MODEL 9400
DISK STORAGE
SYSTEM
(FOR VAX-11/780 COMPUTERS)

TECHNICAL MANUAL
PRELIMINARY SUPPLEMENT

WITH RM03 OR RP04 EMULATORS

GENERAL INFORMATION
INSTALLATION
DIAGNOSTICS AND CHECKOUT
LOGIC DIAGRAMS

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System X Industries

5 AUGUST 1980
CHAPTER 1
GENERAL INFORMATION

1-1. INTRODUCTION. This technical manual provides installation, operating, and maintenance information on the System Industries 9400 Disk Storage System for Digital Equipment Corporation’s VAX-11/780 computers. The manual is divided into ten chapters as follows: Chapter 1, General Information, describes the organization of the manual, the physical configuration of the system, a brief functional description, and general product information such as product warranty and manufacturer services. Chapter 2, Installation, provides instructions for unpacking, installation, and initial checkout. Chapter 3, Operation, gives descriptions of the controls and indicators, instructions for system startup, and operating procedures. Chapter 4, Diagnostics and Checkout, gives procedures for running diagnostic programs that are used for initial checkout, preventative maintenance, and troubleshooting. Chapter 5, Theory of Operation, gives a technical description of the system architecture, the functions of the subsystems, and some of the circuitry that implements the logic for the various functions. Chapter 6, Option Features, describes options and upgrades available for the standard 9400 Disk Storage System for VAX-11/780 computers. Chapter 7, Periodic Maintenance gives periodic maintenance requirements for the system. Chapter 8, Alignment and Calibration, provides calibration and alignment procedures for the system. Chapter 9 contains parts location drawings and parts lists for the Outerface and its major subassemblies. Chapter 10, Difference Data, details model differences created by factory and field engineering changes.

1-2. GENERAL DESCRIPTION.

a. DEC RH780. The DEC VAX-11/780 Synchronous Bus Interconnect (SBI) is designed to connect the VAX-11/780 to high performance, large capacity memory subsystems and disk and tape I/O subsystems. The SBI has a data path width of 32 bits and a physical address space of 28 bits. Disk and tape I/O devices are connected to the SBI by means of the DEC RH780 Massbus Adapter (MBA). The DEC MBA is a device that interfaces between the SBI and the disk or tape controllers. (Refer to Figure 1-2, “VAX-11/780 System Architecture.”) Massbus Adapters plug into four SBI backplane slots that can be provided in a VAX-11/780 system. Each DEC MBA can support up to eight disk or tape controllers. In a standard DEC configuration, each disk controller supports only one drive. The DEC MBA performs the following functions:

1. Maps address for virtual to physical addresses.
2. Buffers between main memory and memory devices connected to the MBA.
3. Transfers interrupts from the memory controller to the SBI.

b. 9400 System. The 9400 Disk Storage System for the VAX-11/780 replaces and emulates a DEC RH780 MBA in conjunction with an RM03 disk system. Each 9400 system can provide access for up to four drives connected radially or in a daisy chain. As an option, up to eight drives can be connected in a daisy chain/radial configuration. (Each CDC 9766 drive has a capacity of 300 Mbytes; each CDC 9762 drive has a capacity of 80 Mbytes; the CDC 9775 Fixed Module Drive (FMD) provides up to 675 Mbytes of storage.) A multiport option allows two to four VAX-11/780s, PDP-11/34s, PDP-11/70s in any combination, to share the 9400 system. A dual channel drive option can provide a single CPU with two 9400 Controllers connected to the same set of dual channel drives. The 9400 Controller can transfer data from the drives to the 9400 Interface at approximately 1.2 Mbytes per second (the transfer rate of the drive). The Interface buffers the data and transfers to the SBI at the bus speed of 13.3 Mbytes/sec.

