RSTS/E

System Reliability Test

DEC-11-ORSRB-A-D

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PREFACE

This document describes the procedures which DIGITAL production personnel, DIGITAL Software Support representatives, or RSTS/E users should follow to test the reliability of RSTS/E VØ5B-24 hardware components at the system level. For DIGITAL production personnel steps are described which enable building a RSTS/E system from the standard distribution kit, creating an operational RSTS/E system disk, and initializing all non-system disks. Additionally, for all users of the reliability test, procedures are described for creating the required files and for running the special SYSTST control program and the peripheral exercising programs on the RSTS/E system. The document is designed to be used in conjunction with the RSTS/E System Manager's Guide, order number DEC-11-ORSMC-A-D.

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CHAPTER 1

INTRODUCTION TO THE RSTS/E SYSTEM RELIABILITY TEST

SYSTST is a set of BASIC-PLUS programs designed to provide a system reliability test of RSTS/E computers. The package includes a control program, several device exerciser programs, and utility routines required to establish the SYSTST environment. Each of the device exercisers is dedicated to driving one or more units attached to a peripheral controller and reporting any errors it may detect. The device exercisers are initiated through operator commands to the control program which is also responsible for monitoring their progress. Since RSTS/E provides for software recovery from many hardware errors, the error logging routines are used to provide continuous monitor level recording of all detectable errors whether or not they are reported by the exercisers. The error logging programs, ERRCPY, ERRDIS, ERRCRS, and ANALYS are part of the standard RSTS/E library.

Although the SYSTST exercisers in combination with the error logging routines do provide some diagnostic information, the package is not intended to replace stand-alone diagnostic or maintenance programs. SYSTST should be used to point out possible problems and to verify hardware on the system level. The diagnostics must be used to identify specific hardware malfunctions at the device level.

1.1 SYSTST ENVIRONMENT AND OPERATION OVERVIEW

SYSTST is intended to run on any RSTS/E system with a minimum of 8K of user core. The monitor must be configured for the Record I/O software option as well as for all devices which are to be tested. The reliability test normally consists of running simultaneously any set of device exercising subjobs over a period of several hours. During the test the control program allows the operator to initiate, terminate, and communicate with the subjobs and provides periodic status reports on request. At the conclusion of the test, the contents of the error log file should be printed to provide additional diagnostic information.

1.2 COMPONENTS OF SYSTST

All SYSTST programs are included in the standard RSTS/E distribution kit. If the distribution medium is 7 or 9 track magnetic tape, the required SYSTST files are included on the System Library and Reliability Tape labelled DEC-11-ORSLA-B-MA7 or -MA9. If the medium is DECtape, a separate Reliability Tape labelled DEC-11-ORSAA-B-UA is included in the kit. For DECpack distribution, all SYSTST files are included on the System Library and Reliability DECpack labelled DEC-11-ORSLA-B-HA. Required SYSTST files are listed below with a brief description of their purpose.

TSTBLD.BAS	A modified version of BUILD
TSTBLD.CTL	Control file for TSTBLD.BAS
CONTRL.BAS	The SYSTST control program
CONTRL.HLP	HELP file for CONTRL.BAS
CPEXER.BAS	CPU/EIS/FIS/FPP exerciser
DFEXER.BAS	RF11/RS11 disk exerciser
DKEXER.BAS	RK11/RKØ3/RKØ5 disk exerciser
DPEXER.BAS	RP11-C/RPØ3 disk exerciser
KBEXER.BAS	Keyboard exerciser
DTEXER.BAS	DECtape exerciser
LPEXER.BAS	Line printer exerciser
PREXER.BAS	Paper tape reader exerciser
PPEXER.BAS	Paper tape punch exerciser
CREXER.BAS	Card reader exerciser
MTEXER.BAS	Magtape exerciser

The following programs are also required and are included in the standard RSTS/E library.

LOGIN.BAS	RSTS/E LOGIN program
LOGOUT.BAS	RSTS/E LOGOUT program
INIT.BAS	RSTS/E system initialization program
UTILTY.BAS	RSTS/E system utility program
TTYSET.BAS	RSTS/E program for setting terminal characteristics
ERRCPY.BAS	RSTS/E error logging program
ERRDIS.BAS	RSTS/E error log printout program
ERRDIS.HLP	HELP file for ERRDIS.BAS
ERRCRS.BAS	RSTS/E crash data recovery program
ANALYS.BAS	RSTS/E crash analysis program
SHUTUP.BAS	RSTS/E system shutdown program

CHAPTER 2

RSTS/E SYSTEM GENERATION FOR SYSTST

SYSTST is intended for use at DEC manufacturing facilities for production testing of RSTS/E systems, at the customer site for field installation tests, and for periodic system reliability testing. Production testing requires generation of a RSTS/E system for the configuration to be tested. This chapter provides guidelines for the system generation at the manufacturing facility. Reference is made to the RSTS/E System Manager's Guide for details of the SYSGEN procedure which are not duplicated in this manual.

2.1 SYSTEM GENERATION FOR PRODUCTION TESTING

Generation of RSTS/E systems has been automated as much as possible to minimize operator error and the time required to get the system on the air. If a DECtape or magtape software kit is used, the first step involves loading a System Generation Monitor onto any disk and running the SYSGEN batch stream. A tape is created during the system generation which contains a hardware configuration file (CONFIG.MAC), four load maps (RSTS.MAP, OUR.MAP, INIT. MAP, and BASIC.MAP), the RSTS Linked Core Image Library (RSTS.LCL file), and a bootable copy of SYSLOD. The SYSLOD program is then used to create the RSTS/E system disk from the RSTS.LCL file on tape. When a DECpack kit is used, procedures are similar but the files mentioned above remain on the System Generation DECpack. The batch stream automatically loads the system code onto the RSTS/E system disk. After the system disk is created, the initialization options, PATCH, DSKINT, REFRESH, DEFAULT, and START are used to bring RSTS/E up to full operational status for production testing.

2.1.1 Creating the RSTS/E System - SYSGEN

The procedure to generate the RSTS/E system is described in Chapter 2 of the RSTS/E System Manager's Guide. The SYSTST user should be familiar with this material before attempting the system generation. In particular, Section 2.4 contains detailed instructions for loading the System Generation Monitor and running the system generation batch stream. When the batch procedure is initiated, the SYSGEN program asks a series of hardware configuration questions. SYSGEN's automatic answer capability should be used for the system generation at the production facility. This feature serves to verify the hardware configuration. Section 2.6 of the Manager's Guide includes all of the configuration questions. Normally, RSTS systems should be configured only for the hardware which is installed. However, RSTS/E is tolerant of missing devices and, with a few reservations, the questions may be answered for the full hardware configuration defined by the DEC order even if some devices are not installed at the manufacturing facility.

The KT11 memory management unit, the EIS option (11/40 only), 11/40 FIS or 11/45 FPP (if configured), 40K words of memory, clock, the console terminal, and the system disk must be installed to begin

timesharing. Since RSTS/E adapts to the amount of additional memory available at start up time, memory may be added or removed as long as the 40K minimum is maintained as the low 40K of physical memory. Similarly, terminal interfaces which are configured but are not physically present at start up time will be locked out and messages conveying the keyboard numbers of the lines disabled are printed by the initialization code. If a swapping disk is configured but is not connected, RSTS/E can be forced to swap on the system disk by appropriate responses to the REFRESH questions discussed below. Other devices such as DECtape, magtape, printers, and auxiliary disks may be configured even if they are not connected provided they are not referenced under timesharing and are not used during the system generation. When running SYSTST, care must be taken not to run any exerciser for a configured device which is not really there. If this is done, RSTS/E will assume the device is present, the driver will access the appropriate bus address, a kernel trap through 4 will occur, and the system will crash.

During the hardware configuration questions, SYSGEN will ask if any non-supported devices are connected to the RSTS/E system. According to the sequence for assignment of floating device addresses and vectors, several non-supported devices will have their addresses and/or vectors assigned before some of the supported devices (notably DH11). RSTS/E conforms to the specifications for assignment of floating addresses and vectors. These specifications are included as Appendix B of this manual. The devices which are not supported in RSTS/E are listed below the question concerning non-supported devices in the SYSGEN example of section 2.6.1, RSTS/E System Manager's Guide.

SYSGEN will also ask which disk will be used as the system disk. Table 2-1 lists the preferred system disk for SYSTST. Note that the RF11 is used as a swapping disk if it is not configured as the system disk.

SYSGEN continues with a series of questions to determine the software configuration. For the system generation at the DEC manufacturing facility, the default responses given in the automatic answers are acceptable for all software options. The user need only type the LINE FEED key to accept the automatic answer. For field installation testing (if a SYSGEN is performed) and for periodic reliability testing at the customer site, the software may be tailored to customer specification. Software requirements and guidelines for

Table 2-1
SYSTST Disk Usage

Disk Configuration			Preferred SYSTST Choices		
RF11/RS11 (platters)	RK11/RK03/RK05 (drives)	RP11-C/RP03 (drives)	System Disk	Default Swapping Disk	Auxiliary Disks
Ø	Ø	1-8	DPØ	None	DP1-DP7
Ø	1-8	Ø	DKØ	None	DK1-DK7
Ø	1-8	1-8	DPØ	None	DKØ-DK7 DP1-DP7
1-8	Ø	Ø	DF(all)	None	None
1-8	Ø	1-8	DPØ	DF(all)	DP1-DP7
1-8	1-8	Ø	DKØ	DF(all)	DK1-DK7
1-8	1-8	1-8	DKØ	DF(all)	DK1-DK7 DPØ-DP7

running SYSTST under these circumstances are presented in Sections 2.3 and 3.5 of this manual.

After all hardware and software configuration questions have been answered, the batch stream proceeds to create the system as specified. The operator is directed to mount tapes or disks as required. If SYSGEN is permitted to use a line printer, load maps and a directory of the LICIL tape will be printed. If a line printer is not available, the tape directory only will be printed on the console terminal.

2.1.2 Creating the System Disk for SYSTST

At this point SYSLOD or CILUS is used to create the contiguous Core Image Library (CIL) on the system disk from the RSTS.LCL file on tape or disk. When DECtape or magtape media is used, SYSGEN prints the correct SYSLOD command string to be used for the specified configuration. The disk to be used as the system disk must be mounted and write enabled before answering the SYSLOD DIALOGUE query. Upon completion of the load operation, SYSLOD bootstraps the RSTS/E initialization code into memory from the newly generated CIL. The load operation is performed automatically with CILUS when DECpack software is used. No command string need be typed. In either case, SYSTST does not require any special procedures in loading the CIL. Section 2.9 of the Manager's Guide presents and explains the SYSLOD

and CILUS command strings which are used for the various types of system disks and distribution media. That document should provide adequate reference material. When the RSTS/E initialization code is loaded into memory it prints an identification line and the OPTION query. The SYSTST user must now invoke several initialization options to install any published patches, create the necessary file structures, and establish start up conditions in preparation for running the reliability test.

