SDC-RX50

Floppy Disk Controller

Manual

Σ Sigma Information Systems

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SIGMA INFORMATION SYSTEMS

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FIGURES/TABLES

SECTION 1 - GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides the information necessary to configure, install, and operate the SDC-RX50 floppy disk controller. The material in this manual is arranged into the following sections.

SECTION 1 - GENERAL INFORMATION. This section provides a general description of the SDC-RX50. Specifications are included.

SECTION 2 - INSTALLATION. This section provides the information necessary to configure and install the controller. Factory settings for address selection, bootstrap and disk parameters are included.

SECTION 3 - BOOTSTRAP AND FORMAT OPERATION. This section provides the information necessary to run the bootstrap program and to format diskettes.

SECTION 4 - OPERATION WITH SYSTEM SOFTWARE. This section describes operation of MSDOS under RT-11, including RT-11 support for multiple controllers.

SECTION 5 - PROGRAMMING. This section describes the SDC-RX50 communication via mass storage control protocol (MSCP). Extended MSCP commands are included.

SECTION 6 - DIAGNOSTICS. This section describes the DEC diagnostics that can be run to verify SDC-RX50 integrity.

SECTION 7 - MPSL "BOS" OPERATING SYSTEM. This section describes the methods that enables a user-defined diskette format to be used. Formatting user-defined diskettes is included.

REF: RX50.WPS

1.2 GENERAL DESCRIPTION

The SDC-RX50 is a DEC compatible floppy disk controller that supports one or two 5-1/4" (3" or 3.5" also) single-sided or doubled-sided floppy disk drives. The controller emulates the RX50 functions of DEC's RQDX controller. It is media compatible with the RX50 and software compatible with standard DEC operating systems and diagnostics designed for the RQDX controller. It includes an Extensive Extended Command Set and operates with non-DEC formats .

In addition to RX50 compatibility, the SDC-RX50 also provides data transfer capability between DEC machines and a diversity of diskette formats found in the PC market. This includes the ability to read and write normal and high-density IBM diskettes and the newer 3" and 3-1/2" formats. Forty or 80 track drives may be used, and the controller detects the type of drive automatically. Other features of the SDC-RX50 include:

- o On-board "universal" bootstrap
- o "Auto-boot" for turnkey systems
- o High-speed DMA data and control transfer
- o Internal self-diagnostics on power-up
- o Standard dual-wide Q bus module.

1.3 SPECIFICATIONS

Power Requirements:	5VDC @ 2.5A
Bus Loading	
AC:	1
DC:	1
Device Address:	Standard MSCP address 172150-2 with jumper-selectable alternate address 172160-2.
Interrupt Vector:	Software configurable
Recording Method:	MFM double density
Drive Support:	One or two single or double-sided drives with any SA400 interface using 34-conductor ribbon cable.
5-1/4" Drive:	BASF 6138 Mitsubishi 4853, 48548 (high density) Mitsubishi MF504 Tandon TM65 Toshiba ND-06DT NEC 1155.i; 3-1/2" Drives: Epson SMD-120 Epson SMD-140
3" Drives:	Hitachi HFD305D
Dimensions:	Standard dual-wide Q bus module

NOTES

SECTION 2 - INSTALLATION

2.1 INTRODUCTION

This section provides the information necessary to configure and install the SDC-RX50 into a Q bus backplane.

2.2 FACTORY CONFIGURATIONS

Figure 2-1 shows the factory configurations for SDC-RX50. Jumpers KA0-KA2 select the device address. Switch 1 (SW1) configures step rate, boot enable/disable, and density selection. Switch 2 (SW2) configures disk parameters and logical unit number.

Table 2-1 summarizes the factory configurations.

Use the paragraphs in this section to verify or change the factory configurations.

PARAMETER	FACTORY SETTING
Step Rate	3ms
Boot	Enabled
Boot Sequence	Universal Bootstrap
Density	Normal (RX50)
Starting Logical Unit Number (SLUN)	0
Disk Parameters	Double-side, Single-density