1.3 PHYSICAL CONFIGURATION. The System Industries 9400 Disk Storage System for the VAX-11/780 computers consists of three major components: the 9400 VAX-11/780 Interface, the 9400 Controller, and the disk drives.

a. 9400 VAX-11/780 Interface. The Interface is made up of four PCBs that are installed in a System Industries backplane and cardcage assembly or a DEC RH780 MBA backplane assembly. The System Industries backplane PCB (9400-6206) and cardcage (9400-7203) are installed in one of the four-inch slots in the VAX cabinets. Devices in these slots can be connected to the SBI. There are two such slots in the system cabinet and two more in an optional expansion cabinet. (The system cabinet houses the CPU and memory.) The VAX-11/780 cabinet configuration is shown in Figure 1-3. A hex high paddleboard PCB (9400-6205) is plugged into the rear panel of the Interface backplane. (Hex-high means six DEC card edge connectors fit on the size board used.) Two standard 9400 cables connect the paddleboard to the 9400 Controller cabinet. A System Industries power supply (9400-7210) is available if the compatible DEC MBA power supply already has two MBA devices to support. The four logic boards that make up the Interface are designated as follows:

- SBI Interface PCB (9400-6201)
- Internal Registers PCB (9400-6202)
- Data Path PCB (9400-6203)
- MPU Interface PCB (9400-6204)

Four similar boards constitute the original DEC RH780 MBA. The DEC boards will not run in a System Industries backplane because their TR and BR levels must be set
through backplane signals. The System Industries TR and BR are set by switches on the boards, and they will run in a DEC backplane.

b. 9400 Controller. The 9400 Controller is a standard System Industries product also used in PDP-11 systems. It is a rackmounted device with its own power supply. It is described in the System Industries technical manual: 9400 Disk Storage System with RP04 or RM03 Emulators for PDP-11 Computers (9400-11-01), Vol. 1. (Vol 2 contains the schematic diagrams.) Those sections of the manual containing information on the Computer Port Adapter (CPA) and the RH70 Cache Bus Interface do not apply to the Controller’s use in the 9400 system for VAX-11/780 computers. The 9400 VAX Interface takes the place of the CPA.

c. Disk Drives. Each disk drive is packed in its own free-standing cabinet. The disk packs are removeable from the CDC models.

1-4. 9400 SYSTEM ARCHITECTURE.

a. Software. RM03 disk handler can run on systems using different size drives in either mapped or direct formats. Depending on how these factors are combined in a 9400 system, RM03 will run under the VMS (Virtual Memory System) with either no changes or a few software modifications to the operating system. Mostly these patches adjust size parameter to support larger capacity drives (300 Mbytes 9766s and 635 Mbyte 9775s).

b. VAX-11/780 Interface. (Refer to the block diagram for the 9400 VAX-11/780 Interface, Figure 1-4.) A bus internal to the 9400 system connects the 9400 Controller to the MPU Interface PCB and Data Path PCB. Another internal bus interconnects the four PCBs that make up the Interface. Both buses use the SBI backplane to communicate.

1. SBI Interface PCB. The SBI Interface board interfaces the 9400 VAX Interface to the SBI. It contains bus transceivers, SBI parity and confirmation logic, and other decoders and encoders for various SBI signal groups. A tristate bus, internal to the Interface, connects the SBI Interface board to the other logic boards in the Interface.

2. Internal Registers PCB. This board contains the eight RH780 internal registers that control the operation of data transfers. This board also contains 256 map registers that allow transfers to and from contiguous or non-contiguous physical memory.

3. Data Path PCB. This board contains logic to accommodate the transfer of data between the 9400 controller and the SBI. Transfers on the SBI occur in 64-bit increments; therefore, there are four transfers of 16 bits each to or from the 9400 Controller for each SBI transaction. The Data Path PCB communicates with the 9400 Controller via a bus shared with the MPU Interface PCB.

4. MPU Interface PCB. This board contains the drive-dependent registers and control logic to communicate with the MPU in the 9400 controller. This communication is via a bus shared with the Data Path PCB. There are two versions of this board: -6204-01 is for RP04 systems: -6204-02 is for RM03 systems.

1-5. REFERENCE LITERATURE.

a. Drive Manufacturers's Manuals. Applicable manuals are shipped with the drives when ordered from System Industries in a 9400 system. For names and part numbers of these manuals, refer to the 9400 Disk Storage System Manual for PDP-11 Computers, Vol. 1, (9400-11-01), Table 1-2, “Equipment, Accessories, and Documents Supplied.”

b. System Industry Manuals.