2.1.3 Installing System Patches - PATCH option

Immediately after the initialization code is bootstrapped into memory, the PATCH option must be used to install any system patches. Patches are published in the RSTS/E System Installation Notes and the monthly Software Dispatch publications. Published patches contain detailed instructions on the correct procedures to install the patch. The PATCH option of the initialization code is described in Section 3.2 of the RSTS/E System Manager's Guide. The SYSTST user should be familiar with that material before attempting to make any alterations to the system code. The example below demonstrates the use of the PATCH option.

```
OPTION: PATCH                                    Example only - not a
MODULE NAME ? INIT                               real patch
BASE ADDRESS ? 67472
OFFSET ADDRESS ? 4724
MODULE   BASE   OFFSET  OLD     NEW?
INIT    067472  004724  100200  ?104200          Single Word Patch.
INIT    067472  004726  XXXXXX  ?                Old contents variable.
INIT    067472  004730  005766  ?                Printed for verification only.
INIT    067472  004732  001000  ? ^C             Control/C exit

OPTION: BOOT                                     Boot required after
BOOT DEVICE ?                                    patching the initialization
                                                 code to load altered INIT
                                                 code into memory.
RSTS V05B-24 TEST SYSTEM

OPTION:
```

2.1.4 Initializing the System Disk - DSKINT Option

After the SYSLOD or CILUS operation, the system disk contains only the CIL. The DSKINT initialization option is used to write the minimal RSTS file structure and to incorporate the CIL into this structure. DSKINT also performs pattern tests on disk devices to check for bad blocks and can therefore be used to supplement the tests performed by the diagnostics and by the SYSTST disk exercisers.

The initialization of a system disk is described in Sections 3.3 through 3.3.2 of the RSTS/E System Manager's Guide. That discussion contains more information than is required to run SYSTST but is valuable for an understanding of the option. To avoid confusion at the manufacturing facility, the following description of DSKINT sets standards for initialization of all types of system disks. Initialization of non-system disks is covered in Sections 3.3.3 and 3.3.4.

DSKINT is run by typing DSKINT or DS in response to the initialization OPTION query. DSKINT responds by asking for the current date and time of day and then proceeds to ask a series of questions about the disk to be initialized. Table 2-2 lists the DSKINT queries and the responses which should be used for SYSTST according to system disk type.

The pattern tests are performed after YES is typed in response to the PROCEED query. If DSKINT finds a bad block, it prints the block number (decimal) and the contents (octal) of the disk registers at the time the error was detected. A few bad blocks (up to 10) might be tolerated on RK cartridges or RP packs but diagnostics should be rerun to ensure that the drive is not at fault. If bad blocks are detected on an RF disk, the RF11 and/or RS11 should not be accepted.

Table 2-2

DSKINT Queries and SYSTST Responses

DSKINT Query	Response for System Disk Type		
	RF	RK	RP
DISK?	RF	RK	RP
PLATTERS? (RF ONLY)[1]	1-8	NA	NA
UNIT? (RK and RP)[2]	NA	Ø	Ø
PACK ID?	SYSTST	SYSTST	SYSTST
PACK CLUSTER SIZE?	1	1	2
MFD PASSWORD?	SYSTST	SYSTST	SYSTST
MFD CLUSTER SIZE?	4	4	4
PUB,PRI,SYS?	SYS	SYS	SYS
LIBRARY PASSWORD?	SYSTST	SYSTST	SYSTST
LIBRARY UFD CLUSTER SIZE?	4	4	4
PATTERNS (1-8)[3]	2	2	2
PROCEED (Y OR N)?	YES	YES	YES

[1]Enter number of RS11 platters connected to RF11 control.

[2]Always unit zero for system disk.

[3]The more patterns used, the better the test. Time required per pattern = .5 minutes for RF, 2 minutes for RK, 12 minutes for RP.

Initializing the System Disk - DSKINT Example

```
RSTS V05-21 TEST SYSTEM

OPTION: DS
DD-MMM-YY? 6-JUL-74
HH:MM? 1:12

DISK ? RK
UNIT ? 0
PACK ID ? SYSTST
PACK CLUSTER SIZE ? 1
MFD PASSWORD ? SYSTST
MFD CLUSTER SIZE ? 2
PUB, PRI, OR SYS ? SYS
LIBRARY PASSWORD ? SYSTST
LIBRARY UFD CLUSTER SIZE ? 4
PATTERNS ? 2
PROCEED (Y OR N) ? Y
PATTERN # 2
PATTERN # 1


OPTION:
```

Refer to Table 2-2 for the correct responses to be used for the various types of system disks.

2.1.5 Initialization of Non-System Disks - DSKINT

The DSKINT option is used to write the minimal RSTS file structure on non-system disks. SYSTST requires that each non-system RK and RP drive be fitted with a cartridge or pack, readied, and write enabled at this time. Do not use cartridges or packs which contain useful information since DSKINT destroys everything on these packs. Sections 3.3.3 and 3.3.4 of the RSTS/E System Manager's Guide contain a general discussion on the use of DSKINT for non-system disks. Specific instructions for SYSTST are presented below.

As described in the previous section, DSKINT is run by typing DSKINT or DS in response to the OPTION query. The current date and time of day entered when the system disk was initialized is retained. Typing the LINE FEED key (indicated by <LF> in the sample dialog) is sufficient response, therefore, to the DATE and TIME questions. The subsequent questions asked are similar to the case of the system disk. Table 2-3 lists the DSKINT queries and responses which should be used for SYSTST according to auxiliary disk type. Do not initialize the system disk using the responses of Table 2-3 as this will destroy the CIL.

Table 2-3
DSKINT Queries and Responses for Non-System Disks

DSKINT Query	Response for Auxiliary Disk Type		
	RF,RSØ3, RSØ4	RK	RP
DISK?	RF	RK	RP
PLATTERS? (RF ONLY)[1]	1-8 (RF)	NA	NA
UNIT? (RS,RK, or RP)[2]	Ø-7 (RS)	Ø-7	Ø-7
PACK ID?	SYSTST	SYSTST	SYSTST
PACK CLUSTER SIZE?	1	1	2
MFD PASSWORD?	SYSTST	SYSTST	SYSTST
MFD CLUSTER SIZE?	4	4	4
PUB,PRI,SYS?	PUB	PUB	PUB
FORMAT?	NA	YES	YES
PATTERNS? (1-8)[3]	2	2	2
PROCEED (Y OR N)?	YES	YES	YES

[1] Use responses from Table 2-2 if RF is the system disk. DSKINT serves only to pattern test an RF, RSØ3, or RSØ4 swapping disk and is not required.

[2] If RK or RP unit Ø, ensure that the disk is not the system disk.

[3] Time required per pattern = .25 minutes for RF or RS, 1 minute for RK, and 12 minutes for RP.

DSKINT is used once for each disk to be exercised under SYSTST. After all disks have been initialized, leave the packs mounted and the drives ready and write enabled for the duration of the test.

Initializing the Auxiliary Disks - DSKINT Examples

```
OPTION: DS
DD-MMM-YY?     <LF>
HH:MM?         <LF>

DISK ? RK
UNIT ? 1
PACK ID ? SYSTST
PACK CLUSTER SIZE ? 1
MFD PASSWORD ? SYSTST
MFD CLUSTER SIZE ? 2
PUB, PRI, OR SYS ? PUB
FORMAT ? YES
PATTERNS ? 2
PROCEED (Y OR N) ? Y
STARTING FORMAT PASS
END FORMAT PASS
PATTERN # 2
PATTERN # 1
```

Time entered above is sufficient until start up time. (See note below on <LF> .)

Refer to Table 2-3 for correct response for all types of auxiliary disks.

```
OPTION: DS
DD-MMM-YY?          <LF>
HH:MM?              <LF>

DISK ? RP
UNIT ? 0
PACK ID ? SYSTST
PACK CLUSTER SIZE ? 2
MFD PASSWORD ? SYSTST
MFD CLUSTER SIZE ? 2
PUB, PRI, OR SYS ? PUB
FORMAT ? YES
PATTERNS ? 2
PROCEED (Y OR N) ? Y
DRIVE NOT READY :
TYPE <LF> TO RETRY, ANYTHING ELSE TO ABORT DSKINT      <LF>
DRIVE NOT READY :
TYPE <LF> TO RETRY, ANYTHING ELSE TO ABORT DSKINT      <LF>
SET RP11C FORMAT ENABLING SWITCH THEN TYPE <LF> :      <LF>
STARTING FORMAT PASS
END FORMAT PASS
DISABLE FORMAT SWITCH THEN TYPE <LF>          <LF>
PATTERN # 2
PATTERN # 1

OPTION: DS                                    <LF>
DD-MMM-YY?                                    <LF>
HH:MM?

DISK ? RF
PLATTERS ? 2
PACK ID ? SYSTST
PACK CLUSTER SIZE ? 1
MFD PASSWORD ? SYSTST
MFD CLUSTER SIZE ? 2
PUB, PRI, OR SYS ? PUB
PATTERNS ? 2
PROCEED (Y OR N) ? Y
PATTERN # 2
PATTERN # 1
```

Typing the Linefeed key is represented by the symbolic characters <LF>.

Drive was not powered up.

Drive was not write enabled

DSKINTing the swapping disk is not required but it does serve to pattern check the disk.

2.1.6 Building the System Files - REFRESH

All RSTS systems require a number of system files during normal time sharing operations. The files required by RSTS/E are listed in Table 3-3 in the RSTS/E System Manager's Guide together with a functional description of each. The DSKINT of the system disk creates the files BADB.SYS, SATT.SYS, and RSTS.CIL. The remaining system files are created by the REFRESH option of the RSTS/E initialization code. REFRESH permits tailoring of the system files to the needs of each individual installation. A lengthy discussion of the options available at REFRESH time is presented in Sections 3.4.1 and 3.4.3 of the RSTS/E System Manager's Guide. SYSTST requires only a small amount of tailoring to locate a swap file (SWAPØ.SYS) on the swapping disk (if one exists) and to create the crash dump file (CRASH.SYS).

The example below shows the preferred responses to the REFRESH dialog for SYTST. With two exceptions, the responses shown cause REFRESH to default the characteristics of the system files. First, REFRESH locates the swap file on the system disk even if a swapping disk exists unless instructed otherwise. The responses shown in the example force SWAPØ.SYS to the swapping disk. If no swapping disk is configured, REFRESH will not ask the "DISK" query and defaults to the system disk. Secondly, REFRESH does not create the crash dump file unless instructed to do so. The crash dump facility should always be enabled for SYSTST, and, hence, the file CRASH.SYS must be created at REFRESH time. "YES" responses to the "CRASH DUMP" queries of both the REFRESH and DEFAULT initialization options serve to enable the crash dump and auto-restart features of RSTS/E.