Table 2-1: Factory Configurations

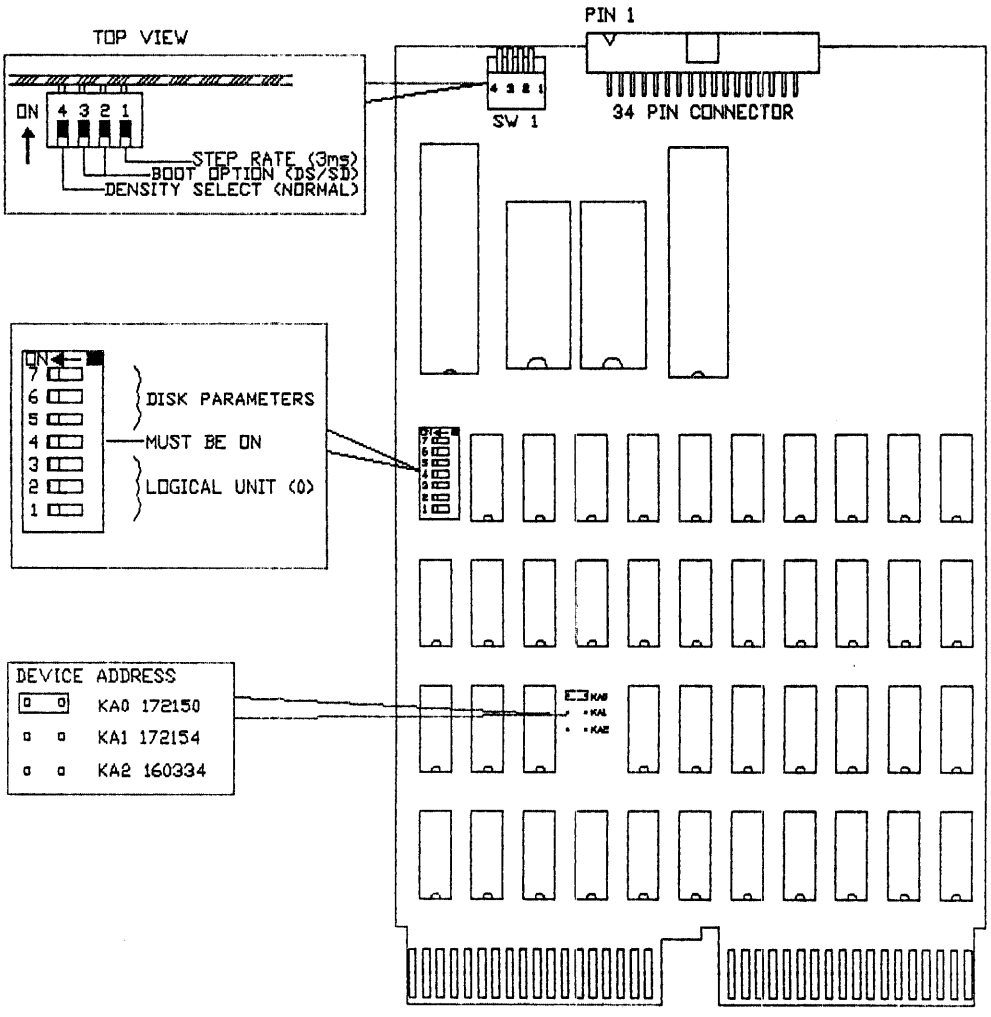


Figure 2-1: Factory Configurations

2.3 STEP RATE, BOOT, AND DENSITY SELECTION (SW1)

The positions on switch bank 1 (SW1) are summarized in Table 2-2.

SW1 POSITION	STATUS	FUNCTION
1		STEP RATE
	* ON	3ms (most industry standard drives)
	OFF	6ms (RX50 drive)
2		BOOT SEQUENCE
	* ON	Executes universal bootstrap. Prompts user for a boot device
	OFF	Alternately attempts to boot DU0 and DU1 until one becomes ready
3		BOOT ENABLE/DISABLE
	* ON	Boot disabled
	OFF	Boot enabled
4		DENSITY SELECT
	* ON	Normal density (e.g., RX50)
	OFF	High density (e.g., IBM PC/AT

*Factory Configuration

Table 2-2: Step Rate, Boot and Density Selection (SW1)

2.4 LOGICAL UNIT AND DISK PARAMETERS (SW2)

Switch bank SW2 configures the Starting Logical Unit Number (SLUN) and the disk parameters.

2.4.1 Starting Logical Unit Number (SLUN)

Switch bank SW2 positions 1-3 select the SLUN of the controller. This is the actual MSCP unit number of the first drive to be accessed. For example, if SLUN is set to "5," the first physical drive on the controller is addressed as DU5.

This feature is necessary under some operating systems when two or more controllers are installed in a system.

The positions for switch bank 2 (SW2) are summarized in Table 2-3.

SLUN	**SW2 POSITIONS 3	2	1
*0	ON	ON	ON
1	ON	ON	OFF
2	ON	OFF	ON
3	ON	OFF	OFF
4	OFF	ON	ON
5	OFF	ON	OFF
6	OFF	OFF	ON
7	OFF	OFF	OFF

*Factory Configuration
**SW2-4 must always be ON

Table 2-3: Logical Unit Selection (SW2)

Example: RSTS/E must not have two units on different controllers with the same unit number. It will disable the second occurance of the same unit number, i.e.,

if controller RU0: has a winchester as unit 0, and
if controller RU1: has two floppies as units 0 and 1,

RSTS/E disables unit 0 of controller RU1: because it is duplicated as the winchester on RU0:.

If controller RU1: is an SDC-RX50, the Starting Logical Unit Number (SLUN) can be configured as "1" via SW2. This defines the first floppy drive as unit 1 and the second floppy drive as unit 2, which are not duplicated on RU0:.

Section 4.2.2 provides more information and example for configuring multiple controllers.

2.4.2 Disk Parameters

Switch bank SW2 positions 5-7 define default disk drive/format types that the SDC-RX50 uses with standard DEC software. The disk parameter configurations are shown in Table 2-4.