1. Installation and Maintenance Instructions, 9400 Disk Storage System with RP04 and RM03 Emulators for PDP-11 computers (9400-11-01), Vol 1. This technical manual contains installation, maintenance, and theory of operation for the 9400 Controller.

2. Model 9400 Disk Storage System, Servicing Diagrams. This is volume 2 of the manual referenced in item 1. The part number is the same. This is a book of 11" x 17" diagrams.


4. Introduction and Presite Instructions, 9400 Disk Storage System with RP04 or RM03 Emulator for PDP-11 Computers.


6. Model 9400 Disk Storage System, Servicing Diagrams. This is volume 2 of the manual referenced in item 5; the title and part number is the same. This is a book of 11" x 17" drawings.

c. DEC® Manuals. DEC® literature related to the 9400 system for VAX-11/780 computers is as follows: (These manuals are not supplied by System Industries; they are listed here for reference.)

1. VAX-11/780 Technical Summary. This is a brief summary and overview of the entire VAX-11/780 system.

2. VAX11 780 Hardware Handbook. This book contains descriptions of the structure of the computer registers, descriptions of the console subsystem and central processor, the process structure, interrupts, memory management, the SBI, the Massbus subsystem,
| VAX-11/780 SYSTEM CABINET | SBI EXPANDER CABINET (OPTIONAL) | UNIBUS EXPANDER CABINET | DEDICATED MAGTAPE CABINET |

Figure 1-3. VAX-11/780 Cabinet Configuration (Front View)

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Figure 1-4. Block Diagram, 9400 VAX-11/780 Interface
mnemonics, and other aspects of the VAX-11/780.

3. RH780 MBA, Technical Description (EK-RH780-TD-001). This book is especially applicable to the 9400 VAX Interface because the Interface is a hardware and software compatible RH780 MBA device. The book gives specifications and a theory of operation of the DEC RH780 MBA.


5. VAX11 Software Handbook. This book contains information on the conventions used to manipulate the operating system, on command language, system services, programming languages, drivers, handlers, and other aspects of the system software.

6. VAX11 Architecture Handbook. This book is a detailed software handbook that describes how the instructions work; it describes the instruction formats and addressing modes, applications programming guidelines for memory, general registers, stacks, status, and types of instructions.

7. VAX-11/780 System Maintenance Guide (EK-11780-PG-001). This book provides information valuable to those responsible for troubleshooting the system when necessary.

There are many other DEC® manuals on the VAX-11/780. A catalog of the literature is available from DEC.

d. CDC Manuals.

1. CDC Fixed Module Drive, FBZ7E1, BZ7E2, Hardware Reference Manual (83323550). This manual contains a general description, operational information, and a theory of operation.

2. CDC Fixed Module Drive, BZ87E1, BZ7E2, (9775) Hardware Maintenance Manual, is in two volumes. Volume 1 (83323560) contains sections on installation and checkout, maintenance, and parts. Volume 2 (83323570) contains logic diagrams and wire lists.

e. Fujitsu Manuals.


1.6 FUNCTIONAL CHARACTERISTICS. The system specifications are given in the following subsections.

a. Performance. System performance specifications are given in Table 1-1, "9400 System Storage Specifications," and Table 1-2, "9400 System Transfer Specifications."

b. 9400 VAX-11/780 Interface. The backplane and card cage assembly and the four PCBs that make up the Interface are DEC compatible devices; they are designed to operate in a DEC MBA slot position and are therefore subject to the same temperature, humidity, and altitude conditions. The backplane and Interface cards consume approximately 25 A from the +5 Vdc power supply. The 70 A System Industries power supply can provide DC power for two System Industries 9400 VAX Interfaces or one Interface and one DEC MBA.

c. 9400 Controller. The power and environmental characteristics of the 9400 Controller are listed in the Model 9400 Disk Storage System Technical Manual, (9400-11-01), Vol. 1, Table 1-1.

d. Disk Drives. The functional characteristics of the disk drives are listed in their respective manuals.