Creating the System Files - REFRESH Example

```
OPTION: REFRESH
DD-MMM-YY? 22-JUL-74
HH:MM? 18:30

OLD ? NO

FILE                                          CURRENT   REQUIRED   START    START
NAME        REQUIRED? EXIST STATUS   SIZE     SIZE     CLUSTER  SECTOR

BADB  .SYS     YES     SYS     OK        0        0
RSTS  .CIL     YES     SYS     D/C     264      264       48       49
SATT  .SYS     YES     SYS     D/C       2        2        4        5
SWAP0 .SYS     YES      NO     CRE       0      512
SWAP1 .SYS      NO      NO     OK        0        0
SWAP2 .SYS      NO      NO     OK        0        0
SWAP3 .SYS      NO      NO     OK        0        0
OVR   .SYS      NO      NO     OK        0       28
ERR   .SYS      NO      NO     OK        0        8
BUFF  .SYS     YES      NO     CRE       0        6
CRASH .SYS      NO      NO     OK        0       28
```

Creating the System Files - REFRESH Example (Cont.)

```
BADS ?                                  <LF>

RSTS.CIL CHANGES ?                      <LF>

SATT.SYS CHANGES ?                      <LF>

SWAP0.SYS CHANGES ? YES                          Type the LINE FEED key here
                                                 to accept REFRESH defaults.
SIZE ?                                  <LF>

DISK ? SWP

BASE ?                                  <LF>

SWAP1.SYS CHANGES ?                     <LF>

SWAP2.SYS CHANGES ?                     <LF>

SWAP3.SYS CHANGES ?                     <LF>

OVR.SYS CHANGES ?                          <LF>

ERR.SYS CHANGES ?                          <LF>

BUFF.SYS CHANGES ?                         <LF>

CRASH ? YES

FILE                                                CURRENT   REQUIRED   START    START
NAME          REQUIRED? EXIST STATUS                  SIZE      SIZE    CLUSTER  SECTOR

BADB  .SYS      YES     SYS     OK                       0         0
RSTS  .CIL      YES     SYS     OK                     264       264        48       49
SATT  .SYS      YES     SYS     OK                       2         2         4        5
SWAP0 .SYS      YES     SWP     OK                     512       512      4799     4800
SWAP1 .SYS       NO      NO     OK                       0         0
SWAP2 .SYS       NO      NO     OK                       0         0
SWAP3 .SYS       NO      NO     OK                       0         0
OVR   .SYS       NO      NO     OK                       0        28
ERR   .SYS       NO      NO     OK                       0         8
BUFF  .SYS      YES     SYS     OK                       6         6         6        7
CRASH .SYS       NO     SYS     OK                      28        28        12       13

OPTION:
```

2.1.7 Setting the Default Start Up Conditions - DEFAULT

The DEFAULT option permits tailoring of a RSTS/E system to meet the needs of each installation. DEFAULT is used to permanently set the system job maximum, the maximum size of user programs, the physical location of the BASIC-PLUS Run Time System in memory, to lock or unlock areas of memory, and to enable the crash dump facility. These default start up conditions are permanent in the sense that they are preserved when the system is shut down. The same characteristics

may be set using the START option described in the next section but the effect is temporary, i.e., in effect only for one time sharing session.

REFRESH assumes a maximum job size of 8K when determining the size of SWAPØ.SYS. Although these limits could be changed using DEFAULT, they are consistent with SYSTST requirements and need not be altered. Relocation of the BASIC-PLUS Run Time System is normally used to gain optimum advantage of fast semiconductor memory. Since SYSTST is not really concerned with speed, there is no requirement to locate BASIC-PLUS in any particular area of memory. Furthermore, memory should not be locked during the reliability test. The memory lock out feature of the DEFAULT and START options should only be used in the case of memory failures where it is necessary to continue operation of the RSTS/E system or to help in locating memory problems. Finally, the crash dump facility should always be enabled during SYSTST.

The DEFAULT code is the most critical of the RSTS/E initialization routines. Prior to using this option, the KT11 memory management unit, physical memory above 28K, and the memory parity registers (if any) have not been used. DEFAULT enables memory mapping and scans the 124K of physical address space to determine the size and location of all available memory. DEFAULT will also enable memory parity checking to determine the association between parity registers and the parity memory banks. If any of this hardware is not operating properly, it is very likely that DEFAULT will fail. If a crash does occur during execution of the DEFAULT option, the components mentioned should be carefully checked with diagnostics.

The responses to the DEFAULT questions necessary to establish default start up conditions as outlined above are shown in the example below. The DEFAULT option is described in greater detail in Section 3.5 of the RSTS/E System Manager's Guide.

```
OPTION: DEFAULT

YOU CURRENTLY HAVE: JOB MAX = 16, SWAP MAX = 8K.

JOB MAX OR SWAP MAX CHANGES ? NO

CURRENT MEMORY ALLOCATION TABLE:

 ADDR   +00000  +04000  +10000  +14000  +20000  +24000  +30000  +34000
000000    MON     MON     MON     MON     MON     MON     MON     MON
040000    MON     MON     MON     MON     MON     MON     MON     MON
100000    MON     MON     MON     MON   BASIC   BASIC   BASIC   BASIC
140000  BASIC   BASIC   BASIC   BASIC   BASIC   BASIC   BASIC   BASIC
200000  BASIC   BASIC     U       U       U       U       U       U
240000    U       U       U       U       U       U       U       U
300000    U       U       U       U       U       U       U       U
340000    U       U       U       U       U       U       U       U
400000    U       U       U       U       U       U       U       U
440000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
500000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
540000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
600000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
640000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
700000    NXM     NXM     NXM     NXM     NXM     NXM     NXM     NXM
740000    NXM     NXM     NXM     NXM     I/O     I/O     I/O     I/O

TABLE OPTION ? EXIT

YOU CURRENTLY HAVE: CRASH DUMP DISABLED.

CRASH DUMP ? YES

RSTS V05B-24 TEST SYSTEM

OPTION:
```

2.1.8 Starting Time Sharing Operations - START

The START option is used to put RSTS/E into a full running state. As mentioned above, start up conditions established by DEFAULT can be temporarily altered by the START option. Any alteration applies only for the current time sharing session. If RSTS/E is shut down and later bootstrapped from the system disk, the start up conditions revert to those set by default. The example below retains the start up conditions established by DEFAULT and indicates the preferred procedure for SYSTST. Section 3.6 of the RSTS/E System Manager's Guide provides adequate reference material for use of the START option.

The START code is also a very critical part of the system initialization. START will reference all configured terminal interfaces and disable any which do not respond. The KT11 memory management unit is activated to determine the size of available memory (as in DEFAULT), to load the monitor and Run Time System, and to prepare for normal time sharing. START, furthermore, loads the stack limit register, enables parity traps for all parity memory, and activates the system clock to begin time sharing. Terminal interfaces, other than that for the console terminal, and the stack limit register have not been used up to this time. Even the clock was not critical to the operation of the System Generation Monitor or the other initialization routines. If the system does not come up as shown in the example below, these components are suspect and should be exercised with the standard diagnostics.

```
OPTION: START

YOU CURRENTLY HAVE: JOB MAX = 16, SWAP MAX = 8K

JOB MAX OR SWAP MAX CHANGES ?    <LF>     Line Feed <LF> is used to
                                          retain DEFAULT start up
ANY MEMORY ALLOCATION CHANGES ?  <LF>     conditions.

CRASH DUMP ?   <LF>

DD-MMM-YY? 22-JUL-74                      Time and date should be
HH:MM? 12:18                              entered here.


CAN'T FIND FILE OR ACCOUNT                These are normal error
PROGRAM LOST - SORRY                      messages.

READY                                     RSTS/E is now up and
                                          running.
```

When time sharing is initiated, the system attempts to execute the INIT system program which does not yet exist in the system library. As a result, two error messages are printed followed by the READY message as shown in the example. At this point, the console terminal is logged into the system under the system library account [1,2] and RSTS/E waits for input. In a normal system generation, the system library would be built at this time. The files listed in Section 1.2 comprise the library for SYSTST. Section 2.2 is concerned with loading the SYSTST files.

2.2 BUILDING THE SYSTST FILES

The SYSTST package includes a BASIC-PLUS program (TSTBLD.BAS) and a control file (TSTBLD.CTL) responsible for loading and compiling the SYSTST files. It is, however, necessary to build most of the standard RSTS/E library in addition to the SYSTST programs since several of these programs are also used for the reliability test. The operator need only type a few simple commands to create the required files. The build process proceeds automatically without operator intervention. Procedures vary slightly with the different distribution media. The next three sections detail the procedures required to build the library and SYSTST files from disk cartridge, magtape, and DECtape.

2.2.1 SYSTST Build from DECpack

If a disk cartridge software kit is used for the system generation, mount the copy of the System Library and Reliability DECpack, DEC-11-ORSLA-B-HA on RK unit 1 and write-enable the drive. Since the system library is initially empty, a small BASIC-PLUS program must be entered to logically mount the library disk. The procedure and program is shown below.

```
CAN'T FIND FILE OR ACCOUNT
PROGRAM LOST - SORRY

READY

NEW MOUNT

READY

10      DIM M%(30%)
20      CHANGE SYS(CHR$(6%)+CHR$(-10%)+"SYSLIB") TO M%
30      M%(0%)=26% : M%(1%)=6%  : M%(2%)=3%
40      M%(3%)=0%  : M%(23%)=68%: M%(24%)=75%
50      M%(25%)=1% : M%(26%)=255%               !M%(25%)=0% IF RK UNIT 0
60      CHANGE M% TO M$
70      M$=SYS(M$)
80      END

RUNNH

READY
```

Now that the library pack is mounted, the standard RSTS/E library programs are loaded by typing the commands shown below.

```
RUN DK1:BUILD
SYSTEM BUILDER
SYSTEM BUILD? YES
SYSTEM BUILD DEVICE? DK1
```

Standard RSTS/E library build proceeds without operator intervention. Many messages are printed as the programs are compiled and stored. See Section 4.2.1.1 of the RSTS/E System Manager's Guide.

```
BUILD COMPLETE

READY

RUN BUILD

SYSTEM BUILDER
SYSTEM BUILD? NO
AUXILIARY BUILD DEVICE? DK1
CONTROL FILE IS? RECIO.CTL
```

Additional programs which use RECORD I/O are loaded without further operator action. Messages are printed as shown in Section 4.2.1.2 of the RSTS/E System Manager's Guide.

```
BUILD COMPLETE

READY
```