(If the SDC-RX50 is used as a backup device it can be configured for 17 sector, 80 track media instead of the RX50's 10 sector media. This increases the capacity of a double-sided disk from 800Kb to 1.3Mb.0

**SW 2 POSITIONS 7	6	5	DRIVE	DISK PARAMETERS
*ON	ON	ON	RX50/RX33	Double-Sided/Single-Density
ON	ON	OFF	RX50	Single-Sided/Single-Density
ON	OFF	ON	RX50	DEC RX50
ON	OFF	OFF	RX50/RX33	Double-Sided/Double-Density
OFF	ON	ON	IBM PC	9 Sector, 40 Track
OFF	ON	OFF	IBM PC/AT	15 Sector, 80 Track
OFF	OFF	ON		17 Sector, 80 Track (Maximum)
OFF	OFF	OFF		Not defined. For future use.

*Factory Configuration **SW2-4 must always be ON

Table 2-4: Disk Parameter Configurations (SW2)

The RX50 sector interleave algorithm is used on other non-DEC formats. This can be switched off by software in the same way that the controller can be programmed to read other formats. See Section 5.4 for more information on extended programming features.

NOTE

The RX33 format is DEC's high-density format for the RQDX3 winchester/floppy controller. The SDC-RX50 automatically switches to RX33 mode when the correct media is loaded into the drive.

Since this format is high-density, special diskettes (HD2) must be used (e.g., DISKY HD2 - high-density, 2-sided), which only work in drives that have switchable density capability and double-sided read/write heads (e.g., Mitsubishi MF504A).

The drive must support split rotational speeds to achieve high-density support (300rpm for normal, 360rpm for high density).

The RX33 format is 15 sectors per track, 80 cylinders, 2-sided, and yields 2400 blocks. See Section 3 for more information on formatting these diskettes.

2.5 INSTALLING THE SDC-RX50 INTO THE BACKPLANE

The SDC-RX50 uses both interrupts and direct memory access (DMA) and must, therefore, be installed so that there are no vacant backplane slots between the processor and the SDC-RX50. The exact arrangement of boards depends on the type of backplane being used and the number of boards already installed.

Refer to the manufacturer's priority specifications when installing the SDC-RX50 into the backplane. Insert the SDC-RX50 into the next available slot and connect the ribbon cable between the SDC-RX50 and the floppy drives. Be sure that pin 1 is correctly aligned. Pin 1 is indicated by an arrow molded into the connector and by a red stripe on the ribbon cable.

2.6 DIAGNOSTICS

Use the following procedure to run diagnostics on the SDC-RX50. **BOLDED** commands are keyboard entries.

1. Put the computer Halt/Enable switch into the Halt position and apply power to the computer and drives.

2. When the power-on LEDs on the drives and the chassis front panel are lit, put a write protected diskette in drive 0 and close the door lock.

3. Check that the drive select LED is OFF on each floppy drive and enter:

```
@77772150/ 177777 0<LF>
77772152 / 005500 100000<CR>
@
```

4. Wait approximately 3 seconds and continue by entering

```
/ 010200 <CR>
@
```

5. If the system returns the prompt as described above, the controller has passed most of the power-up tests. Next, test the subsystem under system software or run the DEC XXDP diagnostics.

If neither diagnostics nor system software are available, the bootable formatting diskette supplied with the controller may be booted and copied. This will check most functions of the controller.

See Section 3 for instructions on making copies of this diskette.

SECTION 3 - BOOTSTRAP AND FORMAT OPERATIONS

3.1 INTRODUCTION

This section provides the information necessary to run the bootstrap program and to format diskettes.

3.2 USING THE BOOTSTRAP PROGRAM

The on-board bootstrap is invoked by a read from location 173000 following a bus initialize. This is usually done by using power-up mode 2 (jumper selectable on the CPU board) or by typing 173000G on the system console.

SW2-3 must be ON (bootstrap enabled) and the bootstrap follows one of two sequences, depending upon the state of SW2-2 (Section 2.3).

SW2-2 OFF — **BOOT FIRST READY DRIVE.** The program attempts to boot from DU0. If DU0 is not ready, or if an error occurs, the program attempts to boot from DU1. If DU1 is not ready, or if an error occurs, the program revert to DU0 again. This process is repeated until a successful read of a valid bootstrap is achieved.

SW2-2 ON — **UNIVERSAL BOOTSTRAP.** This condition allows the user to boot from any supported device and unit. The bootstrap program first prints its version number, sizes the memory and prints the size as a number of K words. It then prompts "Enter Device."

The user then can enter the 2-character mnemonic (*shown below) of the device to be booted and the unit number, followed by a carriage return.

*The following devices are supported.

DU	MSCP at standard address 172150
DQ	MSCP at alternate address 172154
DL	RL02
DM	RK06/RK07
DR	RM02/RM03
RK	RK05
RX	RX01/RX02 8" floppy
MS	TS11/TSV05 Magnetic tape
MT	TM11 Magnetic tape

An example (keyboard entries are **BOLDED**) follows:

```
V01.02  512KW
Enter Device DU0<CR>
```

The program will then indicate whether the bootstrap was read successfully from the selected device by printing

```
Booting... please wait
```

or one of several error messages.

3.3 FORMATTING DISKETTES

The SDC-RX50 has a built in disk format routine to generate any standard IBM SYSTEM 34 format. This routine is entered via a stand-alone disk format utility that can be booted up from an RX50 diskette and configured to generate any type of diskette. The user-configured program can be save onto another RX50 diskette and booted up from any unit.

