reset by deselecting the drive.
20	INDEX	This signal is provided by the drive once each revolution of the disk (16.67 msec. nominal) to indicate the beginning of a track. Only the transition from high to low is valid.
22	READY	This signal, when true (low),in combination with the SEEK COMPLETE, indicates that the drive is ready to read, write or seek and that I/O signals are valid.
24	STEP	This signal causes the read/write heads to move in the direction defined by the DIRECTION IN line.
26	DRIVE SELECT 1	This signal when true connects the drive interface to drive no. 1.
28	DRIVE SELECT 2	This signal when true connects the drive interface to drive no. 2.
34	DIRECTION IN	Defines the direction of motion of the read/write heads when step is pulsed. A high level defines the direction as away from the center of the disk while a low level defines the direction as toward the center of the disk.
2,4, 14,18	HEAD SELECT	Pins 14, 18, 4, and 2 allow selection of each individual read/write head in a reverse binary coded sequence. Bit 0 is the least significant line. Heads are numbered 0 through 14. When pins 14, 18, 4 and 2 are low (active) head 14 will be selected. When pins 14, 18, 4 and 2 are high (inactive) head 0 will be selected.

TABLE C2-4

FLOPPY DRIVE INTERFACE CONNECTOR, J2,
PIN ASSIGNMENTS

J2 PIN NO.	SIGNAL NAME	SIGNAL DESCRIPTION
2	SPARE	
4	+5VDC	+5VDC supply voltage
6	DRIVE SELECT 4	This signal when true connects the drive interface to drive no. 4.
8	INDEX/SECTOR	This signal is provided by the drive to the interface and occurs once for each revolution of the diskette. (200 +/- 5.8 msec).
10	DRIVE SELECT 1	This signal when true connects the drive interface to drive 1.
12	DRIVE SELECT 2	This signal when true connects the drive interface to drive 2.
14	DRIVE SELECT 3	This signal when true connects the drive interface to drive 3.
16	MOTOR ON	When true (low) this signal turns on the drive motor.
18	DIRECTION SELECT	This signal defines the direction of motion for the read/write heads when the STEP line is pulsed. A high level indicates direction away from the center of the diskette. A low level indicates direction toward the center of the diskette.
20	STEP	This signal causes the read/write heads to move in the direction defined by the DIRECTION SELECT line
22	WRITE DATA	This signal is the data to be written on the diskette. Each transition from a high to a low writes a data bit on the diskette.

24	WRITE GATE	This signal when active enables WRITE DATA to be written on the diskette. The inactive state enables data to be read from the diskette.
26	TRACK 00	This signal indicates when the read/ write heads are positioned at track 0 (the outermost track).
28	WRITE PROTECT	This signal is provided by the drive to indicate when a write protected diskette is installed. The signal is low when a diskette is write protected.
30	READ DATA	This signal is the raw data detected by the drive electronics.
32	SIDE SELECT	This signal defines on which side of a two sided diskette the data will be written to or read from.
34	READY	This signal informs the controller that a diskette has been properly inserted and the drive motor is up to speed.

TABLE C2-5

WINCHESTER DRIVE DATA INTERFACE CONNECTOR, J5
PIN ASSIGNMENT

J5 PIN NO.	SIGNAL NAME	SIGNAL DESCRIPTION
1	DRIVE SELECTED	This signal informs the host system of the selection status of the drive. The signal goes low only when the drive is programmed as drive n (n=1, 2, 3, or 4).
13 AND 14	+MFM WRITE DATA -MFM WRITE DATA	This signal pair defines the transi tions to be written on the track. The transition of the +MFM WRITE DATA going more positive than the -MFM WRITE DATA will cause a flux reversal on the track provided WRITE GATE is active. In the read mode this signal must be driven to the high state (+MFM WRITE DATA more negative than -MFM WRITE DATA).

17 AND 18	-MFM READ DATA +MFM READ	This is data recovered by reading a pre-recorded track and is transmitted to the host system over the pair of MFM READ DATA lines. The transition of the +MFM READ DATA line going more positive than the -MFM READ DATA line represents a flux reversal on the track of the selected head.

TABLE C2-6

WINCHESTER OR REMOVABLE CARTRIDGE
DRIVE DATA INTERFACE CONNECTOR J4
PIN ASSIGNMENT

J4 PIN NO.	SIGNAL NAME	SIGNAL DESCRIPTION
1	DRIVE SELECTED	This signal informs the host system of the selection status of the drive. The signal goes active only when the drive is selected.
5	WRITE PROTECTED	This signal is active when the cartridges write protect tab is installed or if recovery mode is active.
9	CHANGE CARTRIDGE	This signal is active when a cartridge change is required.
13 AND 14	+MFM WRITE DATA -MFM WRITE DATA	This signal pair defines the transitions to be written on the track. The transition of the +MFM WRITE DATA going more positive than the -MFM WRITE DATA will cause a flux reversal on the track provided WRITE GATE is active. In the read mode this signal must be driven to the high state (+MFM WRITE DATA more negative than -MFM WRITE DATA).
17 AND 18	-MFM READ DATA +MFM READ	This is data recovered by reading a pre-recorded track and is transmitted to the host system over the pair of MFM READ DATA lines. The transition of the +MFM READ DATA line going more positive than the -MFM READ DATA line represents a flux reversal on the track of the selected head.

TABLE C2-7

SMS 0107 BACKPLANE CONNECTOR PIN ASSIGNMENTS (LSI-11 BUS)

BACKPLANE CONNECTOR PIN DESIG-NATION	SIGNAL NAME	SIGNAL DESCRIPTION
CK1	USER OPTION	
CH1	USER OPTION	
CF1	USER OPTION	
CE1	USER OPTION	
DH1	USER OPTION	
DK1	USER OPTION	
AU2,AV2, BE2,BF2, BH2,BJ2, BK2,BL2, BM2,BN2, BP2,BR2, BS2,BT2, BU2,BV2.	DATA-ADDRESS LINES 0-15 (BDAL0L THROUGH BDAL15L, RESPECTIVELY)	The sixteen-line data/address on the data/address bus. Data and address are communicated over this bus.
AH2	DATA INPUT (BDINL)	When asserted during BSYNC L time this signal implies an input trans fer with respect to the current bus master. Also asserted when the master device is ready to accept data from the slave.
AP2	BANK 7 SELECT (BBS7L)	This signal occurs when the bus master references the I/O page including the portion of the page reserved for non-existent memory.
AE2	DATA OUTPUT (BDOUTL)	This signal implies that valid data is available on the data/address bus.
AF2	REPLY (BRPLYL)	This signal indicates that input or output data is on the data/address lines
AJ2	SYNCHRONIZE (BSYNCL)	This signal indicates that the master bus device has placed an address on the data/address lines.