Finally, the SYSTST files are loaded using the TSTBLD program. One command and one response is sufficient to initiate the SYSTST build. TSTBLD proceeds without further operator action as shown below.

```
RUN DK1:TSTBLD
SYSTST BUILDER

SYSTST BUILD DEVICE? DK1:

^C
HELLO

RSTS V05B-24 TEST SYSTEM  JOB 2  KB0  22-JUL-74  17:30
# 1 / 2
PASSWORD:
JOB(S) 1 ARE DETACHED UNDER THIS ACCOUNT
JOB NUMBER TO ATTACH TO?
1 OTHER USER(S) ARE LOGGED IN UNDER THIS ACCOUNT

READY
```

```
OLD $DK1:CONTRL
READY
COMPILE
READY
OLD $DK1:CPEXER
READY
COMPILE
READY
OLD $DK1:DFEXER
READY
COMPILE
READY
OLD $DK1:DKEXER
READY
COMPILE
READY
OLD $DK1:DPEXER
READY
COMPILE
READY
OLD $DK1:KBEXER
READY
COMPILE
READY
OLD $DK1:DTEXER
READY
COMPILE
READY
OLD $DK1:LPEXER
READY
COMPILE
READY
OLD $DK1:PREXER
READY
COMPILE
READY
OLD $DK1:PPEXER
READY
COMPILE
READY
OLD $DK1:CREXER
READY
COMPILE
READY
OLD $DK1:MTEXER
READY
COMPILE

READY

RUN $PIP
PIP - RSTS V05B-24 TEST SYSTEM
#CONTRL.HLP<$DK1:CONTRL.HLP/FA
#^C

READY
```

These messages are printed as the TSTBLD program loads and compiles the SYSTST files. No operator action is required.

Spacing has been removed to save space.

```
RUN $UTILTY
'UTILTY' SYSTEM UTILITY PROGRAM
? LOGINS
? ^C

READY

^C

HELLO

RSTS V05B-24 TEST SYSTEM  JOB 2  [1,2] KB0  22-JUL-74  17:45
JOB(S) 1 ARE DETACHED UNDER THIS ACCOUNT
JOB NUMBER TO ATTACH TO?  1
ATTACHING TO JOB 1

SYSTST BUILD COMPLETE - STARTING CONTRL


** DEVICES CONFIGURED IN RSTS V05B-24 TEST SYSTEM

TYPE            COUNT          EXERCISER NAME

CPU              1             CPEXER
DP               2             DPEXER
DK               2             DKEXER
KB              22             KBEXER
DT               4             DTEXER
LP               2             LPEXER
PR               1             PREXER
PP               1             PPEXER
MT               4             MTEXER
PK               4             PKEXER  No pseudo keyboard (PK) exerciser exists.
RJ               1             RJEXER  No 2780 (RJ) exerciser exists.

SYSTEM JOB MAX =                32
CONTROL JOB MAX =               29

** JOB NAME TO START OR ATTACH ?
```

Now that the SYSTST control program has been initiated, the full reliability test can be run. Chapter 3 presents guidelines for running SYSTST and includes a comprehensive example of one such test.

2.2.2 SYSTST Build from Magtape

The procedures for building the library and SYSTST files from 7 or 9 track magtape are similar to the DECpack procedures of the previous section. All required files are included on the System Library and Reliability Test Tape, DEC-11-ORSLA-B-MA7 or -MA9. This tape must be mounted on magtape unit Ø. Ensure the drive is ready and the tape is at load point. The standard library build is initiated as shown below.

```
CAN'T FIND FILE OR ACCOUNT
PROGRAM LOST - SORRY

READY

RUN MT0:BUILD
SYSTEM BUILDER
SYSTEM BUILD? YES
SYSTEM BUILD DEVICE? MT0
```

Standard RSTS/E library build proceeds without operator intervention. Messages are printed as the programs are compiled and stored. See Section 4.2.1.1 of the RSTS/E System Manager's Guide.

```
BUILD COMPLETE

READY

RUN BUILD
SYSTEM BUILDER
SYSTEM BUILD? NO
AUXILIARY BUILD DEVICE? MT0
CONTROL FILE IS? RECIO.CTL
```

Additional programs which use RECORD I/O are loaded without further operator action. Messages are printed as shown in Section 4.2.1.2 of the RSTS/E System Manager's Guide.

```
BUILD COMPLETE

READY
```

The SYSTST files are loaded from magtape using the TSTBLD program. The commands shown below initiate the sequence.

```
RUN MT0:TSTBLD
SYSTST BUILDER

SYSTST BUILD DEVICE? MT0:
```

Messages similar to those shown in the previous section are printed as the SYSTST files are compiled and stored. At the end of the build operation, the SYSTST control program is run to start the reliability test. The message below is followed by the table of configured devices and exerciser names as shown in the previous section.

```
SYSTST BUILD COMPLETE - STARTING CONTROL
```

After the SYSTST control program has been initiated, the full reliability test can be run. Chapter 3 presents guidelines for running SYSTST and includes a comprehensive example of one such test.

```
RUN DT0 TSTBLD
SYSTST BUILDER

SYSTST BUILD DEVICE? DT3
```

Messages similar to those shown in Section 2.2.1 of this manual are printed as the SYSTST files are compiled and stored. At the end of the build operation, the SYSTST control program is run to start the reliability test.

```
SYSTST BUILD COMPLETE - STARTING CONTROL
```

Now that the SYSTST control program has been initiated, the full reliability test can be run. Chapter 3 presents guidelines for running SYSTST and includes a comprehensive example of one such test.

```
RUN DT0:TSTBLD
SYSTST BUILDER

SYSTST BUILD DEVICE? DT0:
```

Messages similar to those shown in Section 2.2.1 of this manual are printed as the SYSTST files are compiled and stored. At the end of the build operation, the SYSTST control program is run to start the reliability test.

```
SYSTST BUILD COMPLETE - STARTING CONTROL
```

Now that the SYSTST control program has been initiated, the full reliability test can be run. Chapter 3 presents guidelines for running SYSTST and includes a comprehensive example of one such test.

2.3 SYSTEM GENERATION FOR FIELD INSTALLATION TESTS

The SYSTST package can be used on any RSTS/E system as long as Record I/O is configured. Otherwise, the system may be configured to customer specification for field installation tests or for periodic reliability testing. Inclusion of the extended mathematical functions (sine, cosine, etc.) increases the effectiveness of the processor exerciser (CPEXER) but is not required. The card reader exerciser (CREXER) is designed to work with a MAINDEC punched with the DEC029 card code. If the 026 or 1401 card decode table is used, a corresponding test deck should be punched.

CHAPTER 3

RUNNING THE SYSTEM RELIABILITY TEST

This chapter explains how to run the RSTS/E System Reliability Test. The test consists of running several device exerciser programs as separate jobs (called subjobs) under the supervision of the SYSTST control program CONTRL. Section 3.1 describes CONTRL and explains the commands used to run the test. The reliability test is primarily intended for production use. Therefore, the example reliability test shown in Section 3.2 shows how the test should be run in the manufacturing environment. The subsequent two sections detail the procedures to restart a RSTS/E test system after a normal shut down and after a system crash. Finally Section 3.5 includes guidelines for running the SYSTST device exerciser programs at a customer RSTS/E site.

3.1 USING THE SYSTST CONTROL PROGRAM

The SYSTST control program allows a user to run, terminate, and monitor many programs by means of commands typed at a single terminal. CONTRL runs automatically upon completion of building the SYSTST files as shown by the example in Section 2.2.1. CONTRL runs from the console keyboard which is logged into the system under account [1,2]. However, CONTRL may be run from any terminal as long as the terminal is logged into the system under a privileged account. If the user desires to use CONTRL while conducting normal time sharing operations, he can follow the guidelines presented in Section 3.5.

When CONTRL is started, it always prints a list of devices configured in the system and the name of the SYSTST device exerciser program for each type of device. Following the list, CONTRL prints a prompting message JOB NAME TO START OR ATTACH, after which the user can type commands to:

a. Run SYSTST device exerciser programs and RSTS/E system programs as subjobs under CONTRL (See Section 3.1.1).

b. Monitor the status of programs (subjobs) running under CONTRL (See Section 3.1.2).

c. Attach subjobs to a terminal (See Section 3.1.3).

d. Perform other SYSTST control functions under normal time sharing operations (See Section 3.1.4).

The user at the manufacturing facility need be concerned only with the commands to run programs and monitor subjobs (Sections 3.1.1 and 3.1.2).

After the configuration information is printed, CONTRL detaches itself from the originating terminal and communicates with the operator at that terminal through an open file. CONTRL forms command strings based on the characters typed in response to the JOB NAME TO START OR ATTACH query and executes a FORCE command. The Run Time System executes the command string passed by the FORCE command as if it were typed at the originating terminal. Since the Run Time System may interpret anything typed at the originating terminal as part of a forced string, the user should not type anything at the terminal except in response to CONTRL prompting messages or messages printed by a subjob.

The CONTRL program continuously prints its prompting message to allow the user to start as many subjobs as needed. If a command is not entered within 60 seconds, the CONTRL program automatically enters monitor mode and prints status reports at 60 second intervals.

If, while running in monitor mode, CONTRL determines that a subjob is completed, it attaches the related exerciser to the originating terminal. The exerciser program then prints a report of error statistics and a prompting message which allows the user to rerun the subjob or log it off the system. If no response is entered within 60 seconds, CONTRL automatically logs the subjob off the system and prints its prompting message again.

Any subjob which is attached to the originating terminal and expends no CPU time for a 60-second interval is automatically logged off the system by CONTRL. CONTRL will automatically attach exercisers to the terminal upon completion, print the necessary status reports, and log subjobs off the system without any user intervention. Hence, after the operator starts a number of exercisers, he need not be present for the reliability test to proceed.

3.1.1 Starting Subjobs

The command to start a CONTRL subjob is merely the name of the program to be run. Although CONTRL is intended to supervise operation of SYSTST device exercisers, any BASIC-PLUS program stored under any account on any RSTS/E device can be run as a CONTRL subjob. If the program to be run does not reside in the public disk structure in the account under which CONTRL is running, either a device specification or a project-programmer specification or both may be included in the command to start a subjob. Commands to start a CONTRL subjob should be entered only in response to a prompting message as shown below.

```
** JOB NAME TO START OR ATTACH? DPEXER                    Start DPEXER

** JOB NAME TO START OR ATTACH? MTØ:DTCOPY[100,100]       Possible
```

3.1.2 Monitoring Status of Subjobs

Monitor commands cause CONTRL to enter monitor mode and specify the scope and frequency of status reports. Monitor commands must begin with a slash (/) and can include either a program name, a job number (preceded by a pound sign (#)) or both. A colon and a decimal integer can follow the program name or job number. The slash causes CONTRL to enter monitor mode. If the user types a program name following the slash, CONTRL prints a status report of all subjobs with that name. The command /ALL causes CONTRL to print a status report of all subjobs. Alternatively, if a job number is specified in the command, CONTRL prints a status report of that job. A colon followed by a number in the command designates the number of seconds between status reports. The following examples show the use of the monitor commands.

```
** JOB NAME TO START OR ATTACH? /              Enter Monitor Mode
** JOB NAME TO START OR ATTACH? /ALL:20        Status of all jobs every 20 seconds
** JOB NAME TO START OR ATTACH? /DPEXER        One status report for all jobs
                                               named DPEXER
** JOB NAME TO START OR ATTACH? /#20:30        Status of job #20 every 30 seconds
```

If CONTRL is running in monitor mode, the user can cause it to print the JOB NAME TO START OR ATTACH query by typing the CTRL/C combination at the terminal. He can then enter a new command.