1.7. LIMITED WARRANTY. Refer to Model 9400 Disk Storage System, Technical Manual (9400-11-01), Vol. 1, paragraphs 1-6 and following, for information on the following:

Limited Warranty
Safety Practices
Reference Data
Manufacturer Services

1-5
<table>
<thead>
<tr>
<th>Table 1-1. 9400 System Storage Specifications</th>
</tr>
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<tbody>
<tr>
<td><strong>Data surfaces per disk unit</strong></td>
</tr>
<tr>
<td>Cylinders per disk unit</td>
</tr>
<tr>
<td>Sectors per track</td>
</tr>
<tr>
<td>Words per sector (16 bits/word)</td>
</tr>
<tr>
<td>Total data capacity per disk unit</td>
</tr>
<tr>
<td>Maximum system capacity,</td>
</tr>
<tr>
<td>4 disk units (words)</td>
</tr>
</tbody>
</table>

Notes: 'Unformatted.

<table>
<thead>
<tr>
<th>Table 1-2. 9400 System Transfer Specifications</th>
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<tr>
<td><strong>Disk rotation speed (rpm)</strong></td>
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<tr>
<td>Bit transfer rate</td>
</tr>
<tr>
<td>Byte transfer rate</td>
</tr>
<tr>
<td>Average latency time</td>
</tr>
<tr>
<td>Head movement times</td>
</tr>
<tr>
<td>* cylinder to cylinder (max)</td>
</tr>
<tr>
<td>* average</td>
</tr>
<tr>
<td>* maximum (track 0 to max)</td>
</tr>
</tbody>
</table>

Notes: 'For multi-sector transfers on disk whose sectors are interleaved, the byte transfer will be a fraction of the values listed.
CHAPTER 2
INSTALLATION
S.I. RH780 EMULATOR INSTALLATION PROCEDURE

Overview
Four different types of installation may be encountered:

a) No MBA's currently installed in system.
b) One MBA currently installed in system.
c) Two MBA's currently installed in system.
d) Three MBA's currently installed in system.

For type a) or b) the SI RH780 Emulator is installed in the CPU System Cabinet. For type c) or d) the SI RH780 Emulator is installed in the SBI Expander Cabinet.

<table>
<thead>
<tr>
<th>VAX-11/780 SYSTEM CABINET</th>
<th>SBI EXPANDER CABINET (OPTIONAL)</th>
<th>UNIBUS EXPANDER CABINET</th>
<th>DEDICATED MAGTAPE CABINET</th>
</tr>
</thead>
</table>

Figure 1  VAX-11/780 CABINET CONFIGURATION (FRONT VIEW)

NOTE: Before starting installation on types c) or d) ensure that the SBI Expander Cabinet has already been fully installed by the customer or D.E.C.
Type a) -
Typically, this is the RK07-based system with no massbus devices i.e. no magtape or large disks (RM03/RP05/RP06). The SI RH780 Emulator is installed in the first space reserved for a massbus adaptor (MBA) in the system cabinet. An S.I. power supply is also required, and this is installed in the space reserved for an MBA power supply in the system cabinet (see figure 2).

Type b) -
Typically, this is an RK07-based system with a magtape, or a system based around a large disk (RM03/RP05/RP06) and no magtape. The SI RH780 Emulator is installed in the second space reserved for an MBA in the system cabinet. Power for the device is obtained from the D.E.C. MBA power supply (see figure 3).

Type c) -
Typically this is a large-disk based system (RM03 or RP05/6) with a magtape. The S.I. RH780 Emulator is installed in an SBI Expander Cabinet, in the first space available for an MBA (4 inch slot).

An S.I. power supply is also required, and this is installed in the space reserved for an MBA power supply in the Expander Cabinet (see figure 4).

Type d) -
This would be a very large system with a magtape and either two types of large disks (e.g. RM03 or RP05/6), or more than 8 drives of one type.