AN1	DMA REQUEST (BDMRL)	This signal indicates that a device has requested use of the bus.
BB1	POWER OK (BPOKH)	This signal indicates that AC power has dropped below the value required to sustain power.
BN1	ACKNOWLEDGE (BSACKL)	This signal indicates that a DMA device has control of the bus.
BA1	DC POWER OK (BDCOKH)	This signal indicates the presence of sufficient dc power for reliable system operation.
BP1	INTERRUPT REQUEST (BIRQ7L)	Interrupt request priority level 7
AB1	INTERRUPT REQUEST (BIRQ6L)	Interrupt request priority level 6
AA1	INTERRUPT REQUEST (BIRQ5L)	Interrupt request priority level 5
AL2	INTERRUPT REQUEST (BIRQ4)	Interrupt request priority level 4
AN2	INTERRUPT ACKNOWLEDGE (BIAKOL)	This signal occurs to acknowledge receipt of an interrupt.
AM2	INTERRUPT ACKNOWLEDGE (BIAKIL)	This signal is part of the interrupt acknowledge sequence.
AR2	DMA GRANT (BDMGIL)	This signal indicates bus control for a requesting device according to the control protocol.
AS2	DMA GRANT (BDMGOL)	This signal is part of the DMA grant sequence.
AT2	INITIALIZE (BINITL)	This signal is used for system reset. All devices are returned to their initial state.

AR1	MEMORY REFRESH (BREFL)	This signal, produced by a DMA device, forces all dynamic memory units requiring bus refresh signals to be activated for each BSYNC signal.
AK2	WRITE/BYTE (BWTBTL)	This signal is used to control a bus cycle
BF1	ADDRESS LINE 21 (BDAL21L)	Extended-address data/address lines.
BE1	ADDRESS LINE 20 (BDAL20L)	Extended-address data/address lines.
BD1	ADDRESS LINE 19 (BDAL19L)	Extended-address data/address lines.
BC1	ADDRESS LINE 18 (BDAL18L)	Extended-address data/address lines.
AD1	ADDRESS LINE 17 (BDAL17L)	Extended-address data/address lines.
AC1	ADDRESS LINE 16 (BDAL16L)	Extended-address data/address lines.

SECTION C3

OPERATION

INTRODUCTION

This section provides procedures and information on selecting the SENSE monitor and booting the host CPU. Additionally, the overall features and capabilities of SENSE are described. Detailed information on parameter setup and other features of SENSE is provided in Sections C4 and C6 of this Appendix.

MODES OF OPERATION

The disk controller has two fundamental modes of operation:

1. HOST OPERATION. After system power up or reset of your Model 30, you have the option of entering SENSE or booting the host CPU. The host CPU is booted from boot code resident in the SMS 0107 disk controller boot code PROM. After the host CPU is fully operational, the disk controller responds to operating system device drivers. User communication with the host is via your video terminal.

2. SENSE MONITOR OPERATION. The SENSE Monitor (also termed "SENSE") is a group of utility, operational, system-configuration and analytical programs residing in EPROM on the disk controller board. These programs are organized, for user purposes, as a set of menus and sub-menus. The programs interact with the system's peripherals as well as with the CPU and memory so as to permit you to configure device parameters, perform certain drive diagnostics, format disks, and identify component failures. Once entry into SENSE is made, communication with the SENSE menu system is via your video terminal.

DESCRIPTION OF THE SENSE MENU SYSTEM

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 three basic groups:

OPERATION. Operation menu commands allow format identification of connected disk drives, formatting of floppy and Winchester disks, and setup and maintenance of flaw management for Winches-

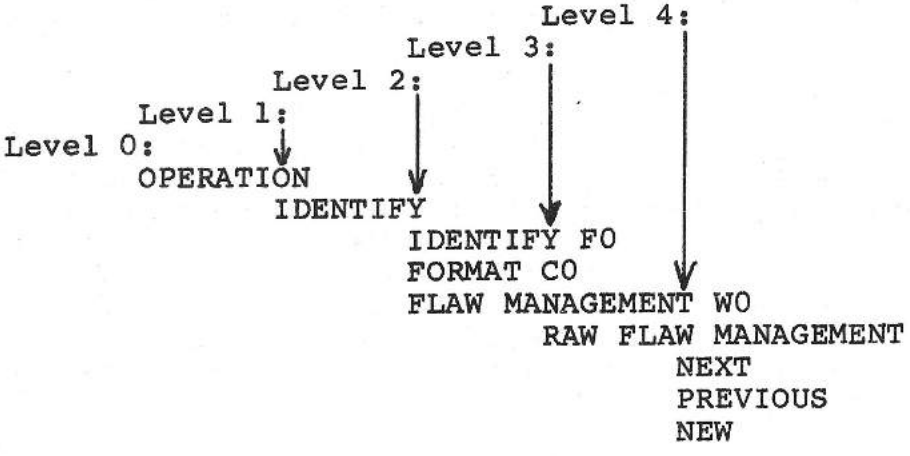
ter disk media. All operation commands are summarized in Section C6 of this Appendix.

EVALUATION. Evaluation menu commands test and report status of disk drives connected to the disk controller. 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 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. All operation commands are summarized in Section C6 of this Appendix.

CONFIGURATION. Configuration menu commands enable you to define various parameters affecting disk controller operation in the host system, such as floppy formats, device parameters, bus addresses, and so on. All operation commands are summarized in Section C6 of this Appendix.

LEVELS WITHIN MENUS

The concept of levels within menus is important because SENSE allows you to view only one level at a time. This manual uses the convention of indentation to designate levels within menus, as shown in the following sample listing of the OPERATION menu:



COMMAND FUNCTIONS

As seen in the example above, some commands display information. Other commands, such as FORMAT, initiate disk controller functions. Still other commands display a parameter list and give you an opportunity to modify that parameter. For example the FORMAT FLOPPY command displays a list of the possible formats and allows you to change the current setting. The command always displays the currently configured format first. There-

fore, you can use this type of dual-purpose command to determine the current format of a particular floppy drive and/or change the setting.

CONVENIENCE FEATURES OF SENSE

MOVING THROUGH THE MENUS. In moving through the menus, SENSE allows you to step backward in a list as well as forward. To move backward using the system console, press the BACKSPACE key.

READY PROMPT. When you select a command that requires operator intervention, SENSE displays the READY? NOT READY? prompt. This gives you time to perform actions such as inserting a diskette into a 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, SENSE displays appropriate messages to let you know what is happening. During flaw map installation, for example, SENSE 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 SENSE concentrates its resources on the task rather than displaying messages. Be sure to wait for the format command to complete, even though SENSE may appear to be inactive for several minutes.

HOW TO OPERATE YOUR SMS 1000 MODEL 30

SMS 0107 SELF-TEST

When the system is powered up or reset, the disk controller first performs an internal self-test to verify its operational readiness. If an error occurs during the self-test, the error-indicator LEDs on the handle end of the disk controller board (Figure C2-1) and behind the front-panel access door (Figure 1-4) will display a specific pattern. Viewed from left to right in Figure C2-1, the LEDs are designated as follows: CR1, CR2, and CR3. These will flash in the same sequence as the front-panel lamps ERROR 1, ERROR 2, and ERROR 3 during self test. Table C3-1 describes the meaning of various possible error indications. However, in many cases it may not be possible to remedy the fault on your own. In these cases, technical support should be contacted. Describe the specific error indication(s) received to your technical support representative who, in turn, will provide further direction.

When the disk controller passes all internal self-tests, the error-indicator LEDs remain unlit. When this indication is received, the disk controller is ready for normal operation in host mode or in SENSE.