3.3.1 Running the Format Program

The formatting disk is bootable using any standard DU type hardware bootstrap. It should be booted in the same way as the operating system is booted when the computer is first switched on. The formatting disk may be booted in either of the drives (0 or 1) by specifying DU0 or DU1 in response the the bootstrap prompt. The program will be read in from the disk, and a menu similar to the following will appear on the system console.

```
FORMAT UTILITY V01.00

1.  Format disk
2.  Setup disk format type
3.  Remove a format from menu
4.  Save this prog to a new disk
5.  Help information
6.  Reboot system

Type AC at any time to return to main menu

Select function :-
```

The (master) diskette may now be removed since the program is memory-resident.

Diskettes are formatted by selecting menu option 1. The program will first display the current format settings (bytes per sector. sectors per track. etc.). Place the diskette to be formatted in either drive. enter the drive number as prompted. and the program will begin formatting.

If the currently selected format is not the one required. then a different format may be selected by using menu option 2.

The program will print a list of all its known formats. (As of date this is only RX50). To enter a new format. select menu option 98 in the submenu. The program will prompt for various format parameters. The parameters for some command disk formats are contained in Table 3-1.

DISK DESCRIPTION	BYTES/ SECTOR	LOG/PHY FLAG	SECTORS/ TRACK	DENSITY FLAG	TRACKS/ SURFACE
DEC RX50	512	1	10	0	80
DEC RX33	512	1	15	1	80
Rainbow	512	1	10	0	80
IBM PC 8 sec	512	1	8	9	40
IBM PC 9 sec	512	1	9	0	40
IBM AT 15 sec	512	1	15	1	80
Apricot 3.5"	512	1	9	0	80
Micro-V 1000	256	0	16	0	80
DRS 20	256	1	16	0	80
Morrow PC	1024	1	5	9	40

Table 3-1: Typical Drive Formats

NOTE

Diskettes are always written in MFM code (double density). However, some drives, notably the one used on the IBM PC AT, are capable of storing approximately 600 Kbytes per surface, which is referred to as high density. Normal density is used by most vendors including the DEC RX50 format and the standard IBM PC. To operate at high density the disk drive must be capable of switched densities and special 1.6 Mb diskettes must be used.

The program will now prompt for a description of the format to be placed in the menu (e.g., "Double Side RX50" or "IBM PC AT").

If a wrong or non-required format is placed into the table it may be deleted using option 3 of the main menu. Option 3 lists all the formats in the table, and prompts for the format number to be removed.

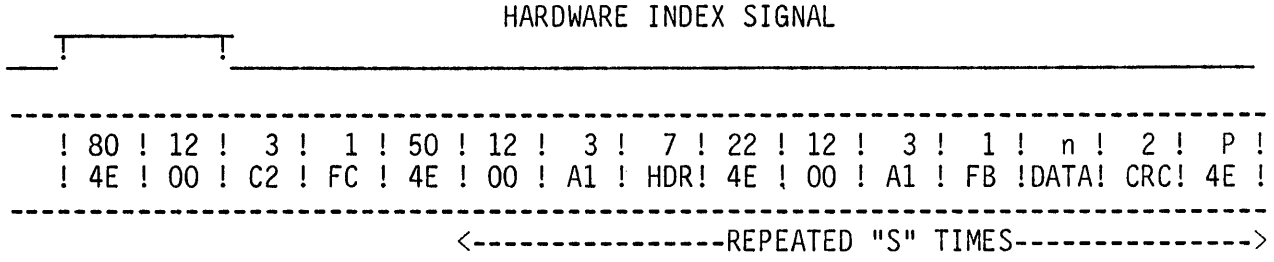
To update the program back onto the boot disk, select main menu option 4. This is only allowed on an RX50 type disk, which must be unprotected.

3.3.2 Logical Track Layout

The logical track layout of all 5-1/4" diskettes written by the SDC-RX50 conforms to a specification defined by IBM. This is the IBM SYSTEM 34 format, using MFM data encoding only.

DEC's RX50 disks are similar to this, but do not record an index address mark at the beginning of the track. Although RX50 format disks generated by the SDC-RX50 are written with this index mark, this does not affect the operation of these disks when used with either the SDC-RX50 or a DEC controller/drive subsystem.

The diskette surface is divided into 80 concentric tracks numbered 0-79. The track starts at the leading edge of the hardware-detected index hole in the diskette. Following the index are 80 bytes of "4E" data, 12 bytes of "00" data, and an index address mark indicating the beginning of the track. Following the index mark is the post index gap, which is 50 bytes of "4E." The next field is the sector header preamble, address mark and information. This consists of 12 bytes of "00" and then the data record for the first sector. Following this is the inter-record, which is variable, depending on the number of bytes per sector and the number of sectors per track. This field leads on to the next sector header preamble field. Following the last sector on the track is the pre-index gap, which is "4E" data is is of variable length. The disk format is shown in Figure 3-1.