The SI RH780 Emulator is installed in the SBI Expander Cabinet in the second space available for an MBA (4 inch slot). Power is taken from the D.E.C. MBA power supply in the expander cabinet (see figure 5).
**Figure 2** (Real View)

**Figure 3** (Rear View)
Figure 4 (Rear View)

Figure 5 (Rear View)
Installation Details

1. Install new disk drives in position as required by customer.

2. Get customer to bring down operating system, and remove all disks and tapes from drives.

3. Set five-position key switch on VAX control panel to OFF (CAUTION: This will turn off power to the CPU cabinets with the exception of the memory backplane and blowers).

4. Install 9400 Controller in the Unibus Expander Cabinet (or other position as required by customer). Connect cabling to drives, but do not yet cable up connectors J1 & J2 on C.I. board (see 9400 Manual for details).


6. Determine TR level at which RH780 emulator is to be operated. Check that the wire-wrap jumper on the backplane has been installed correctly, for the required TR level (see table 1).

7. Remove the 6 SBI Cables going to the SBI terminator board (pull them off evenly to avoid bending the pins).

8. If SBI terminator is already in its correct final position in the system, go to step 18. Otherwise continue at step 9.

9. Remove power connector going to J7 on terminator board.

10. Remove AC/DO LO connectors going to J8 (& J9 if in System Cabinet) on terminator board.

11. Remove 6 8-32 screws retaining the terminator and simulator panel assembly and carefully slide out assembly from the rear of machine.

12. Remove the blank 4 inch simulator panel from the 4 inch slot in the expander cabinet where the terminator is to be installed.

13. If the terminator is being moved from a 3 inch slot in the system cabinet to a 4 inch slot in the expander cabinet, go to step 14. If the terminator is being moved from one 4 inch slot to another 4 inch slot in the expander cabinet, refit terminator and blank simulator panels in their correct final positions and go to step 17.
14. Transfer the terminator printed circuit card from the 3 inch panel to the 4 inch panel, taking care to assemble the spacers and plexiglass cover plate correctly.

15. Refit the 3 inch simulator panel in the last slot of the system cabinet to maintain uniform air flow.

16. Fit the terminator and simulator panel into the correct final position in the expander cabinet.

17. Reconnect J7 and J8 connectors to the terminator board. If the terminator has been moved from the system cabinet to the SBI expander cabinet, plug the three connectors removed in steps 9 and 10 into the sockets of the extension cables in the system cabinet. (See figure 6 for details of this cabling).

18. Remove simulator panel from position where SI RH780 emulator is to be installed, saving the 6 8-32 screws and washers.


20. If required install SI power supply by first removing dummy power supply simulator box and then sliding in SI power supply. Secure with snap clip at rear first and finally 8-32 screw & washer at front top center. Plug the "switched" A.C. power cord into the receptacle on the front of the power supply. (In the SBI Expander Cabinet there are 2 power cords; one is switched, the other unswitched. Be sure to use the switched one).

21. Connect power supply leads from SI RH780 emulator backplane to power supply using 10-32 screws and washers supplied. (Red leads are +5V, black leads are 5V return).

22. As viewed from the rear of the machine connect six SBI cables between right side of SI RH780 emulator (J7-J12) and left side of SBI backplane immediately right of it (J1-J6). These will be 18 inch cables if SI RH780 emulator is being installed as the first backplane in the expander cabinet, otherwise they will be 4 inch cables). **CAUTION:** Signal side of cable must connect to the inside row of pins on each backplane connector (i.e. signal side on outside radius of cable).
23. Connect six SBI cables between left side of SI RH780 Emulator backplane and right side of SBI backplane immediately left of it. In most cases this will be the SBI terminator board, and the cables to be used will be 12 inch cables removed in step 7. (See CAUTION note in step 22).

24. Connect the -5V J15 connector to the SI RH780 emulator backplane (blue and black wires).

25. For type a) and c) installations connect the AC/DO LO cable between J3 on the power supply and J13 on the SI RH780 emulator backplane. For type b) and d) installations, connect the AC/DO LO Cable between J13 on the SI RH780 emulator backplane and J14 on the previous RH780 backplane. (This cable has yellow, violet and black wires).