TABLE C3-1

SMS 0107 DISK CONTROLLER
SELF-TEST ERROR-LAMP (LED) INDICATIONS
(see Figures C2-1 and 1-4)

LAMP DESIGNATION AND SELF-TEST CONDITION (for both SMS 0107 and access-door LEDs)			
CR1 and ERROR 1	CR2 and ERROR 2	CR3 and ERROR 3	MEANING
OFF	OFF	OFF	No error
OFF	OFF	ON	Host DMA error
OFF	ON	OFF	Reserved (no assigned meaning)
OFF	ON	ON	On-board CPU error
ON	OFF	OFF	On-board RAM error
ON	OFF	ON	EPROM Checksum error
ON	ON	OFF	On-board Peripheral Chip error
ON	ON	ON	EEPROM Checksum error

NOTE: VIEWING FROM LEFT TO RIGHT IN FIGURE C2-1, ERROR-INDICATOR LEDs ARE DESIGNATED CR1, CR2, AND CR3. VIEWING FROM LEFT TO RIGHT AT THE FRONT-PANEL ACCESS DOOR, THE LEDs ARE DESIGNATED ERROR 1, ERROR 2 AND ERROR 3.

BOOTING HOST OR SELECTING SENSE FROM MAIN SYSTEM MENU

When the system is powered up or reset, the SMS 0107 disk controller self-test is executed. Once this has completed successfully, various other system tests take place. At their conclusion, the system displays a main menu from which you can select either booting the host or going into the SENSE menus. This main system menu appears as follows:

***KW MEMORY 11/73 [or 11/23] CPU

DEVICE NAME	DEVICE TYPE	UNIT NUMBERS
DU	DSA	0-15
MU	TK50	0
MS	TS	0
SENSE		S

NOTE: "***" is replaced by a number showing actual capacity, in words, of existing memory.

The system now waits for an operator response. If entry into SENSE is desired, enter "S" and press the RETURN key <CR>. SENSE can be exited at any time by resetting the host system. If the CPU is to be booted instead, enter the previously configured DU or MS number corresponding to the desired bootable device in the system, followed by a Return.

IMPORTANT: If SMS 0107 jumper W24 is installed, thus disabling SENSE, the system always goes into boot mode and the last line of the above menu is not displayed. However, the system will NOT operate properly unless basic configuration parameters are set, using the CONFIGURATION menus, BEFORE disabling SENSE.

SYSTEM SELF-TEST AND INITIALIZATION

1. APPLYING POWER. Apply power to your Model 30 system.

2. SMS 0107 DISK CONTROLLER SELF TEST. For a short period after d-c power is applied, the disk controller preliminary self-test is executed (see above). Provided that the test completes successfully, as signified by the error-indicator LEDs remaining unlit, it then proceeds to further testing.

3. The following SENSE self-test events occur prior to displaying the main system menu.

4. EPROM VERSION TEST. The first SENSE operation is to compare the current SENSE firmware version number stored in the disk controller firmware EPROM with the corresponding version number read from the EEPROM (i.e. the electrically erasable and reprogrammable read-only memory in which various configurable disk controller 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, a hard or soft error has occurred. When this happens, the system automatically downloads the default (as shipped) code from the EPROM back into EEPROM. The three

front-panel LEDs will then light in the pattern ON-ON-ON until the system is reset. This pattern of lights indicates that some type of EEPROM error has taken place.

Note that when an EEPROM reload from EPROM occurs, all configuration parameters are returned to the default values stored in the EPROM and, thus, any previously configured (i.e. non-default) values that had been entered by means of the CONFIGURATION menus of SENSE are lost. Therefore, to start the re-configuration process, you must reset (i.e. restart) your Model 30 system. Next, reconfigure using the CONFIGURATION menus, as described in Appendix C4 of this manual. After reconfiguring, you must again restart SENSE by resetting the host.

NOTE

At any time during the complete start-up process, as well as when SENSE is running applications, you can restart from the beginning of the self-test sequence by resetting the host.

NOTE

The disk controller is shipped with a default image in EEPROM, which has W0 enabled, and configured with 0 heads and 0 cylinders. Similarly, F0 is enabled, and configured as an 8" floppy.

NOTE

All self-test mssages are temporarily stored in the controller memory and displayed just before the main SENSE menu is displayed.

5. HARDWARE SELF-TEST. After performing its test of firmware version-number compatibility (see previous step), SENSE performs a self-test of major disk controller hardware components. If this test runs to completion without detecting any failures, the following message is stored for later display only if SENSE 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 as a result of resetting the host system.

If an error is detected, the following error message is stored for later display:

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 Section 5. Note that some errors are sufficiently severe that even the console display messages cannot appear. For all displayable errors, however, the operator has the option of continuing processing by pressing the RETURN (<CR>) key on the console keyboard.

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

If there is a checksum error, a hard or soft error has occurred in the EEPROM. The firmware will automatically reload the default EEPROM message from the EPROM into memory. The three LEDs will be on until the controller is reset.

Note that when this occurs, all configuration parameters are returned to the default values stored on the firmware 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 reset (i.e. restart) the host system. Next, reconfigure using the CONFIGURATION menus, as described in Section C4 of this manual. After reconfiguring, you must again restart SENSE by resetting the host system.

NOTE

When performing tests on Winchester drives during the power-up sequence (see following steps), SENSE tests access to each drive. The order followed is: Winchester 0 (W0), cartridge-Winchester 0 (C0).

7. WINCHESTER SPINUP. As soon as d-c power is applied, any Winchester drives connected to the disk controller 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 host system can load and run programs. This delay, which is configurable in the WINCHESTR SPINUP portion of the CONFIGURATION menus (see Section C4 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. When C0 is enabled in CONFIGURATION the Winchester spin-up time is automatically set to 45 seconds.

When each Winchester drive is up to speed and initialized, the following message is stored for later display:

```
xx ONLINE OK
```

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

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

NOTE: If your system is configured with a cartridge-type Winchester drive in addition to the standard fixed-disk Winchester drive, the cartridge drive is designated as C0 and the fixed-disk drive is designated as W1. If there is no cartridge drive in the system, then the fixed-disk Winchester drive is designated W0.

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

```
xx FlaTbl OK
```

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

If the flaw table cannot be successfully loaded, one of the following two messages is stored for later display:

```
xx FlaTbl Err nn
xx FlaTbl Bad
```

where xx can be W0, W1 or C0, depending upon how your SENSE is configured; and nn is the decimal number assigned to the error as listed in Section C5.

NOTE

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

The first message indicates that, for the reason listed in Section C5, 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 RETURN key on the console keyboard. This causes a so-called "null" flaw table (i.e. an empty flaw table) to be built, and the following message is stored for later display:

xx Entries = 0

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

CAUTION

If you receive an error message indicating a defective flaw table after initial configuration has been completed and data has been placed on the disk, it is advisable that you attempt to recover the table before proceeding further. 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 to have the flaw table restored.

9. 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 stored for later display:

xx Access OK

where xx can be W0, W1 or C0, depending upon how SENSE 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 following message is stored for later display:

xx Access Err nn

where xx can be W0, W1 or C0, depending upon how your disk controller is configured, and nn is the error number as listed in Section C5. SENSE will store the following message for later display, which warns that there may be a conflict between the actual hardware and how SENSE is currently configured:

Check config!

Also, any time the Winchester under test is write protected, SENSE stores the following message for later display:

xx Writ Prot

where xx can be W0, W1 or C0, depending on how your disk controller is configured.