3.1.3 Attaching Subjobs to a Terminal

The user can cause CONTRL to attach a subjob to the terminal by typing the commercial at sign (@) followed either by the program name (if only one copy of the program is currently running) or by a pound sign and the job number of the subjob. As a result, CONTRL attaches the subjob to the terminal. The user may then terminate the subjob. The following examples show the use of the attach command.

```
** JOB NAME TO START OR ATTACH? @DPEXER          Attach DPEXER
** JOB NAME TO START OR ATTACH? @#20             Attach job #20
** JOB NAME TO START OR ATTACH? @DPEXER#20       Redundant but legal
```

3.1.4 Using Additional SYSTST Commands

Two additional commands are available during the reliability test. The ↑QUIT command terminates execution of CONTRL, but does not terminate any subjobs. If any subjobs are running when CONTRL is terminated, they continue running detached if no other action is taken. The second command, HELP, prints instructions on the use of the CONTRL program. (The instructions are stored in the file, CONTRL.HLP.) The following examples show the use of both commands.

```
** JOB NAME TO START OR ATTACH? ↑QUIT  Terminates CONTRL job only
** JOB NAME TO START OR ATTACH? HELP   Prints a help message
```

NOTE

The user enters the up arrow character (↑ or ^) by typing the SHIFT key and the N key simultaneously on an ASR 33 type terminal or by typing the up arrow key (^) on an LA30 or a VT05 type terminal.

3.2 RUNNING THE SYSTEM RELIABILITY TEST

This section presents a detailed example of a reliability test performed on a test system. The console printout generated by running the reliability test has been edited to remove extraneous printout, and margin notes have been added wherever they might be helpful.

Running a reliability test involves running certain RSTS/E system programs and relevant SYSTST device exerciser programs. The user should consult the appropriate section of Chapter 4 for information concerning the operation of the individual device exercisers. RSTS/E system programs are described in Chapter 6 of the RSTS/E System Manager's Guide.

In the reliability test shown in this example, some of the errors reported by the exercisers were real. Other errors were forced to demonstrate what happens when an error condition is detected. The reliability test was limited to approximately two hours to reduce the amount of printout for documentation purposes. It is recommended that acceptance procedures at the DEC manufacturing facility include approximately eight hours of continuous system operation under heavy SYSTST load.

Upon completion of the SYSTST Build program shown in Section 2.2.1, control is automatically transferred to the SYSTST control program, which first prints a list of devices configured in the test system and then waits for an operator command. The user can continue running the reliability test from that point according to the guidelines presented in the example.

```
** DEVICES CONFIGURED IN RSTS V05B-24 TEST SYSTEM

TYPE            COUNT           EXERCISER NAME

CPU              1              CPEXER
DP               1              DPEXER
DK               2              DKEXER
KB              32              KBEXER
DT               2              DTEXER
LP               1              LPEXER
PR               1              PREXER
PP               1              PPEXER
CR               1              CREXER
MT               3              MTEXER
PK               4              PKEXER
RJ               1              RJEXER

SYSTEM JOB MAX =                 16
CONTROL JOB MAX =                13

** JOB NAME TO START OR ATTACH ? ERRCPY
** LOGGING IN NEW JOB NAMED 'ERRCPY'.

ERRCPY V05-06
DETACHING

** JOB NAME TO START OR ATTACH ? UTILTY
** LOGGING IN NEW JOB NAMED 'UTILTY'.


'UTILTY' SYSTEM UTILTY PROGRAM
? MOUNT DK1:SYSTST
? MOUNT DP0:SYSTST
? ^Z

READY

BYE/F


** JOB NAME TO START OR ATTACH ? MTEXER
** LOGGING IN NEW JOB NAMED 'MTEXER'.


MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 0
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 40
MT*ARE DRIVE(S) 0 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING
```

Insure that all console switches are up (1's) to enable the crash dump automatic restart features of RSTS/E.

No exercisers are currently available for PK or RJ.

Always run ERRCPY as the first control subjob if it was not run by commands in the START.CTL file. Error logging information will be lost if ERRCPY is not running.

Auxiliary (non-system) disks must be logically mounted. See Section 6.3 of SMG for a description of UTILTY.

Magtape and disk exercisers run for long periods. They should be initiated first.

First copy of MTEXER.

Use only a few feet of tape and many iterations for interaction tests.

```
** JOB NAME TO START OR ATTACH ? MTEXER
** LOGGING IN NEW JOB NAMED 'MTEXER'.
```

Second copy of MTEXER

```
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 1
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 40
MT*ARE DRIVE(S) 1 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? MTEXER
** LOGGING IN NEW JOB NAMED 'MTEXER'.
```

Third copy of MTEXER

```
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 2
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 40
MT*ARE DRIVE(S) 2 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? DPEXER
** LOGGING IN NEW JOB NAMED 'DPEXER'.
```

First copy of DPEXER

```
DP*SYSTEM CONFIGURED FOR 1 DRIVES.
DP*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DP*WHICH DRIVE(S) ? 0
DP*ONE ITERATION ON A SINGLE RP DRIVE TAKES ABOUT 4 MINUTES.
DP*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 5
DP*DP EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? DPEXER
** LOGGING IN NEW JOB NAMED 'DPEXER'.
```

Second copy of DPEXER

```
DP*SYSTEM CONFIGURED FOR 1 DRIVES.
DP*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DP*WHICH DRIVE(S) ? 0
DP*ONE ITERATION ON A SINGLE RP DRIVE TAKES ABOUT 4 MINUTES.
DP*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 5
DP*DP EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? /ALL
```

Frequent status reports should be printed.

```
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:24 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                 2.7
ERRCPY           2              SL                 0.0
MTEXER           3              RN              1:38.7
MTEXER           4              RN              1:10.9
MTEXER           5              RN                42.7
DPEXER           6              RN                 5.0
DPEXER           7              RN                 4.4

^C      CTRL/C exit from monitor mode.

** JOB NAME TO START OR ATTACH ? DKEXER
** LOGGING IN NEW JOB NAMED 'DKEXER'.
```

First copy of DKEXER

```
DK*SYSTEM CONFIGURED FOR 2 DRIVES.
DK*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DK*WHICH DRIVE(S) ? 0
DK*ONE ITERATION ON A SINGLE RK DRIVE TAKES ABOUT 4 MINUTES.
DK*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 5
DK*DK EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? DKEXER
** LOGGING IN NEW JOB NAMED 'DKEXER'.
```

Second copy of DKEXER

```
DK*SYSTEM CONFIGURED FOR 2 DRIVES.
DK*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DK*WHICH DRIVE(S) ? 1
DK*ONE ITERATION ON A SINGLE RK DRIVE TAKES ABOUT 4 MINUTES.
DK*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 5
DK*DK EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? DTEXER
** LOGGING IN NEW JOB NAMED 'DTEXER'.


DT*SYSTEM CONFIGURED FOR 2 DRIVES.
DT*HOW MANY DRIVES DO YOU WANT TO TEST ? 2
DT*WHICH DRIVE(S) ? 0,1
DT*ARE DRIVE(S) 0,1 MOUNTED AND W/E? YES
DT*ERROR AT LINE 180 :DEVICE HUNG OR WRITE LOCKED (14-JUL-74,09:27 AM)

DT*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.
? CONT
DT*SYSTEM CONFIGURED FOR 2 DRIVES.
DT*HOW MANY DRIVES DO YOU WANT TO TEST ? 2
DT*WHICH DRIVE(S) ? 0,1
DT*ARE DRIVE(S) 0,1 MOUNTED AND W/E? YES
DT*DT EXERCISER DETACHING
```

DTØ was not ready.

Two copies of DTEXER could be run to test both drives simultaneously.

```
** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:29 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                 4.5
ERRCPY           2              SL                 0.0
MTEXER           3              HB              1:45.6
MTEXER           4              RN              2:10.6
MTEXER           5              RN              1:57.7
DPEXER           6              RN                 6.6
DPEXER           7              RN                 5.6
DKEXER           8              RN                 5.3
DKEXER           9              RN                 4.8
DTEXER           10             DT                18.0

** REATTACHING SUBJOB MTEXER

MT*ERROR AT LINE 310 :DEVICE HUNG OR WRITE LOCKED (14-JUL-74,09:30 AM)

MT*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.
? CONT
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 0
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 40
MT*ARE DRIVE(S) 0 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING


** JOB NAME TO START OR ATTACH ? CPEXER
** LOGGING IN NEW JOB NAMED 'CPEXER'.


CP*STARTING CPU/EIS/FIS/FPP EXERCISER

CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? HELP

CP*DURING THE RSTS/E SYSTEM GENERATION, YOU WERE ASKED WHETHER
CP*OR NOT THIS SYSTEM REQUIRED THE EXTENDED MATHEMATICAL FUNCTIONS
CP*(SINE, COSINE, ETC.). IF YOU ANSWERED 'YES' TO 'FUNCTIONS?' AT
CP*SYSGEN TIME, THEN REPLY 'YES' TO THE QUERY BELOW. IF YOU
CP*ANSWERED 'NO' AT SYSGEN, THEN YOU ARE NOT CONFIGURED FOR THE
CP*EXTENDED FUNCTIONS AND YOU SHOULD ANSWER 'NO' BELOW. IF YOU ARE
CP*UNSURE, THEN ANSWER 'YES' AND I WILL TRY TO USE ONE OF THE
CP*EXTENDED FUNCTIONS. IF THE OPERATION FAILS, AN ERROR MESSAGE
CP*WILL BE PRINTED AND THIS EXERCISER WILL ABORT. SHOULD THAT
CP*OCCUR, SIMPLY TYPE 'RUNNH' TO RERUN CPEXER AND REPLY 'NO'
CP*WHEN AGAIN ASKED IF YOU ARE CONFIGURED FOR EXTENDED FUNCTIONS.

CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? YES

CP*EACH ITERATION TAKES ABOUT 2 MINUTES
CP*HOW MANY ITERATIONS DO YOU WANT TO RUN ? 10

CP*CP EXERCISER DETACHING
```