26. Insert p.c. boards into SI RH780 emulator backplane, ensuring first that switches for TR level and interrupt priority have been set correctly on 6201 and 6202 boards (see table 2), and switches for the "last drive number" have been set up on 6204 board (see table 3). As viewed from the front of the machine the order of the boards from left to right is 6204, 6203, 6202, 6201.

27. Plug the paddle-board card (6205) into the connector at the rear of the SI RH780 emulator. (The J1 and J2 connectors are on the right of the board as viewed from the rear). If the paddle board needs to be removed for any reason take care to pull it out evenly, otherwise the connector blocks will be damaged.

28. Mark both ends of J1 and J2 cables and connect to J1 and J2 on the paddle-board. Route cables up and around left-hand side of cabinet, securing them in the upper cable hangers and on the cabinet side with wire-wraps supplied.

29. Feed J1 and J2 cables out through bottom left of cabinet, into the Unibus expander cabinet and up to the 9400 Controller. Ensure that there is enough slack in all the cables to allow the 9400 to be pulled out of the rack when necessary. Connect J1 and J2 cables to CI board.

30. After re-checking all installation and cable work, power system up and run diagnostics (see "SI RH780 Emulator Diagnostic Procedure" for details).
**TR ARBITRATION LEVEL WIREWRAP**

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<thead>
<tr>
<th>TR#</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2-F1</td>
<td>2-FM1</td>
</tr>
<tr>
<td>9</td>
<td>2-F1</td>
<td>2-FN1</td>
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<td>10</td>
<td>2-F1</td>
<td>2-FP1</td>
</tr>
<tr>
<td>11</td>
<td>2-F1</td>
<td>2-FP2</td>
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**Table 1. TR LEVEL WIREWRAP**
<table>
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<tr>
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<table>
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<td>7</td>
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SBI I/F Board (6201) Switch 9A

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Internal Registers Board (6202) Switch 17 D

Table 2: TR and BR Level Switches
### Table 3: "Last Drive" Switches

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<th>SW1</th>
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<th>SW3</th>
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<td>ON</td>
</tr>
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<td>3</td>
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<td>OFF</td>
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</tr>
<tr>
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<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
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<td>6</td>
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</tr>
<tr>
<td>7</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

*NOTE: "Last Drive" means highest logical drive number connected to the 9400.*

MPU INTERFACE BOARD (6204) SWITCH 15E

(SW4 is unused)
CABLING TO SBI TERMINATOR IN SYSTEM CABINET

CABLING TO SBI TERMINATOR IN EXPANDER CABINET

FIGURE 6: SBI TERMINATOR CABLING
CHAPTER 3
DIAGNOSTICS AND CHECKOUT
The System Industries 300 megabyte SBI Installation floppy is in the same format as DEC system update floppies. The operating instructions for system updates in the VAX-11 Software Installation Guide apply.

After the installation DB/DRDRIVER.EXE, VMOUNT.EXE, INIT.EXE, SYSINIT.EXE in directory [SYSEXE] have been patched to reflect the new 300 megabyte RP04/RM03 configuration. The VMB.EXE file on the consol floppy has been patched. A new file EXOR.EXE has been added to the directory [SYSEXE]. If the installation is an RM03, a new BAD utility has been patched in directory [SYSEXE].

Before installing the patches it is recommended that the controller, interface, and drive be tested as an 80 megabyte RM03 or 100 megabyte RP04, whichever is appropriate. This should be done to keep the variables to a minimum. To do this it is necessary to copy EXOR from the floppy to a system device.

DISM DX1: Dismount console floppy

Take out consol floppy and install SI floppy.

MOU DX1:/0V=ID Mount SI floppy
COPY DX1:[SYSEP]EXOR.EXE ?:? Copy file
DISM DX1: Dismount SI floppy

Take out SI floppy and put consol floppy back into drive.

After everything is tested to satisfaction, install the 300 megabyte patches and change the switches on the disk interface board(s) to reflect 300 megabyte drives.

Now you are ready to use the Drive.

A recommended procedure is:
1. Format pack
2. Bad pack
3. Either DSC or INIT pack depending on usage.
4. Now the pack is ready to be used by the system.
EXOR

EXOR prompts for the drive to be tested and for the tests to run; it will do all the tests given, in the order given and then return to ask for more tests.