10. DISPLAY OF MAIN SYSTEM MENU. At this point, the self-test is completed and any previously stored messages are displayed, followed by display of the main system menu (see above). If you are configuring the disk controller for the first time, you will also have to perform the following steps:

a. Use the CONFIGURATION menu to configure all drives connected to the disk controller, and other system-related parameters, such as the Boot Code PROM start address, and DU device addresses.

b. Use the OPERATION menu to format the connected Winchester drive(s), and to enter initial SENSE flaw tables into the SENSE flaw management program.

Refer to Section C4 for information on the various commands to configure the disk controller and connected drives using SENSE.

After the initial configuration is performed, software can be installed on the Winchester drive(s) and the EVALUATION menu can be used to perform Winchester disk exercises.

SECTION C4

SMS 0107: SENSE MONITOR MENU COMMANDS

INTRODUCTION

This section describes the SMS 0107 SENSE monitor menu commands. The SENSE MONITOR has three basic menus: Operation, Evaluation and Configuration. Within each of these basic menus are several sub-menus. At the end of this section is a summary of the SENSE command structure.

OPERATION MENU COMMANDS

The OPERATION menu provides the facility to identify disk drives attached to the disk controller, format floppy disks, and provide Winchester formatting and flaw management.

The WINCHESTER MANAGEMENT commands perform essential but infrequently used functions such as formatting disks, and building 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 C4-1 provides a summary of the OPERATION menu commands:

Table C4-1. OPERATION MENU COMMAND SUMMARY

IDENTIFY	Displays the format, sector size, recording density, etc., of the specified disk.
FORMAT FLOPPY	Formats the diskette in the specified floppy drive.
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.

LEGEND

C0 = Removable-Cartridge Winchester Drive 0
F0 = Floppy Drive 0
F1 = Floppy Drive 1
W0 = Fixed-Disk Winchester Drive 0
W1 = Fixed-Disk Winchester Drive 1

NOTE: If your system is configured with a cartridge-type Winchester drive in addition to the standard fixed-disk Winchester drive, the cartridge drive is designated as C0 and the fixed-disk drive is designated as W1. If there is no cartridge drive in the system, then the fixed-disk Winchester drive is designated W0.

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 a Maxtor XT-1140 Winchester drive:

```
#Cyls=918
#Heads=15
CylOff=5                [Not displayed for floppy disk]
HeadOff=1               [Not displayed for floppy disk]
Cyl#=53
Head#=0
Format=MFM
Byt/Sct=512
```

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 format definition is performed using 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.

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):

```
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-inch drives "#Heads" can have three values, 0, 1 or 2 as set in the DEVICE PARAMETERS portion of the CONFIGURATION menus. If 0, the /FDSD signal from the drive tells SENSE if diskette is single or double sided. If 1 or 2 is entered, then /FDSD is not used.

Note that Intrlv means physical interleaving, not logical interleaving. 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 the 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.
          <Flaw management message sequence>
```

REMARKS

NOTE: If your system is configured with a cartridge-type Winchester drive in addition to the standard fixed-disk Winchester drive, the cartridge drive is designated as C0 and the fixed-disk drive is designated as W1. If there is no cartridge drive in the system, then the fixed-disk Winchester drive is designated W0.

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, SENSE 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=MFM
Intrlv=1
Byt/Sct=512
CylOff=5
HeadOff=1
#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 0107 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, SENSE 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. 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 a 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.

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. SENSE provides a flaw mapping facility that prevents errors by automatically mapping around flawed sectors.

SENSE 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= <SENSE 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
            Head#=  xxxx
            BytDsp=  xxxx
            BitCnt=  xxxx
            Are you sure?
            BadSct#=xxxx
            [BadSct#=xxxx]  [Use if double-sector flaw]
```

```
        LBN#=xxxxxxx
        [LBN#=xxxxxxx]  [Use if double-sector flaw]
        Entry#= xxxx
    DONE/BLD TBL?
    <Flaw management message sequence.  SENSE goes
        through the following steps in building
        the flaw table:>
        Phase #1 [SENSE 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?
        Cyl#=   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= <SENSE 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
        Entry#= xxxx
```

```
        GrpDsp=+xxxx
    NEW?
        Cyl#=
        Head#=
        Sector#=
        Cyl#=   xxxx
        Head#=  xxxx
        Sector=  xxxx
        Are you sure?
        GrpDsp=+xxxx
        LBN#=xxxxxxx
        BytDsp=xxxx
        Entry#=xxxx
    DONE/BLD TBL?
        <SENSE 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 tables]
    REMOVE?
        Cyl#=   xxxx
        Head#=  xxxx
        Sector=  xxxx
        Entry#= xxxx
        Are you sure?
        Done (no errs).
    CLEAR?
        Are you sure?
BLOCK FLAW MGT
    NEXT?
        LBN#=xxxxxxxxxxx
        Entry#=xxxx
    PREVIOUS?
        LBN#=xxxxxxxxxxx
        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?
    REMOVE?
```

```
                LBN#=xxxxxxxxxxx
                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:

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. Physical 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 disk controller local 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 disk controller local 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 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 message "Tbl full" to be displayed.

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 disk controller is equipped with two Winchester drives and W1 is enabled in SENSE.

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.

EVALUATION MENU COMMANDS

The SENSE EVALUATION menu commands are used to exercise the circuits, mechanism and recording media of disk drives connected to the disk controller, 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.

The following table provides a summary of the commands supported by the EVALUATION menu:

Table C4-2. EVALUATION MENU COMMAND SUMMARY

SPECIFY CONTROLS	Specifies the devices to be tested, error limits for the tests, the number of times an evaluation test is to be repeated, and whether the auto flaw mode, auto retry, and ECC are enabled or disabled during the tests.
DISK EXERCISES	Performs random I/O tests on groups of sectors. Reserved areas are avoided.

SPECIFY CONTROLS COMMAND

The SPECIFY CONTROLS command specifies the number of times a test is to be performed, the extent of the test, devices to be tested, and error limits for the tests.

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 SENSE pauses to display an error message.

SPECIFY DISKS	This command specifies which of the configured peripherals are to be included in the test.
MODES	Permits selection of various evaluation modes, by enabling or disabling error recovery features, such as auto flaw, auto retry, and ECC.

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 SENSE 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 SENSE 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 (types ^C (control C) at the console 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 persists, contact your technical support 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. 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 technical support if the scan generates errors.

SPECIFY DISKS SUBCOMMAND

SPECIFY DISKS names the peripheral device to be included in any of the tests described under DISK EXERCISES (see below).

MENU STRUCTURE

```
SPECIFY DISKS
          W0
               Disable?
               Enable?
          W1
               Disable?
               Enable?
          C0
               Disable?
               Enable?
          F0
               Disable?
               Enable?
          F1
               Disable?
               Enable?
```

REMARKS

Only those drives configured into SENSE appear in this menu. For example, W1 does not appear in the menu a SENSE setup that does 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 DISK EXERCISES command. 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, and F0 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.

MODES SUBCOMMAND

The MODES subcommand permits the user to enable or disable various error recovery features such as auto-flaw management, auto retry, and error correction.