WHERE: S = NUMBER OF SECTORS PER TRACK
N = NUMBER OF BYTES PER SECTOR
P = NUMBER OF DATA POSTAMBLE BYTES

Figure 3-1: Disk Format

3.3.3 Sector Header Description

A sector header field consists of 3 bytes of address marks and 7 bytes of information. The address marks are unique, being of data A1 (hex) with a missing clock transition. The information bytes are listed below.

1. **Byte 0 - Header ID mark.** This is a byte which identifies the previous address mark as a header and not a data address mark.

2. **Byte 1 - Track Address.** This byte indicates the absolute track address of the sector. This is in the range 0-79 for an 80-track diskette and 0-39 for a 40-track diskette.

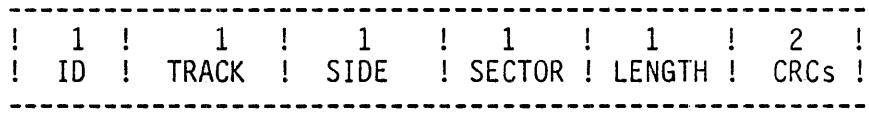
3. **Byte 2 - Side Address.** This byte indicates which side of the disk the sector is on. This is a "zero" for side zero and a "one" for side one.

4. **Byte 3 - Sector Address.** This byte indicates the absolute sector address. The sectors contain this information to identify their position on the track.

5. **Byte 4 - Sector Length.** This byte contains a value (1-3) which defines the sector length in bytes. The values are:

   1 256 byte sectors
   2 512 byte sectors
   3 1024 bytes sectors

6. **Bytes 5 and 6 - CRC.** These bytes contain the 16-bit cyclic redundancy character which is calculated for each header as a check of its validity.



SECTION 4 - OPERATION WITH SYSTEM SOFTWARE

4.1 INTRODUCTION

In single controller configurations the SDC-RX50 is totally software compatible with DEC's RX50 and, therefore, needs no software patches or special drivers under any of DEC's operating systems.

In a configuration which has more than one MSCP controller each controller must 'know' the logical unit number of the first drive connected to it. This is termed the Starting Logical Unit Number (SLUN). The present revision of SDC-RX50 has no mechanism to allow the user to set the SLUN although this will be incorporated in future revisions. However, in applications where the SDC-RX50's SLUN is to be greater than 0, a specially configured firmware PROMS with specific SLUN's can be supplied.

In configurations where the SDC-RX50 is present in addition to a standard DEC RQDX controller it will usually be convenient to put logical units 0.1. (& 2 & 3) on the SDC-RX50 and the higher units on the RQDX.

4.2 OPERATION WITH NON-DEC FORMATS

The SDC-RX50 is capable of reading and writing formats other than the standard RX50 format. This requires extra information be sent to the SDC-RX50, in addition to that required by a standard RX50 controller. Sigma has written a program designed to run under RT-11 and TSX+, which will communicate with the SDC-RX50 via the standard RT-11 DU driver. The program, call MSDOS.SAV, reads or writes to any IBM PC DOS diskette regardless of whether it is in 8-sector or 9-sector, 40-track format or the new high-density 15-sector, 80 track disks.

4.2.1 Operation of MSDOS under RT-11

The MSDOS program is run under RT-11 using the command R MSDOS. The program attempts to fetch in the required DU driver from the system disk and, if successful, displays a menu of options described below:

```
MSDOS File Convertor V02.10

1. List directly
2. Delete file
3. Rename file
4. Copy file to RT-11
5. Copy file from RT-11
6. Initialize disk
7. Format disk

Select function for MSDOS disk:-
```

When a valid function has been selected, the program prompts for the unit number of the MSDOS disk and other parameters dependent on the function selected. The program waits for a few seconds while the controller works out which type of disk is being accessed (8-, 9-, or 15-sectored disks) and while the file allocation table(s) are read from the diskette.

The following is an example of a file transfer from RT-11 to an IBM PC DOS diskette (keyboard entries are **BOLDED**):

```
Select function for MSDOS disk :- 5
ENTER UNIT NUMBER OF MSDOS disk :- 0
Enter RT-11 i/p file name :- DL3:TEST.TXT
Enter MSDOS o/p file name :- TESTDAT.TXT
```

The file on DL3: called TEST.TXT is now copied to the MSDOS diskette in drive 0. If an error occurs, a message is reported back t the user; otherwise a prompt to continue back to the menu is given as shown below:

Continue (Y/N) ? **Y**

The file transfer is now complete. The program performs no file conversion on the data. It simply transfers those sectors allocated to the file to the MSDOS diskette. This also applies to reverse direction file transfers (e.g., MSDOS to RT-11).

4.2.2 Multiple Controllers under RT-11

RT-11 supports two methods for installing multiple MSCP controllers. These are to either modify the DU driver, as described in the RT-11 Software Support Manual, or by performing a SYSGEN.

The following is an example of a SYSGEN for two SDC-RX50 controllers. (Keyboard Entries are **BOLDED**.)

1. The SYSGEN program prompts for information about the system by asking questions. After the MONITOR TYPE and MONITOR OPTIONS sections have been completed the DEVICE OPTIONS section is entered.

2. Select DU as one of the device names prompted for.

   Enter the device name you want support for [dd]: **DU<CR>**

3. Define the number of controllers to be supported. Each port is defined as an individual MSCP controller with its own Q bus address and vector.