The tests are all indicated by a single letter as follows:

Ci:j  (Cylinder) Restrict the cylinder range to i to j inclusive (i and j are decimal numbers). If i is omitted 0 is used as the limit. If j is omitted the last cylinder on the disk is used as the limit. The limits remain in effect until altered by another C command. Note: C by itself means use whole disk.

S     (Seek) Seek to Ø, then maxcyl, then Ø then maxcyl-1...and then seek to 0,1...maxcyl.

F     (Format) Format the pack. Formatting is done a track at a time. The data area contains zeroes.

R     (Read) Read the disc (this can be done with a good disc, write protected). (35 sector transfers).

W     (Write) Write each sector with a pattern, then writecheck each sector. Then software check each sector. If a mismatch is detected, then the following 12 bytes are printed to enable one to spot patterns. (35 sector transfers).

L     (Last-track) Write a last track descriptor saying all blocks are good. (Applicable to RMOX only).

X     (Exit) Leave the program and return to command level.

Ctrl/C abandon current set of tests, and ask for more.

eg;    R EXOR

Drive: DR:A1 Name of drive to be tested.
Tests:  F (Format disc).
Tests:  SCØ:1W (Seek test, then write test and verify cylinders Ø & 1).
Tests:  CR (Now, read the whole disc).
Tests:  X (Exit from the program).
To: All Customers
From: Spare Sales
Subject: Procedure and Policy for Pass Thru Packs

Date: Dec. 6, 1979

Packs are warrantied by CDC to be free from defects in workmanship, for one year from date of shipment.

CDC 877/9877 DISK PACK P/N 101-0158 (80 Megabyte)
Read Acceptance Specification for:
Storage Module Drive Model 9762 or equivalent drives.

Read Error Acceptance Criteria
- No read errors of any type at cylinder 000, head 00, and head 01.
- Not more than 30 error tracks per pack.

CDC 9/883-91 DISK PACK P/N 101-0196 (300 Megabyte)
Read Acceptance Specification for:
Storage Module Drive Model 9764/66 or equivalent drives.

Read Error Acceptance Criteria
- No read errors of any type at cylinder 000, head 00, and head 01.
- Not more than 100 error tracks per pack.

Both packs are designed to operate with systems having error correction capabilities of up to 11 bits of errors within one burst location providing the rest of the track is error free. Tracks which contain errors that exceed 11 bits are considered uncorrectable.

Cause For Pack Rejection

To reject a pack it must exceed the above specifications. Suggested method of testing is to use one of the following programs or equivalent:

For DEC users of System Industries 9500 system
Pack Certification

For Data General users of System Industries 9500 system
DK Init.

For DEC users of System Industries 9400 system
DEC Program Bad

Exchange Policy

When a pack does exceed the read acceptance specification, a no-charge exchange will be initiated.

All warranty claims must be initiated within seventy-five days after shipment by System Industries.
A Return Authorization Number must be obtained from Spare Sales before returning a pack.

Information required for Return Authorization:

- Purchase order number
- "Ship to" & "Bill to" address(es)
- Type of system
- Quantity
- Type of pack(s)
- Serial numbers
- Date of delivery (approximate month/year)
- Reason for rejection

System Industries will make every effort to immediately replace the defective pack from stock available.

A copy of the test results showing that the pack has exceeded the read specification, must be enclosed with the pack. Without the test results the pack will be returned to you. System Industries will then invoice you for the replacement.

Purchase Orders issued to System Industries must include the following information:

- Purchase Order Number
- Return Authorization Number
- Description of Pack
- Quantity Requested

Customers will be invoiced at current selling prices if the pack to be returned is not received within fifteen days of Return Authorization date or if System Industries determines that the pack is out of warranty to CDC. Lead time of thirty days is required to validate warranty claims. All shipping charges for packs returned to System Industries will be the responsibility of the customer.
NOTE:
1. THIS SCHEMATIC REPRESES ASSEMBLY 9420-4205
   AT DATE CODE A 004.