MENU STRUCTURE

```
MODES
     AUTO FLAW MODE
          DISABLE?
```

```
          ENABLE?
               VrfyLim=
     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 defective sectors or tracks are processed automatically by the SENSE flaw-management facility. In this process, the defective sectors 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 disk controller's default mode for this command is DISABLE. If you enable auto flaw management, disk controller event codes 70, 71, 75 or 76 (decimal) will trigger the automatic revectoring process. See Section C5 for event codes. Note that soft errors do not cause an auto-flaw-management response.

During the auto-flaw-management process, SENSE 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 automatically 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 constructed. Therefore, data should be backed up before entering AUTO FLAW mode.

SETTING SCAN LIMIT FOR FLAW VERIFICATION. As part of the auto-flaw-management process, SENSE can be configured to repeatedly scan a cylinder having a flaw before the pass counter is incremented. By repeatedly scanning a 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 RECOVERY. The SMS 0107 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 disk controller to error detection only. If ECC CORRECTION is disabled, the disk controller detects but does not correct ECC events. The default setting for this parameter is ENABLE. Error correction should be disabled when testing the Winchester disks since the purpose of the test is to find errors, correctable or otherwise. This parameter is ignored during normal host system operation and the error correction is always enabled unless commands received from the host have error correction disabled in the command packet.

When enabled, AUTO RETRY attempts to correct a read or write error up to ten times before reporting the error. AUTO RETRY should be disabled when testing the disk. The default setting for this parameter is ENABLE. This parameter is ignored during normal host system operation and the auto retry is always enabled unless the commands received from the host have auto retry disabled in the command packet.

DISK EXERCISES COMMAND

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 READ?
          <evaluation parameter list is displayed>
     READ-ONLY SCAN?
```

<evaluation parameter list is displayed>
WRITE/SCAN?
<evaluation parameter list is displayed>
Are you sure?

REMARKS

All of the disk exercises terminate execution 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 DISKS command.

RANDOM READ. The RANDOM READ tests generate a cylinder, head, and starting sector number using a random-number generation technique, and then perform a read to that cylinder. These random reads provide an effective test of the disk's head-positioning hardware. When a read fails and auto retry has been enabled (see AUTO RETRY under the MODES command (above)), the controller attempts to bring the heads back into registration by performing a seek to cylinder zero, then repeating the original read. A persistent read error indicates that disk drive servicing is required.

After you select the RANDOM READ command, SENSE 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/SCAN test.

The RANDOM READ command performs the following steps on each disk previously selected using the SPECIFY DISKS command:

1. SENSE generates a random disk address and displays an in-progress message having 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. Read a group of logically consecutive sectors.

3. If an error is found in the read operation, then SENSE displays the following messages:

Read Error...
<name of error>

<event code> [refer to Section C5 for descriptions]

If the number of hard and soft errors measured from the test equals the previously configured HARD ERR LIMIT and SOFT ERR LIMIT, then SENSE will issue the message:

Action?

If you now press Return on your video terminal keyboard, SENSE gives you 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.

READ-ONLY SCAN. The READ-ONLY SCAN command reads the entire contents of a disk within the evaluation range defined by the DISK RANGES command (see SPECIFY CONTROLS, described previously), 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, SENSE displays a list of the parameters involved in the test. The entire diskette is scanned.

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") the number of times specified by the "VrfyLim=" parameter (see MODES) before the next cylinder is scanned.

WRITE/SCAN. The WRITE/SCAN command formats a disk under test with a 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 on a disk. Therefore, be sure to back up your disk before starting a WRITE/SCAN.

Once the WRITE/SCAN command is selected, SENSE displays a list of the parameters involved in the test. The WRITE/SCAN command

performs the following steps:

1. Each disk is formatted with a default pattern that represents a worst case data condition. Reserved areas are not written over. Existing flaw-map information is preserved.

2. SENSE next scans each sector on the disk for errors or flaws.

3. The number of times SENSE 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 SENSE performs a complete pass, which consists of formatting and scanning the disk, is set by the value of the PASS LIMIT command (see SPECIFY LIMITS).

5. At the end of each cylinder scan, SENSE 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>f<new flaw count>

Thus, for example, at the end of pass 1008, on Winchester W0, cylinder 123, at the completion of verification pass 18, and with 22 flaws thus far found, the following message would be issued:

> 1008W0c123V18f22

6. When autoflaw mode is enabled and a flaw is found, the flaw is mapped as previously described in this section. The "VrfyLim=" counter is then reset and the disk is again scanned the number of times set in the "VrfyLim=" parameter (see MODES). 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.

CONFIGURATION MENU COMMANDS

The SENSE CONFIGURATION menus include commands used to enter or change disk controller parameters. In effect, these commands answer questions such as: What disk drives are connected to the disk controller?, or what format specifications are to be used when formatting a floppy disk? The typical user is likely to use the CONFIGURATION commands only for initial disk controller

setup. 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 disk controller is shipped with configurable parameters set to default values determined by SMS. The default image in disk controller EEPROM has W0 and W1 configured with 0 heads and 0 cylinders. W0 is enabled and W1 is disabled. The default image also has F0 and F1 configured, with F0 enabled and F1 disabled. These parameters must be configured per user requirements using the CONFIGURATION menu commands before any connected Winchester or floppy drive can be accessed by the disk controller.

VERY IMPORTANT:
STORING PARAMETER VALUES

WHEN MAKING CHANGES TO ANY OF THE PARAMETERS DESCRIBED IN THE CONFIGURATION MENU, 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 (i.e. RESET THE SYSTEM) AFTER EACH CHANGE. BUT TO ACTUALLY STORE YOUR CHANGES IN THE DISK CONTROLLER LOCAL RAM, YOU MUST RESTART (RESET) THE HOST SYSTEM AFTER THE LAST CHANGE IS MADE. This is because when the CONFIGURATION commands are performed, parameters are changed in the EEPROM only. Restart (reset) downloads the changed parameters from EEPROM into local RAM. Parameter changes do not become effective until after this has occurred.

The following conventions apply to the CONFIGURATION menu description that follows:

1. DEFAULT SETTINGS. Default settings are listed either to the right of the corresponding commands or in the accompanying REMARKS discussion.

2. CURRENT VALUES. While in SENSE mode, you can query 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.

Table C4-3. CONFIGURATION MENU COMMAND SUMMARY

FLOPPY FORMATS	Specifies the format to be used by the formatting commands in the OPERATION menu.
BOOTSTRAP	Specifies search sequence for bootable devices.
POWER ON/RESTART	Specifies actions to be taken when the host system is powered on or reset, such as the Winchester spin-up delay time and whether reloading of the disk controller EEPROM is required.
DEVICE PARAMETERS	Invokes a submenu of commands used for installing disk drives. These commands specify characteristics of the drives.
BUS ADDRESSES	Modifies hardware addresses for the disk controller boot code PROM, and the DU disk devices connected to the disk controller.
Q-BUS BURST	Allows a degree of system fine tuning. Either a short or long Q-bus burst period can be specified for disk controller data transfers to optimize the bus bandwidth for system loading conditions.