   How many ports are to be supported (1)? **2<CR>**

4. Enter the rest of the device names that you want support for, and complete the rest of the SYSGEN questions.

5. Build the new system using the command files generated during the SYSGEN procedure.

6. After the system has been built and booted up, use the SET commands to configure the DU handler.

Example 1

The following is an example of two SDC-RX50s, each with four logical units.

```
SET DU CSR 172150      (Default SDC-RX50 controller 1)
SET DU CSR2 172154     (SDC-RX50 controller 2)
SET DU VECTOR 154      (Default)
SET DU VEC2 170        (See note below)
```

NOTE

The vector for the second controller depends upon the hardware configuration of the system. The vector can be any unused modulo 4 address between 0 and 774.

Configure the correct port and unit values for the second controller.

```
SET DU4: UNIT = 0 PORT = 1
SET DU5: UNIT = 1 PORT = 1
SET DU6: UNIT = 2 PORT = 1
SET DU7: UNIT = 3 PORT = 1
```

This configures DU4 through DU7 to be logical units 0 through 3 on the second controller.

Example 2

The following is an example for an RQDX1 controller with one winchester at the standard address and an SDC-RX50 with four logical units at the alternate address.

```
SET DU0: UNIT = 0 PORT = 0     (Default)
SET DU1: UNIT = 0 PORT = 1     (SDC-RX50 drive 0)
SET DU2: UNIT = 1 PORT = 1     (SDC-RX50 drive 1)
SET DU3: UNIT = 2 PORT = 1     (SDC-RX50 drive 0 second side)
SET DU3: UNIT = 3 PORT = 1     (SDC-RX50 drive 1 second side)
```

SECTION 5 - PROGRAMMING

5.1 INTRODUCTION

The SDC-RX50 controller communicates with the host computer via a message-oriented control protocol. This protocol, defined as mass storage control protocol (MSCP), allows the host to send message requests for reads or writes to the SDC-RX50, and accept back the response message from the completed requests.

5.2 CONTROLLER COMMUNICATIONS

Before the host can communicate the the SDC-RX50 it has to inform the module of the communications area in memory where messages are to be transferred. This is called initialization, and it sets up the module interrupt vector, interrupt flags, and communication ring area lengths and address.

The ring area is made up of response descriptors and command descriptors. These descriptors contain information on where a message area has been designated and flags which control the handshake of messages between the host and controller. These descriptor rings are two words in length, but multiple ring lengths can be specified at initialization time.

The first word contains the low order address for the communication packet, and the second word contains the flags and extended address of the packet.

The descriptor format is shown in Figure 5-1.

```
         15 !14 !13 !12 !11 !10 !09 !08 !07 !06 !05 !04 !03 !02 !01 !00 !
        ---------------------------------------------------------------
WORD 0  ! A ! A ! A ! A ! A ! A ! A ! A ! A ! A ! A ! A ! A ! A ! Z !
        ---------------------------------------------------------------
WORD 1  ! O ! F ! R ! R ! R ! R ! R ! R ! R ! R ! A ! A ! A ! A ! A ! A !
        ---------------------------------------------------------------
```

Z = zero bit, as the packet pointed to is word-aligned.
A = bits allocated to address description
R = not used - reserved
F = interrupt flag bit
O - ownership bit. Set to 0 if owned by the host, or 1 if owned by by the controller.

Figure 5-1: Descriptor Format

5.3 MESSAGE PACKETS

A typical command packet for a read or write command is shown below.

OFFSET	DESCRIPTION
-4	Message Length (bytes)
-2	Connect ID/credits
0	Command reference #1
2	Command reference #2
4	Logical unit number
6	Not used
10	Operation code
12	Not used
14	Bytes to transfer
16	Not used
20	Buffer address (0-15)
22	Buffer address (16-21)
24	Not used
26	Not used
30	Not used
32	Not used
34	Logical block number (0-15)
36	Logical block number (16-31)

Figure 5-2: Typical Message Packet

5.4 EXTENDED MSCP COMMANDS

The SDC-RX50 has an extra set of MSCP commands used for reading non-DEC format disks. These disks may have different sectors/track, bytes/sector, or tracks/surface. To enable the SDC-RX50 to communicate with these "foreign" disks, certain parameters must be sent to the controller before normal read/write commands.

In a normal DEC disk system, before a unit can be accessed, it must be first placed 'ONLINE." This is done by issuing an ONLINE command (octal value 11). For a non-DEC disk this must still be done, but the SDC-RX50 extended operations bit must be set in the command along with the particular disk type parameters (bytes/sector, sectors/track, etc.). Normal read/write commands can then be used to access the disk.

The extended ONLINE command performs extensive tests on the disk to calculate the size of the sectors, the quantity of sectors, and the way that they are numbered. This usually takes about one second to complete, but may take up to 10 sends in exceptional circumstances. This information is then compared with the parameters passed across in the command packet from the host; if the agree, the unit is placed online. If the parameters do not agree, the unit is not placed online (hence locking out any read/write commands), and the command is terminated with the 'MEDIA FORMAT TYPE" error code in the return status packet.
The command packet structure of an extended command is shown below. These offsets are used only for the extended online command and the extended format command.