Hardware failure caused MTØ to appear unaccessible. "Device Hung" and "Magtape Select" errors are most likely to occur when running several drives simultaneously. More than 2 or 3 errors of this type under heavy SYSTST load usually indicates that drives or controller are not up to current ECO level. Consult PDP-11 engineering.

```
** JOB NAME TO START OR ATTACH ? /ALL:60

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:36 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                 11.8
CRRCPY           2              SL                  0.0
MTEXER           3              RN              3:07.4
MTEXER           4              RN              2:40.2
MTEXER           5              RN              2:34.9
DPEXER           6              RN                 8.0
DPEXER           7              RN                 6.7
DKEXER           8              RN                 6.1
DKEXER           9              RN                 5.8
DTEXER           10             RN              1:59.6
CPEXER           11             RN                 4.1

^C

** JOB NAME TO START OR ATTACH ? PREXER^U
PPEXER
** LOGGING IN NEW JOB NAME 'PPEXER'.
```

If a paper tape punch is connected, the punch exerciser should be run before the reader exerciser.

```
PP*STARTING PP EXERCISER. PP READY ? YES
PP*THIS TEST WILL PUNCH A BINARY COUNT PATTERN TAPE.
PP*THE TAPE IS EQUIVALENT TO MAINDEC-00-D2G4-PT ENTITLED
PP*SPECIAL BINARY COUNT PATTERN TAPE. EITHER THE TAPE
PP*PUNCHED BY THIS EXERCISER OR THE SUPPLIED MAINDEC
PP*TAPE MAY BE USED TO TEST THE PAPER TAPE READER.

PP*I WILL PUNCH A LEADER AND THEN SLEEP 30 SECONDS
PP*WHILE YOU STRAIGHTEN OUT THE TAPE IN THE HOPPER.
PP*PP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** REATTACHING SUBJOB PPEXER

PP*PP EXERCISER DONE
PP*NOW USE THE GENERATED TAPE TO TEST THE READER
PP*TO REATTACH TO CONTROL TYPE 'BYE' TO RERUN TYPE 'RUNNH'.

READY

BYE/F
```

Tape punched is about two inches thick so there may be a stacking problem.

```
** JOB NAME TO START OR ATTACH ? PREXER
** LOGGING IN NEW JOB NAMED 'PREXER'


PR*STARTING PR EXERCISER.
PR*LOAD MAINDEC-00-D2G4-PT OR THE BINARY COUNT PATTERN
PR*TAPE GENERATED BY THE PUNCH EXERCISER INTO THE READER
PR*WITH THE LEADER UNDER THE READ STATION.  READER READY ? YES
PR*PR EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:47 AM

NAME          JOB NO.       STATE          CPU TIME
CONTRL          1           RN                20.9
ERRCPY          2           SL SW              0.0
MTEXER          3           RN              4:08.5
MTEXER          4           RN              3:05.7
MTEXER          5           RN              4:03.5
DPEXER          6           RN                 9.5
DPEXER          7           RN                 8.1
DKEXER          8           RN                 7.3
DKEXER          9           RN                 6.8
DTEXER          10          RN              4:27.3
CPEXER          11          HB              1:05.2
PREXER          12          RN                16.0


** REATTACHING SUBJOB CPEXER

CP*CPU/EIS/FIS/FPP EXERCISER DONE.  TOTAL OF 0 ERRORS DETECTED
CP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

RUNNH

CP*STARTING CPU/EIS/FIS/FPP EXERCISER

CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? YES

CP*EACH ITERATION TAKES ABOUT 2 MINUTES
CP*HOW MANY ITERATIONS DO YOU WANT TO RUN ? 20

CP*CP EXERCISER DETACHING
```

Control job entered monitor mode automatically after waiting one minute for an operator command.

If any errors are reported by CPEXER, you may have flaky CPU, EIS, FIS, FPP, memory or UNIBUS.

```
** JOB NAME TO START OR ATTACH ? /PREXER

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:48 AM

NAME            JOB NO.         STATE           CPU TIME
PREXER           12             HB                 16.9
** REATTACHING SUBJOB PREXER

PR*INCORRECT NUMBER OF FANFOLDS ON PR

PR*STARTING PR EXERCISER
PR*LOAD MAINDEC-00-D2G4-PT OR THE BINARY COUNT PATTERN
PR*TAPE GENERATED BY THE PUNCH EXERCISER INTO THE READER
PR*WITH THE LEADER UNDER THE READ STATION. READER READY ? YES
PR*PR EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? LPEXER
** LOGGING IN NEW JOB NAME 'LPEXER'


LP*SYSTEM CONFIGURED FOR 1 PRINTER(S).
LP*HOW MANY PRINTERS DO YOU WANT TO TEST ? 1
LP*TYPE UNIT #'S OF PRINTER(S) TO BE TESTED ? 0
LP*ARE PRINTER(S) 0 ONLINE AND READY? YES
LP*HOW MANY PAGES OF OUTPUT DO YOU WANT? 20
LP*LP EXERCISER DETACHING.

** JOB NAME TO START OR ATTACH ? CREXER
** LOGGING IN NEW JOB NAME 'CREXER'
** CONTROL JOB LIMIT EXCEEDED - CANNOT START NEW JOB



** JOB NAME TO START OR ATTACH ? /ALL:60

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 09:52 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                 25.6
ERRCPY           2              SL                  0.0
MTEXER           3              RN               4:20.7
MTEXER           4              HB SW            3:11.1
MTEXER           5              RN               4:38.3
DPEXER           6              DF                 10.1
DPEXER           7              RN                  8.5
DKEXER           8              RN                  7.5
DKEXER           9              RN                  7.2
DTEXER           10             RN               5:27.7
CPEXER           11             SL               1:25.6
PREXER           12             RN                 35.6
LPEXER           13             RN                 20.1

** REATTACHING SUBJOB MTEXER
```

Reader jammed due to poor mechanical adjustment.

Just wait for any exerciser to finish.

```
MT*MT EXERCISER DONE FOR DRIVE(S):1
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

RUNNH
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 1
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 100
MT*HOW MANY REPETITIONS PER DRIVE ? 4
MT*ARE DRIVE(S) 1 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING
```

Use lots of tape and few iterations for data integrity test.

```
** JOB NAME TO START OR ATTACH ? /
** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB PREXER

PR*PREXER DONE, ERROR COUNT= 0
PR*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'

READY

** PREXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #12 PREXER
^^C
BYE/F$
READY
```

Operator did not respond within one minute so CONTRL killed this job.

```
** JOB NAME TO START OR ATTACH ? CREXER
** LOGGING IN NEW JOB NAMED 'CREXER'


CR*STARTING CARD READER EXERCISER.

CR*LOAD MAINDEC-89-D1B1-C LABELLED 'ALPHA CARD DECK' INTO THE
CR*READER. THE DECK WILL BE READ AND VERIFIED. IF ANY ERRORS ARE
CR*DETECTED, THE EXPECTED AND ACTUAL CONTENTS OF THE BAD CARD
CR*WILL BE RECORDED IN A DISK FILE FOR LATER PRINTING ON EITHER
CR*THE CONSOLE TERMINAL OR THE LINE PRINTER. CARDS WILL BE READ
CR*UNTIL END OF FILE OR HOPPER EMPTY IS DETECTED. SEVERAL COPIES
CR*OF THE MAINDEC MAY BE STACKED FOR A MORE THOROUGH TEST.

CR*CARD READER READY ? YES
CR*CARD READER EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE

** STATUS OF CONTROL SUBJOB(S) AT 10 04 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                  35.8
ERRCPY           2              SL                   0.0
MTEXER           3              RN                4:42.0
MTEXER           4              RN                5:44.3
MTEXER           5              RN                5:15.0
DPEXER           6              RN                  10.9
DPEXER           7              RN                   9.3
DKEXER           8              RN                   8.6
DKEXER           9              RN                   8.1
DTEXER          10              HB                6:24.5
CPEXER          11              RN                2:31.8
CREXER          12              RN                   0.9
LPEXER          13              RN                3:08.3

** REATTACHING SUBJOB DTEXER

DT*DT EXERCISER DONE FOR DRIVE(S):0,1
DT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'

READY

BYE/F

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB CREXER

CR*OUT OF 640 CARDS READ, ERRORS WERE DETECTED ON 1 CARDS.

CR*TYPE 'LP:' TO LIST ERRORS ON THE LINE PRINTER OR TYPE 'KB:'
CR*TO LIST ERRORS ON THIS KEYBOARD.                 This error was forced
                                                    for demonstration purposes.
CR*YOUR LISTING DEVICE ? KB:

CARD 85 EXPECTED : DEFGHIJ.<(+!-JKLMNOPQR]$*);^0/STUVWXYZ\,%_>? 12345678
9:#@'="&ABCDEFGHIJ.<(+!&ABC

CARD 85 ACTUAL   : DEF&HIJ.<(+!-JKLMNOPQR]$*);^0/STUVWXYZ\,%_>? 12345678
9:#@'="&ABCDEFGHIJ.<(+!&ABC
```

Note that the letter G (12-7 punch) was changed to & (12 punch). This may be just dust on the read head or marginal operation of the photo-sensor for row 7.

```
CR*CARD READER EXERCISER DONE.
CR*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F
```

```
** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB LPEXER

LP*LINE PRINTER EXERCISER DONE
LP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F

** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:10 AM

NAME          JOB NO.       STATE          CPU TIME
CONTRL         1            RN                38.6
ERRCPY         2            SL SW              0.0
MTEXER         3            HB              5:15.2
MTEXER         4            RN              7:22.3
MTEXER         5            RN              5:25.6
DPEXER         6            RN                11.7
DPEXER         7            RN                 9.9
DKEXER         8            RN                 9.3
DKEXER         9            RN                 8.8
CPEXER         11           HB              3:02.4

** REATTACHING SUBJOB MTEXER


MT*MT EXERCISER DONE FOR DRIVE(S):0
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

RUNNH
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 0
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 100
MT*HOW MANY REPETITIONS PER DRIVE ? 4
MT*ARE DRIVE(S) 0 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB CPEXER
```

```
CP*CPU/EIS/FIS/FPP EXERCISER DONE.  TOTAL OF 0 ERRORS DETECTED
CP*TO REATTACH TO CONTROL TYPE 'BYE'.  TO RERUN TYPE 'RUNNH'.

READY

RUNNH

CP*STARTING CPU/EIS/FIS/FPP EXERCISER

CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? YES

CP*EACH ITERATION TAKES ABOUT 2 MINUTES
CP*HOW MANY ITERATIONS DO YOU WANT TO RUN ? 20

CP*CP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ?  KBEXER
** LOGGING IN NEW JOB NAMED 'KBEXER'.
```