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                          (Use for 5-1/4" floppy)
          DEC PC?
          IBM PC 8 S/T?
          IBM PC 9 S/T?
     F0 FMT                          (Use for 8" floppy)
          RX01?
          RX02?              [Default setting.  256 B/S]
          IBM 2D/FW?
          OTHER
               IBM 1D/128?
               IBM 1D/256?
               IBM 1D/512?
               IBM 2D/128?
               IBM 2D/256?
               IBM 2D/512 15 S/T?
```

RX03?
F1 FMT
(same as for F0 . . . see above)

LEGEND: S/T = Sectors per track
B/S = Bytes per sector

REMARKS

When you select a particular format, that selection is marked with an arrow on video terminal display. 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 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 disk controller.

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.

RX02 AND RX03 FORMATS. Note that for RX02, the disk 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.

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 the search sequence for bootable devices that are connected to the disk controller. Actual search for the bootable device occurs when the host CPU is requested to load the operating system or a standalone application program.

BOOT DRV Subcommand

The BOOT DRV subcommands specify the order in which the bootstrap searches through the disk drives when looking for the program-load boot block.

MENU STRUCTURE

```
BOOT DRV#1
     BOOT DRV=W0?     [This is the default setting
     BOOT DRV=W1?
     BOOT DRV=C0?
     BOOT DRV=F0?
     BOOT DRV=F1?     [Not used]
BOOT DRV#2
     BOOT DRV=W0?
     BOOT DRV=W1?
     BOOT DRV=C0?
     BOOT DRV=F0?     [This is the default setting
     BOOT DRV=F1?     [Not used]
BOOT DRV#3
     BOOT DRV=W0?     [This is the default setting
     BOOT DRV=W1?
     BOOT DRV=C0?
     BOOT DRV=F0?
     BOOT DRV=F1?     [Not used]
BOOT DRV#4
     BOOT DRV=W0?
     BOOT DRV=W1?
     BOOT DRV=C0?
     BOOT DRV=F0?     [This is the default setting
     BOOT DRV=F1?     [Not used]
FIRST DU#
     DU#=        [Default is 0]
```

REMARKS

NOTE: If your system is configured with a cartridge-type Winchester drive in addition to the standard fixed-disk Winchester drive, the cartridge drive is designated as C0 and

the fixed-disk drive is designated as W1. If there is no cartridge drive in the system, then the fixed-disk Winchester drive is designated W0.

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 SENSE 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# The choice of FIRST DU# is dependent on the requirements of the host operating system. This defines the first DU# assigned to the drive that is connected to the controller. The controller assigns DU#s starting at first DU# according to the following sequence:

W0, W1, F0, F1, C0.

Examples: First DU#=4 with W0, C0, and F0 present.
Then: W0=DU4, F0=DU5, F0=DU6. NOTE: If C0 is present W1 cannot be present

POWER ON/RESTART COMMANDS

POWER ON/RESTART invokes a menu of commands that determine system actions when the power is turned on or when the system is restarted (reset). It includes the WINCHESTER SPINUP subcommand, and the RE-LOAD EEPROM subcommand.

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)=2?
     DELAY (SEC)=20?    [This is the default setting]
     DELAY (SEC)=45?
```

REMARKS

DELAY (SEC)=2 specifies two seconds of 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.

DELAY (SEC)=20 is the default option configured for the disk controller. 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 SENSE parameter EEPROM from the firmware EPROM. The EEPROM stores the actual disk controller configuration parameters that have been entered using the CONFIGURATION menus. Default values for these parameters are stored in the firmware EPROM. Hence, by use of this command, all configuration parameters are changed back to these default values. THE DISK CONTROLLER WILL NOT WORK NORMALLY UNTIL THE DISK CONTROLLER'S OPERATING PARAMETERS ARE RECONFIGURED.

CAUTION

Reloading the EEPROM changes all configuration parameters to their default values and requires full SENSE 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?
```

REMARKS

After you select this command and give an affirmative response to "Are you sure?", SENSE displays the message:

```
Changing EEPROM!
```

When the reloading process is complete, SENSE displays:

```
Task completed.
```

To activate the new parameters stored in EEPROM, the new EEPROM image must be loaded into local RAM. This is performed by restarting (resetting) the host 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 disk controller firmware. 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 SENSE to reflect actual physical and electrical drive characteristics, using the DEVICE menu, described later.

USING A CONFIGURATION LOG. As an aid in reconfiguring the disk controller, after you have installed your SMS 0107 and gone through a complete system checkout, take some time to enter all your setup 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.

SAMPLE FORM FOR MAKING A CONFIGURATION LOG

```
================================================================
              LOG OF SYSTEM CONFIGURATION SETTINGS

SYSTEM SERIAL NO. _____________ MODEL NO. ____________________

FIXED-DISK WINCHESTER TYPE _____________

FLOPPY TYPE ___________________

CARTRIDGE WINCHESTER TYPE ________

CONFIGURATION MENU
      FLOPPY FORMAT
            F0 FMT ________
      BOOTSTRAP
            1ST BOOT DRV ________
            2ND BOOT DRV ________
            3RD BOOT DRV ________
            FIRST DU#    ________
      POWER-ON/RESTART
            WINCHESTER SPINUP DELAY (SEC) __________
      ADDRESSES
            BUS ADDRESSES
                  BOOT PROM ADDR __________
                  DU DEVICE ADDR __________
================================================================
```

DEVICE PARAMETERS COMMAND

The DEVICE PARAMETERS menus permit you to enter, change or examine the disk drive parameters that are currently configured and used by the disk controller.

F0 CONFIGURATION SUBCOMMAND MENU STRUCTURE

```
DEVICE PARAMETERS
     F0 CONFIGURATION
          DEVICE PRESENT
               DISABLE?
               ENABLE?
          SIZE STRAPPING
```

```
                SIZE=8"?   [This is the default setting]
                SIZE=5 1/4"?
           CAPACITY
                #HEADS
                     #HEADS=    [Default is 0]
                #CYLS
                     #CYLS=     [Default is 77]
           TIMINGS
                MOTOR ON (MSEC)
                     MOTOR ON= [Default is 700]

F1 CONFIGURATION
           (NOT USED)
```

REMARKS

These remarks apply equally to F0 and F1.

SIZE STRAPPING specifies whether the drive is an 8" or 5-1/4" floppy.

The #HEADS= and #CYLS= commands request the number of heads and cylinders available on the disk drive.

The TIMINGS subcommand MOTOR ON (MSEC) requests you to enter information pertaining to your particular floppy drive. This information is normally available in the drive manufacturer's literature. Do not attempt to use this command without the proper information.

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 is always disabled
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:

1. /FDSD signal always disabled.
2. Bufferd seek = disabled.
3. Precomp is always enabled.
4. Number of cylinders = 80.
5. Bytes per sector = 512.

6. Format = DEC PC.
7. 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 5]
               HEAD OFFSET
                    HEAD OFF=  [Default is 1]
          PRECOMP
               DISABLE?
               ENABLE?         [This is the default setting
          WRITE PROTECT
               ENABLE?
               DISABLE?

     W1 CONFIGURATION
          (same as for W0)

     C0 CONFIGURATION
          (same as for W0)
```

REMARKS

NOTE: If your system is configured with a cartridge-type Winchester drive in addition to the standard fixed-disk Winchester drive, the cartridge drive is designated as C0 and the fixed-disk drive is designated as W1. If there is no cartridge drive in the system, then the fixed-disk Winchester drive is designated W0.