Setting the extended operations bits for read or write commands causes the SDC-RX50 to inhibit its built-in sector interleaving and inter-cylinder skew which is necessary for RX50 diskettes, and map the logical block number to a physical track/sector with no interleave.

OFFSET	DESCRIPTION	VALUE
-4	Message length (bytes	n
-2	Connect ID/credits	0
0	command reference #1	
2	Command reference #2	
4	Logical unit number	0-3
6	Not used	0
10	Command ORed 1000 octal	1007, 1011
12	Not used	0
14	Sector byte count/256	1=256, 2=512, 4=1024
16	Logical/physical sector flag	0=log, 1=phys sector numbering
20	Not used	0
22	Not used	0
24	Not used	0
26	Not used	0
30	Not used	0
32	Not used	0
34	Not used	0
36	Not used	0
40	Not used	0
42	Not used	0
44	Sectors per track	1-17
46	Density select	0=normal, 1=hi-density
50	Tracks per surface	0=40, 1=80

Figure 5-3: Message Packet for Extended Commands

SECTION 6 - DIAGNOSTICS

6.1 INTRODUCTION

Diagnostic testing can be run using DEC'S ZRQA??, ZRCF?? and ZRCD?? MSCP diagnostic utilities. Only part of the ZRC diagnostics is used, as these were intended for use the the DEC RC25 removable disk subsystem.

6.2 RUNNING ZRCF??

The ZRCF?? diagnostic is described below. Keyboard entries are **BOLDED**.

```
.R ZRCF??
DRS-EO
CZRCF-B-3
RC25 FRONT END/HOST DIAGNOSTIC
UNIT IS AZTEC RC25 FLATTER
RSTRT ADR 147642
DR> START/TEST:1-8 <CR>
CHANGE HW (L) ? Y <CR>
# UNITS (D) 1 <CR>
UNIT 0
IP ADDRESS (0) 172150 ? <CR>
VECTOR (0) 154 ? <CR>
BR LEVEL (0) 5 ? <CR>
PLATTER ADDRESS(ES) (D) ? 0 <CR>
CHANGE SW (L) ? N <CR>
```

The tests begin and a log is sent to the terminal. One pass takes about one minute and should be error-free.

6.3 RUNNING ZRCD??

```
.R ZRCD??

DRS-EO
RC25 DISK EXERCISER
UNIT IS SINGLE RC25 PLATTER
RSTRT ADR 147642

DR? START <CR>

CHANGE HW (L) ? Y <CR>

# UNIT (D) ? 1 <CR>
UNIT 0
IP ADDRESS (O) 172150 ? <CR>
VECTOR (O) A54 ? <CR>
BR LEVEL (O) 5 ? 4 <CR>
PLATTER ADDRESS (UNIT PLUG) (D) O ? <CR>
ALLOW WRITES TO CUSTOMER DATA AREA ON THIS PLATTER (L) ? Y <CR>
**WARNING - CUSTOMER DATA AREA MAY BE OVERWRITTEN!...CONFIRM (L) ? Y

CHANGE SW (L) ? Y <CR>

ERROR LIMIT (O FOR NO LIMIT) (D) 32 ? <CR>
TRANSFER LIMIT IN MEGABYTES (O FOR NO LIMIT) (D) 2 ? 1 <CR>
SUPPRESS PRINTING ERROR LOG MESSAGES (L) Y? N <CR>
RUN DM EXERCISER INSTEAD OF MULTI-DRIVE SUBTEST (L) N ? <CR>
RANDOM SEEK MODE (L) Y ? <CR>
STARTING TRACK (D) O ? <CR>
ENDING TRACK (D) 1641 ? 24 <CR>
READ COMPARES PERFORMED AT THE CONTROLLER (L) Y ? N <CR>

THE REMAINING QUESTIONS ONLY APPLY TO UNPROTECTED PLATTERS.

WRITE ONLY (L) N ? Y <CR>
WRITE COMPARES PERFORMED AT THE CONTROLLER (L) Y ? N <CR>
CHECK ALL WRITES AT HOST BY READING (L) N ? Y <CR>
USER DEFINED DATA PATTERN (L) N ? <CR>
SELECT PRE-DEFINED DATA PATTERN (O FOR SEQUENTIAL SELECTION)(C)O? <CR>
```

The program will test the controller addresses, interrupt vector, and interrupt priority and, if OK, will start the multi-drive test.

The ending track address is set to 24. This is for the RX25 and is approximately 800 blocks, which is 80 RX50 tracks.

More than one unit can be tested at a time. The maximum is 4 per controller, i.e., both sides of two double-sided drives.

6.4 RUNNING ZRQA??

ZRQA?? is the exerciser diagnostic for the DEC RQDX1. The SDC-RX50 emulates the floppy part of this controller.