See KBEXER abstract in Chapter 4.

```
KB0  * KEYBOARD EXERCISER

KB0  * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: /KB1:
KB0  * INVALID KEYBOARD NUMBER - TRY AGAIN.

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: /KB1
KB0  * KEYBOARD EXERCISER TRANSFERRING FROM KB0  TO KB1
KB0  * PLEASE ENTER SUBSEQUENT COMMANDS FROM KB1
KB0  * KEYBOARD EXERCISER DETACHING
```

Keyboard tests can be performed on KB1 while continuing with normal SYSTST operation from KBØ.

```
** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:16 AM

NAME          JOB NO.       STATE          CPU TIME
CONTRL         1            RN                40.9
ERRCPY         2            SL SW              0.0
MTEXER         3            RN              5:49.7
MTEXER         4            RN              9:10.5
MTEXER         5            RN              5:40.7
DPEXER         6            RN                12.2
DPEXER         7            RN                10.5
DKEXER         8            RN                 9.6
DKEXER         9            RN                 9.4
KBEXER         10           TT                 1.2
CPEXER         11           RN              3:35.6

^C
```

```
** JOB NAME TO START OR ATTACH ? KBEXER
** LOGGING IN NEW JOB NAMED 'KBEXER'.

RUN KBEXER

KB0  * KEYBOARD EXERCISER

KB0  * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: ASCII

KB0  * ROTATING ASCII CHARACTERS TEST

 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$%&'
' !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$%&
&' !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$%
%&' !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$
$%&' !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#
#$%&' !"#$%&'()*+,-./0123456789:;<^C

KB0  * ENTER TEST NAME OF TRANSFER COMMAND: REPEAT

KB0  * REPEAT TEST
? ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
? ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890

? ^C

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: WORST

KB0  * ROTATING WORST CASE (ASR33) PATTERN TEST

'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W
W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_
_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'^C


KB0  * ENTER TEST NAME OR TRANSFER COMMAND: P\P\SPACE

KB0  * SPACING TEST

\
 \
  \
   \
    \
     \
      \
       \
^C

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: /KB2
KB0  * KEYBOARD EXERCISER TRANSFERRING FROM KB0  TO KB2
KB0  * PLEASE ENTER SUBSEQUENT COMMANDS FROM KB2
KB0  * KEYBOARD EXERCISER DETACHING.
```

Second copy of KBEXER

This KBEXER will check the console keyboard before being transferred to another terminal.

```
** JOB NAME TO START OR ATTACH ? /ALL:60

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:21 AM

NAME          JOB NO        STATE          CPU TIME
CONTRL         1            RN                45.4
FRRCPY         2            SL SW              0.0
MTEXER         3            RN              7:27.2
MTEXER         4            RN             10:19.4
MTEXER         5            RN              5:49.7
DPEXER         6            RN                12.6
DPEXER         7            RN                11.1
DKEXER         8            RN                10.0
DKEXER         9            RN                10.0
KBEXER         10           TT                 3.0
CPEXER         11           SL              4:09.7
KBEXER         12           TT                10.2



** REATTACHING SUBJOB MTEXER

MT*MT EXERCISER DONE FOR DRIVE(S):2
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

RUNNH
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 2
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 100
MT*HOW MANY REPETITIONS PER DRIVE ? 4
MT*ARE DRIVE(S) 2 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB KBEXER

KB0  * KEYBOARD EXERCISER

KB0  * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: ^C

READY

BYE/F
```

KBEXER was transferred back to CONTROL keyboard with /CONTROL command.

```
** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB KBEXER

KB0  * KEYBOARD EXERCISER

KB0  * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: ^C

READY

BYE/F
```

Same here for the second KBEXER.

```
** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:27 AM

NAME          JOB NO.       STATE          CPU TIME
CONTRL          1           RN                49.6
ERRCPY          2           SL                 0.0
MTEXER          3           RN              9:16.8
MTEXER          4           RN             11:36.4
MTEXER          5           RN              5:56.7
DPEXER          6           RN                13.2
DPEXER          7           RN                12.0
DKEXER          8           RN                10.4
DKEXER          9           RN                10.9
CPEXER          11          SL              4:46.3

^C

** JOB NAME TO START OR ATTACH ? ERRDIS
** LOGGING IN NEW JOB NAMED 'ERRDIS'.


ERRDIS V5B-11
INPUT FILE (<CR> FOR DEFAULT)?
OUTPUT TO? KB:
OPTIONS? ALL/S
```

May be helpful to get an error logging summary about half way through the SYSTST run. See description of ERRDIS in Section 6.11.3 of SMG.

```
OPTIONS: ALL/S
   FILE: $ERRLOG.FIL
 OUTPUT: KB:
     AT: 10:30:31 AM, 14-JUL-74

DECTAPE ERRORS
      12
```

This option lists a breakdown of errors by type.

See more specific analysis below.

```
RF11 ERRORS
      0

RC11 ERRORS
      0

RK11 ERRORS
      0

RP11 ERRORS
      0

MAGTAPE ERRORS
      0

HUNG TTY ERRORS
      32

TRAP THROUGH 4 ERRORS
      0

POWER FAIL ERRORS
      0

TRAP THROUGH 0 ERRORS
      0

RESERVED INSTRUCTION ERRORS
      0

JUMP TO ZERO ERRORS
      0

CHECK-SUM ERRORS
      0

MEMORY MANAGEMENT ERRORS
      0

DH11 ERRORS
      0

MEMORY PARITY ERRORS
      0
```

More than 1 or 2 disk errors in a period of 2-3 hours is indicative of disk problems. Seek errors will show up here but are usually recoverable by the system's retrying of the operation.

Magtape parity errors are to be expected, but excessive errors may mean intermittent controller, drive, or head problems.

Excessive HUNG TTY errors indicate terminal interface problems. See analysis at end of this SYSTST run.

Should not occur.

Should not occur.

Excessive UNIBUS noise and flaky BUS repeater can cause traps through 0.

Should not occur.

Should not occur.

Can be caused by disk or memory errors.

Should not occur. May signal KT11 problems.

Should not occur.

Memory parity errors may or may not crash RSTS/E depending on where they occur.

```
 44 ERRORS LISTED OUT OF 44 LOGGED SINCE 09:12:04 AM. 14-JUL-74
```

```
OPTIONS? DT

OPTIONS: DT
   FILE: $ERRLOG.FIL
 OUTPUT: KB:
     AT: 10:32:14 AM, 14-JUL-74
DECTAPE ERROR AT 09:27:13 AM, 14-JUL-74
REPEAT COUNT WAS 11  BY 09:27:14 AM, 14-JUL-74

TCST:     004034
TCCM:     100302
TCWC:     177400
TCBA:     020000
TCDT:     000000

 12 ERRORS LISTED OUT OF 44 LOGGED SINCE 09:12:04 AM, 14-JUL-74

OPTIONS? ^Z

READY

BYE/F

 ** JOB NAME TO START OR ATTACH ? ALL:120
 ** ILLEGAL FILE NAME
 ** JOB NAME TO START OR ATTACH ? /ALL:120

 ** CONTROL JOB ENTERING MONITOR MODE.

 ** STATUS OF CONTROL SUBJOB(S) AT 10:33 AM

 NAME          JOB NO.       STATE         CPU TIME
 CONTRL         1            RN               53.1
 ERRCPY         2            SL                0.0
 MTEXER         3            RN            10:50.6
 MTEXER         4            RN            12:36.7
 MTEXER         5            RN             7:17.4
 DPEXER         6            RN               13.6
 DPEXER         7            RN               12.6
 DKEXER         8            RN               11.0
 DKEXER         9            RN               11.5
 CPEXER         11           RN             5:22.0

 ** REATTACHING SUBJOB MTEXER

 MT*MT 2 ERROR AT LINE 340 :MAGTAPE SELECT ERROR (14-JUL-74,10:34 AM)

 MT*MAGTAPE STATUS SUMMARY :
 MT*LAST COMMAND WAS WRITE
 MT*      DENSITY PARITY  TRACKS
 MT*       3      ODD     9
 MT*      W-LOCK  EOT     BOT     EOF     RLE
 MT*      NO      NO      NO      NO      NO
 MT*      SELECTION ERROR OCCURED
```

For a complete listing of DECtape errors.

Note that time corresponds to time printed when error was reported by DTEXER.

Selection error.
Unit Ø.
Errors were caused by the 12 normal retries of DECtape operation when drive was offline - can be ignored.

Operator error.

This error was forced by switching drive offline.

Error status summary will be printed if MTEXER has a test file open at the time of the error.

```
MT*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.
? CONT
MT*SYSTEM CONFIGURED FOR 3 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 2
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 100
MT*ARE DRIVE(S) 2 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING



** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB DPEXER

DP*DPEXER ERROR STATISTICS FOR DP 0

DRIVE          PASS          FILE SIZE      ERROR COUNT

DP 0            1              400            0
DP 0            2              400            0
DP 0            3              400            0
DP 0            4              400            0
DP 0            5              400            0

DP*DP EXERCISER DONE
DP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F



** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:37 AM

NAME           JOB NO.        STATE          CPU TIME
CONTRL          1             RN                56.6
ERRCPY          2             SL                 0.0
MTEXER          3             RN             12:04.2
MTEXER          4             RN             13:27.2
MTEXER          5             RN              7:51.7
DPEXER          7             HB                13.1
DKEXER          8             RN                11.2
DKEXER          9             RN                12.0
CPEXER          11            HB              5:50.0
```