The DEVICE PRESENT command is used to take a drive off-line from the disk 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 A-1 of Appendix A, or the manual for your disk drive.

The #CYLS command specifies the highest cylinder number provided by the drive. Obtain this information from Table A-1 of Appendix A, or the manual for your disk drive.

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 0107 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 five for cylinder offset and one 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 cylinder-offset value is the track-to-track access time in milliseconds indicated in the drive manual plus 2. For example, if the track-to-track offset time of a given drive is 5-milliseconds, the corresponding optimal cylinder-offset value would be "7". The optimal head-offset value is normally "1".

PRECOMP should be enabled only if so indicated in Table A-1 of Appendix A or the manufacturer's manual for the drive in question. Precompensation is a recording technique used to make a signal easier to read on the inner cylinders of the disk media. 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. The process of precompensation causes bits to be written closer together or wider apart so that they can be read back with the correct spacing between them. With a configuration setting of PRECOMP=ENABLE the starting cylinder for precompensation is defined as ((MAX CYL#)/2).

WRITE PROTECT can be enabled or disabled by SENSE as required for operational requirements. This feature is only available, however, when the SMS 0107 write-protect jumper W15 is installed (IN). If jumper W15 is not installed (OUT), both Winchesters are automatically write protected by hardware and SENSE write-protect settings have no effect.

BUS ADDRESSES COMMAND

The BUS ADDRESSES command allows you to modify Q-bus addresses for the disk controller boot PROM and DU devices.

MENU STRUCTURE

```
BUS ADDRESSES
     DU DEVICES
          17772150?      [Default setting]
          17760334?
          17760340?
          17760344?
```

REMARKS

Initially, the first address 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.

Q-BUS BURST COMMAND

The Q-BUS BURST command allows you to perform a degree of bus bandwidth optimization in your system, by shortening or lengthening the interval between the DMA bursts in the disk controller data transfers over the Q-bus.

MENU STRUCTURE

```
Q-BUS BURST
     SHORT INTERVAL
     LONG INTERVAL
```

REMARKS

A long interval offers a wider window between controller's DMA bursts to allow lower priority peripherals to transfer data on the Q-bus. Shorter intervals allow the controller to transfer data at the highest speed.

SECTION C5

SMS 0107: SENSE ERROR MESSAGES

INTRODUCTION

This section contains error-code and error-message information pertaining to the operation of the SMS 0107 Disk Controller.

SELF-TEST ERROR INDICATIONS

During the hardware self test sequence that takes place at initial startup or RESTART, certain errors are reported on the console 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 C5-1 which summarizes the error codes and their meanings. The octal code provided in column one is accessible from the host system through the SA register.

TABLE C5-1

SELF-TEST ERROR CODES AND THEIR MEANINGS

ODT ERROR CODE (OCTAL)	ERROR CODE DISPLAYED (DECIMAL)	ERROR TYPE OR DESCRIPTION
100011	9	Host access (protocol dependent)
100012	10	Credit limit exceeded
100013	11	Bus master error (DMA)
100016	14	Invalid connection identifier
100023	19	INIT sequence error
100024	20	Protocol incompatibility

104000	256	EEPROM checksum error
104001	257	First EPROM checksum error
104003	259	RAM error
104006	262	DMA-to-system-memory failure
104007	263	DMA-from-system-memory failure
104010	264	80188 test failure

MAPPING ERROR MESSAGES TO CONTROLLER EVENTS

The following table (Table C5-2) maps the 10 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 C5-3).

TABLE C5-2

SYSTEM ERROR MESSAGES AND CONTROLLER EVENTS

DISPLAYED ERROR-MESSAGE (DECIMAL)	POSSIBLE CONTROLLER EVENT(S) THAT COULD CAUSE THE ERROR MESSAGE (LISTED BY DECIMAL EVENT CODE. SEE FOLLOWING TABLE (TABLE C5-3).)
"DRIVE NOT READY"	64
"DRIVE WRITE PROT"	88
"BAD SCT DATA"	76*
"BAD MEDIA"	70*, 71*, 75*, 115, 117
"INCORRECT FORMAT"	66, 67, 72, 73, 74
"CONTRLR TIMEOUT"	69, 77, 78, 79, 87, 97, 100
"SOFT ERROR"	85
"BAD DISK CMD"	34, 35, 36, 37, 38, 39, 40, 41 42, 43, 51, 52, 54, 57, 126
DISPLAYED ERROR-MESSAGE (DECIMAL)	POSSIBLE CONTROLLER EVENT(S) THAT COULD CAUSE THE ERROR MESSAGE (LISTED BY DECIMAL EVENT CODE. SEE FOLLOWING TABLE (TABLE C5-3).)

"CONTRLR ERROR"	68, 96, 98, 99, 104, 105 106, 107, 108, 109, 110 111, 112, 116
"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 C5-3) lists controller event codes and their corresponding explanations. The codes are listed in decimal, which is the form in which they are displayed on the host console display.

TABLE C5-3

CONTROLLER-EVENT CODES AND THEIR MEANINGS

CONTROLLER-EVENT CODE			MEANING
DEC.	HEX	OCTAL	
			USER-ERROR EVENTS
13	0D	15	Carriage retry
15	0F	17	Access retry
24	18	30	Power-up or reset occurred
34	22	42	Invalid command
35	23	43	Illegal unit
36	24	44	Invalid cylinder number
37	25	45	Invalid head number
38	26	46	Invalid sector number
39	27	47	Illegal number of bytes/sector
			USER-ERROR EVENTS
40	28	50	Too many Winchester cylinders
41	29	51	Too many Winchester heads
42	2A	52	Illegal number of floppy sides specified

43	2B	53	Format not supported by this system
51	33	63	Illegal test number specification
52	34	64	Media overflow
54	36	66	Sector size not supported.
57	39	71	Non-existent or reserved drive strapping
			SYSTEM-ERROR EVENTS
58	3A	72	Invalid buffer descriptor
59	3B	73	Invalid byte count
60	3C	74	Invalid logical block number
61	3D	75	Host credit exceeded
64	40	100	Drive not ready
66	42	102	Deleted data address mark encountered
67	43	103	Data address mark mismatch
68	44	104	Write error
69	45	105	Format pass timeout
70	46	106	No sector ID address marks found on track
71	47	107	No good sector ID found on track
72	48	110	Sector length not initialization value
73	49	111	Cylinder no. mismatch: positioning error
74	4A	112	Sector ID/head (side) number mismatch
75	4B	113	Sector ID not found on track
76	4C	114	Data field CRC/ECC error
77	4D	115	Internal byte processor timeout error
78	4E	116	Track write timeout
79	4F	117	Data late
85	55	125	Winchester data corrected (ECC)
87	57	127	No track 0
89	59	131	Bad block not located
90	5A	132	Unrecoverable data
			CONTROLLER/HARDWARE-ERROR EVENTS
96	60	140	Default error: execute self test
97	61	141	Carriage registration timeout error
			USER-ERROR EVENTS
98	62	142	No Winchester seek complete
99	63	143	Immediate seek complete
100	64	144	Seek-complete timeout

104	68	150	80188 self-test failure
105	69	151	Program checksum error
106	6A	152	80188 system RAM error
107	6B	153	Buffer RAM failure
108	6C	154	Millisecond clock too slow
109	6D	155	Millisecond clock too fast
111	6F	157	Byte processor hung in execute-self-test data loop
112	70	160	Computed-write ECC error
114	72	162	Host DMA timeout
115	73	163	No stable ECC residue
116	74	164	Byte processor error
117	75	165	Failed to determine disk format
118	76	166	Host CPU error

NOTE: Where disk 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. To obtain the correct decimal error code after retry subtract 128 from the displayed error code.