ZRQA?? will test out, to a limited degree, the floppy disk drives and the SDC-RX50. However, ZRCD?? is a better data reliability test if it is run as described in Section 6.3.

```
.R 'ZRQA??

DRS-E-0
CZRQA-E-0
RD/RX EXERCISER
UNIT IS RQDX1 OR RUX50
RSTRT ADR 147642

DR> START <CR>

CHANGE HW (L) ? Y <CR>

# UNITS (D) ? 1 <CR>
IP ADDRESS (O) 172150 ? <CR>
VECTOR (O) 154 ? <CR>
BR LEVEL (USUALLY 4-RQDZ1 5-RUX50) (O) 4? <CR>
DRIVE NUMBER (D) ? 0 <CR>
ALSO RUN DUP EXERCISER (L) Y ? <CR>
TEST ENTIRE CUSTOMER AREA OF THIS DISK (L) ? Y <CR>
WRITE ON CUSTOMER DATA AREA OF THIS DISK (L)  ? Y <CR>
**WARNING - CUSTOMER DATA AREA MAY BE OVERWRITTEN!..CONFIRM(L)? Y <CR>

CHANGE SW (L) ? N <CR>
```

The program tests out the controller address, vector and priority and starts up the exerciser. Performance reports are reported every 10 minutes or so.

NOTES

SECTION 7 - MPSL "BOS" OPERATING SYSTEM

7.1 INTRODUCTION

The SDC-RX50 run normally with BOS in its RX50 mode (i.e., using R29A format disks). To use disk of other format types it is necessary to replace the micro disk driver software module in the system with one supplied by Sigma. This is basically an upgraded version of that supplied by BOS, having the extra code required to drive any other type of disk format defined in the volume type library.

The Sigma drive software module or "controller," as BOS calls it, performs all the functions of the one supplied by BOS (i.e., drive the micro winchester RD51, RD52 and RC25), and has the additional features:

- o Enables a user-defined diskette format to be used.
- o Enables formatting of diskettes.
- o Has corrected error messages.
- o Enables file conversion of 5.25" RT-11 diskettes
- o Enables access to track 0 of diskettes.
- o Supports variable-sized MSCP winchesters.

To complement this software driver, Sigma has changed the action file to support the following extra features.

- o Enables more than 3 units per controller.
- o Enables the formatting support.
- o Sets up the correct access option of 52 during during initialization.

These two files make the interchange of software with many different machines possible. It also enhances the speed of the standard R29A format diskettes to a level comparable with double-density 8" disks at a greatly reduced cost and greater flexibility.

7.2 INSTALLING THE BOS "CONTROLLER"

The additional software driver is supplied by Sigma on a 5.25" R29A format diskette. The two modules are:

```
+Z1CAOF                              Software Drive Module
A.Z1  Enhanced PDP-11 Action File.
```

The software driver must be copied to SYSRES, usually unit 201, and either copied into the +.Z1 controller library (replacing the old module) or copied to SYSRES (deleting the old +Z1CAOF module in the controller library).

WARNING

This installation must only be undertaken by a BOS dealer experienced in DEC systems.

Example: BOS Installation

The following is an example installation of the SDC-RX50 support software supplied by Sigma. System parameters are:

SYSRES is unit 201
CFPROG is unit 203
Micro floppy drive with Sigma BOS upgrade disk is unit 140.

```
$LIB
$95  TARGET LIBRARY: +.NEW <CR>      UNIT: 201 <CR>
$95  NEW ? Y <CR>    SIZE: <CR>
$95  TITLE: <CR>
$95  LIBRARY MAINTENANCE
:COP <CR>   FROM UNIT: 201 <CR>
$95  FILE: +.Z1 <CR>  MEMBER: ©B (copies all member to new lib)

$95  LIBRARY MAINTENANCE
:COP <CR>  FROM UNIT: 140 <CR>
$95  FILE: +Z1CAOF <CR>  MEMBER ALREADY EXISTS-DELETE ? : Y <CR>
$95  LIBRARY MAINTENANCE
:TRU <CR>   NEW SPARE SPACE: 0 <CR>  TRUNCATED
$95  LIBRARY MAINTENANCE
:END <CR>
$95  TARGET LIBRARY: <ESC>

$F
$66  INPUT DEVICE: 201 <CR>
$66  OUTPUT DEVICE: 201 <CR>
$66  FILE MAINTENANCE
:REN <CR>  :+Z1 <CR>  AS:OLDZ1 <CR> RENAMED
$66  FILE MAINTENANCE
:REN <CR>  :+NEW <CR>   AS:+.Z1 <CR>  RENAMED
$66  FILE MAINTENANCE
: <ESC>
```

Now copy across the new action file to CFPROG:

```
$F
$66  INPUT DEVICE: 203 <CR>
$66  OUTPUT DEVICE: 203 <CR>
:REN  <CR>  :A.Z1 <CR>  AS:OLDAZ1 <CR>  RENAMED
$66  FILE MAINTENANCE
: <CR>
$66  INPUT DEVICE :140 <CR>
$66  OUTPUT DEVICE :203 <CR>
:COP <CR>  :A.Z1 <CR>  TO: <CR>  SIZE: <CR>   COPIED
$66  FILE MAINTENANCE
```

Before these files have any effect, install file maintenance must be performed. This is achieved by running CFUPDATE and skipping through the install file by typing ^b. Answer yes to the EDIT COMPLETE> message and replace the existing install file on the disk by specifying the same name and unit number. CFUPDATE takes information from the new action file and enables the extra features of the SDC-RX50 to be used. The system should now be re-booted.