APPENDIX C6

SENSE MONITOR COMMAND SUMMARY

The following paragraphs contain two command summaries for each of the three main SMS 0107 SENSE menus. The first summary is a brief table that provides a general description of each command in the menu. Second, a complete listing of all the commands in each menu follows its corresponding summary table.

SENSE 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 C6-1

SENSE MONITOR OPERATION MENU COMMAND SUMMARY

COMMAND	FUNCTION
IDENTIFY	Displays the format (sector size, recording density, etc.) of the specified disk.
FORMAT FLOPPY	Formats the diskette in the specified drive.
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

    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>
          READY?
     FORMAT FLOPPY F1
          <Parameter list appears here>
          READY?
WINCHESTR MGT
     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= <SENSE 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=
          Cyl#=    xxxx
          Head#=   xxxx
          BytDsp=  xxxx
          BitCnt=  xxxx
          Are you sure?
          BadSct#=xxxx
          [BadSct#=xxxx]
          LBN#=xxxxxxx
          [LBN#=xxxxxxx]
          Entry#= xxxx
     DONE/BLD TBL?
     <Flaw management message sequence.  SENSE
          performs the following steps in building
          the flaw table:>
          Phase #1 [Sort 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= <SENSE 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
          Entry#= xxxx
          GrpDsp=±xxxx
     NEW?
          Cyl#=
          Head#=
          Sector#=
          Cyl#=   xxxx
          Head#=  xxxx
          Sector=  xxxx
          Are you sure?
          GrpDsp=+xxxx
          LBN#=xxxxxxx
          BytDsp=xxxx
          Entry#=xxxx
     DONE/BLD TBL?
          <SENSE 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#=xxxxxxxxxxx
          Entry#=xxxx
```

```
          PREVIOUS?
               LBN#=xxxxxxxxxxx
               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?
          REMOVE?
               LBN#=xxxxxxxxxxx
               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 C6-2

SENSE MONITOR
EVALUATION MENU COMMAND SUMMARY

COMMAND	FUNCTION
SPECIFY CONTROLS	Specifies the devices to be tested and the number of times an evaluation test is to be repeated.
DISK EXERCISES	Specifies the type of test to be performed.

COMPLETE MENU STRUCTURE

```
EVALUATION MENU

     SPECIFY CONTROLS
          SPECIFY LIMITS
               PASS LIMIT
```

```
                    Limit=
              HARD ERR LIMIT
                    Limit=
              SOFT ERR LIMIT
                    Limit=
        SPECIFY DRIVES
              W0
                    Disable?
                    Enable?
              W1
                    Disable?
                    Enable?
              C0
                    Disable?
                    Enable?
              F0
                    Disable?
                    Enable?
              F1
                    Disable?
                    Enable?
        MODES
              AUTO FLAW MODE
                    DISABLE?
                    ENABLE?
                          VrfyLim=
              ERROR RECOVERY
                    ECC CORRECTION
                          DISABLE?
                          ENABLE?       [Default setting]
                    AUTO RETRY
                          DISABLE?
                          ENABLE?       [Default setting]

DISK EXERCISES
      RANDOM READ?
            <evaluation parameter list>
      READ-ONLY SCAN?
            <evaluation parameter list>
      WRITE/SCAN?
            <evaluation parameter list>
            Are you sure?
```

TABLE C6-3

SENSE MONITOR
CONFIGURATION MENU COMMAND SUMMARY

COMMAND	FUNCTION
FLOPPY FORMATS	Specifies the format to be used by the formatting commands in the OPERATION menu.
BOOTSTRAP	Specifies search sequence for boot devices.
POWER ON/RESTART	Specifies actions to be taken when the SENSE is powered on or reset, such as whether to autoboot or enter the SENSE menu SENSE.
DEVICE PARAMETERS	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.
BUS ADDRESSES	Modifies hardware addresses for the boot code PROM and DU devices.
Q-BUS BURST	Allows adjustment of controller DMA cycle duration to optimize Q-bus bandwidth allocation to system devices.

COMPLETE MENU STRUCTURE

CONFIGURATION MENU

```
FLOPPY FORMATS
      F0 FMT                              (5-1/4" floppy)
            DEC PC?
            IBM PC 8 S/T?
            IBM PC 9 S/T?
      F0 FMT                              (8" floppy)
            RX01?
            RX02?                         [Default setting]
            IBM 1D?
            IBM 2D/FW?
            OTHER
                  IBM 1D/128?
                  IBM 1D/256?
                  IBM 1D/512?
                  IBM 2D/128?
                  IBM 2D/256?
                  IBM 2D/512, 15 S/T
                  RX03
      F1 FMT
      (same as for F0 . . . see above)
```

```
BOOTSTRAP
      BOOT DRV#1
            BOOT DRV=W0?                    [Default setting]
            BOOT DRV=W1?
            BOOT DRV=C0?
            BOOT DRV=F0?
            BOOT DRV=F1?
      BOOT DRV#2
            BOOT DRV=W0?
            BOOT DRV=W1?
            BOOT DRV=C0?
            BOOT DRV=F0?                    [Default setting]
            BOOT DRV=F1?
      BOOT DRV#3
            BOOT DRV=W0?                    [Default setting]
            BOOT DRV=W1?
            BOOT DRV=C0?
            BOOT DRV=F0?
            BOOT DRV=F1?
      BOOT DRV#4
            BOOT DRV=W0?
            BOOT DRV=W1?
            BOOT DRV=C0?
            BOOT DRV=F0?                    [Default setting]
            BOOT DRV=F1?
      FIRST DU #
            DU #=

POWER-ON/RESTART
      WINCHESTR SPINUP
            DELAY (SEC)=2?
            DELAY (SEC)=20?           [Default setting]
            DELAY (SEC)=45?
      RE-LOAD EEPROM
            Are you sure?

DEVICE PARAMETERS
      F0 CONFIGURATION
            DEVICE PRESENT
                  DISABLE?
                  ENABLE?
            SIZE STRAPPING
                  SIZE=5 1/4"?
                  SIZE=8"?                  [Default setting]
            CAPACITY
                  #HEADS
                        #HEADS=             [Default is 1]
                  #CYLS
                        #CYLS=              [Default is 5]
            TIMINGS
                  MOTOR ON
```

```
                        MOTOR ON=        [Default is 700]
        F1 CONFIGURATION
              (same as for F0)
        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?              [Default setting]
              WRITE PROTECT
                    DISABLE?             [Default setting]
                    ENABLE?
        W1 CONFIGURATION
              (same as for W0)
        C0 CONFIGURATION
              (same as for W0)

  BUS ADDRESSES
        DU DEVICE ADDR
              17772150?                  [Default setting]
              17760334?
              17760340?
              17760344?

  Q-BUS BURST
        SHORT INTERVAL?
        LONG INTERVAL?
```

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