See discussion of disk errors in Section 4.1 of the manual.

```
** REATTACHING SUBJOB DPEXER

DP*DPEXER ERROR STATISTICS FOR DP 0

DRIVE          PASS          FILE SIZE      ERROR COUNT

DP 0            1              400            0
DP 0            2              400            0
DP 0            3              400            0
DP 0            4              400            0
DP 0            5              400            0

DP*DP EXERCISER DONE
DP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F
** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB CPEXER

CP*CPU/EIS/FIS/FPP EXERCISER DONE. TOTAL OF 0 ERRORS DETECTED
CP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F

** JOB NAME TO START OR ATTACH ? DFEXER
** LOGGING IN NEW JOB NAMED 'DFEXER'.


DF*SYSTEM IS EITHER NOT CONFIGURED FOR AN RF DISK      DFEXER is useful
DF*OR THE RF DISK IS CONFIGURED AS A SWAPPING DISK.    if RF is the
DF*DFEXER CANNOT BE USED UNDER THESE CIRCUMSTANCES.    system disk.
DF*TYPE 'BYE' TO REATTACH TO CONTROL.

READY

BYE/F

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB MTEXER

MT*MT EXERCISER DONE FOR DRIVE(S):1
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

** MTEXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #4 MTEXER
^^C
BYE/F$
READY
```

```
** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:51 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN                1:05.8
ERRCPY           2              SL                   0.0
MTEXER           3              RN               15:50.9
MTEXER           5              RN               12:16.2
DKEXER           8              RN                  12.6
DKEXER           9              RN                  13.6


** REATTACHING SUBJOB DKEXER

DK*DKEXER ERROR STATISTICS FOR DK 0

DRIVE           PASS            FILE SIZE       ERROR COUNT

DK 0             1               400             0
DK 0             2               400             0
DK 0             3               400             0
DK 0             4               400             0
DK 0             5               400             0

DK*DK EXERCISER DONE
DK*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

** DKEXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #8 DKEXER

^^C
BYE/F$
READY

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB DKEXER.

DK*DKEXER ERROR STATISTICS FOR DK 1

DRIVE           PASS            FILE SIZE       ERROR COUNT

DK 1             1               400             0
DK 1             2               400             0
DK 1             3               400             0
DK 1             4               400             0
DK 1             5               400             0

DK*DK EXERCISER DONE
DK*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F
```

```
** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 10:57 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN               1:07.7
ERRCPY           2              SL                  0.0
MTEXER           3              HB              16:35.2
MTEXER           5              MT              16:49.3


** REATTACHING SUBJOB MTEXER

MT*MT EXERCISER DONE FOR DRIVE(S):0
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB MTEXER

MT*MT EXERCISER DONE FOR DRIVE(S):2
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

** MTEXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #5 MTEXER
^^C
BYE/F$
READY


** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 11:00 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN               1:09.0
ERRCPY           2              SL                  0.0

** STATUS OF CONTROL SUBJOB(S) AT 11:01 AM

NAME            JOB NO.         STATE           CPU TIME
CONTRL           1              RN               1:09.4
ERRCPY           2              SL                  0.0
```

All exercisers have terminated.

```
^C

** JOB NAME TO START OR ATTACH ? ERRDIS
** LOGGING IN NEW JOB NAME 'ERRDIS'.

RUN ERRDIS
[ERRDIS V5B-11
INPUT FILE (<CR> FOR DEFAULT)?
OUTPUT TO? KB:
OPTIONS? ALL


HUNG TTY ERROR AT 09:12:04 AM, 14-JUL-74
REPEAT COUNT WAS 1  BY 09:12:58 AM, 14-JUL-74

KB#:      0
#CSR:     177564
CSR:      000000
READY BIT NOT SET

HUNG TTY ERROR AT 09:16:26 AM, 14-JUL-74
REPEAT COUNT WAS 1  BY 09:17:16 AM, 14-JUL-74

KB#:      0
#CSR:     177564
CSR:      000000
READY BIT NOT SET


DECTAPE ERROR AT 09:27:13 AM, 14-JUL-74
REPEAT COUNT WAS 11  BY 09:27:14 AM, 14-JUL-74

TCST:     004034
TCCM:     100302
TCWC:     177400
TCBA:     020000
TCDT:     000000

...
...
...

HUNG TTY ERROR AT 10:53:17 AM, 14-JUL-74
JOB#:     3
KB#:      10
#CSR:     176610
CSR:      004000
INT. ENB. BIT NOT SET

 46 ERRORS LISTED OUT OF 46 LOGGED SINCE 09:12:04 AM, 14-JUL-74

OPTIONS? /KILL

READY

BYE/F
```

Now is the time to list a full errlog report.

RSTS/E reenables hung TTY's so these errors are not serious. The terminal interface should be replaced if errors on any one keyboard are excessive. (e.g., KBØ on this machine is not in good shape.)

See comments on previous printout.

Additional printouts of HUNG TTY errors have been deleted. Most were KBØ hangs.

This deletes the current errlog file.

```
** JOB NAME TO START OR ATTACH ? SHUTUP
** LOGGING IN NEW JOB NAMED 'SHUTUP'.

AUTOMATIC SYSTEM SHUTDOWN PROGRAM

HOW MANY MINUTES UNTIL SYSTEM SHUTDOWN? 1
HOW MANY MINUTES BETWEEN WARNING MESSAGES? 1
1 MINUTE WARNING MESSAGE SENT
FURTHER LOGINS ARE NOW DISABLED
FINAL WARNING MESSAGE SENT
PASS 1 OF LOOKING FOR STILL ACTIVE JOBS
        JOB 1 FOUND STILL ACTIVE AND DETACHED
THE NEXT PASS WILL OCCUR IN 15 SECONDS
PASS 2 OF LOOKING FOR STILL ACTIVE JOBS
NON-SYSTEM DISKS WILL NOW BE DISMOUNTED
        DISK DK1 FOUND STILL MOUNTED
          DISK IS NOW DISMOUNTED
        DISK DP0 FOUND STILL MOUNTED
          DISK IS NOW DISMOUNTED
ALL NON-SYSTEM DISKS ARE NOW DISMOUNTED

ALL SET TO PROCEED WITH SYSTEM SHUTDOWN

PLEASE WAIT FOR THE COMPUTER TO ACTUALLY 'HALT'
WHEN IT DOES, PRESSING 'CONT' WILL BOOT BACK RSTS/E
```

Disk structures may be destroyed if system is <u>not</u> taken down by running SHUTUP. See Section 6.2 of SMG. SHUTUP will terminate any jobs still active and may be used at any time to shut the system down for corrective maintenance.

3.3 NORMAL TEST SYSTEM RESTARTING PROCEDURES

If the user shuts down the RSTS/E test system for any reason, he may restart it by bootstrapping the system disk as described in Section 5.2.1 of the RSTS/E System Manager's Guide and by typing START in response to the OPTION query printed by the initialization code. During a normal start up of a RSTS/E system, the system initialization program INIT runs automatically and accesses the START.CTL file under the system library account [1,2]. The INIT system program and the START.CTL file are installed in the system library when the system is built (see Section 4.3, RSTS/E System Manager's Guide).

After the system is initialized, the user must log in under a privileged account and run the CONTRL program.

The following example shows the use of the START option and the printout of the INIT program as it runs and causes the CONTRL program to run. When the CONTRL program prints the query JOB NAME TO START OR ATTACH, the user can proceed to run the system reliability test according to the guidelines presented in Section 3.2.

```
RSTS V05B-24 TEST SYSTEM

OPTION: START


YOU CURRENTLY HAVE: JOB MAX = 32, SWAP MAX = 16K.

JOB MAX OR SWAP MAX CHANGES ?    <LF>


ANY MEMORY ALLOCATION CHANGES ?  <LF>

CRASH DUMP?    <LF>

DD-MMM-YY? 14-JUL-74
HH:MM? 12:30


SYSTEM INITIALIZATION PROGRAM

RUN $ERRCPY

READY

ERRCPY V05-06
DETACHING
LOGIN 1/2
PASSWORD: SYSTST

READY

RUN $CONTRL
```

```
** DEVICES CONFIGURED IN RSTS V05B-24 TEST SYSTEM

TYPE            COUNT           EXERCISER NAME

CPU              1              CPEXER
DP               2              DPEXER
DK               2              DKEXER
KB               32             KBEXER
DT               4              DTEXER
LP               1              LPEXER
PR               1              PREXER
PP               1              PPEXER
CR               1              CREXER
MT               4              MTEXER
PK               4              PKEXER
RJ               1              RJEXER

SYSTEM JOB MAX =                 32
CONTROL JOB MAX =                29

** JOB NAME TO START OR ATTACH ?
```

3.4 RESTARTING THE TEST SYSTEM AFTER A SYSTEM CRASH

If a system crash occurs on the test system during the reliability tests and the system halts, the user can restart the system by following the procedures described in Section 5.2.2.1 of the RSTS/E System Manager's Guide. When a system crash occurs, normally RSTS/E attempts to perform a crash dump and to enter automatic restart mode. Section 5.3 of the RSTS/E System Manager's Guide explains the automatic recovery and restart facilities of the RSTS/E system. If either of the two conditions described in Section 5.3.2 of that guide are not fulfilled, the system simply halts at address 54 without performing a crash dump and entering automatic restart mode.

The user can ensure that the system performs a crash dump and enters automatic restart mode when it crashes if he follows procedures exactly as described in this document. To be exact, he must do the following:

a. When creating the system files as shown in Section 2.1.6 of this document, he must type YES in response to the CRASH query to create the CRASH.SYS file.

b. When setting the default start up conditions as described in Section 2.1.7, he must type YES in response to the CRASH DUMP query to enable the crash dump facility.

c. When starting the test system as described in Section 3.3, he must type the LINE FEED key in response to the CRASH DUMP query to retain the enabling of the crash dump facility.

d. When starting the reliability test according to the guidelines described in Section 3.2, he must set the CPU Switch Register to 777777 (all switches in the up position) to enable the automatic restart facility.

If the test system halts in spite of the user having performed all of the above steps, the probability is that two system crashes have occurred within a minute of each other. In this case, the halt occurs by design as explained in Section 5.3.2 of the RSTS/E System Manager's Guide. In addition, if any of the hardware in the system is not operating correctly, the user can expect system crashes to occur during the reliability tests.

When the test system enters automatic restart after a system crash or the user requests a core dump and automatic restart after a system halt, the INIT system program runs as in the case of a normal start up described in Section 3.3. However, when INIT runs in automatic restart mode, it accesses the CRASH.CTL file instead of the START.CTL file. The CRASH.CTL file included in the system library kit contains commands which cause the system programs ERRCRS, ERRDIS, and ANALYS to run. These programs recover important information on the probable cause of the system crash.

The ERRCRS program is similar to the ERRCPY program, since it saves error logging information in a disk file. The ERRCPY program extracts error logging information from monitor tables in core during time sharing operations. The ERRCRS program extracts similar error logging information from the same monitor tables saved in the CRASH.SYS file by means of the crash dump facility at the time of the system crash. Hence, the ERRCRS program may recover error logging information concerning hardware malfunctions which occurred prior to the system crash. This error logging information may not have been recovered by the ERRCPY program and may reflect the cause of the system crash.

When the ERRDIS program runs, it prints the error logging information recorded by the ERRCRS program. Subsequently, the ANALYS program runs and prints a thorough analysis of the information written in the CRASH.SYS file by the crash dump facility. When all commands in the CRASH.CTL have been executed, the CONTRL program must be restarted with the RUN $CONTRL command. When the CONTRL program prints the query JOB NAME TO START OR ATTACH, the user can continue running the system reliability test according to the guidelines presented in Section 3.2.

The CRASH.CTL file is installed in the system library account [1,2] when the system library files are built.

3.5 GUIDELINES FOR USING CONTRL UNDER NORMAL TIME SHARING

The examples of this and the previous chapter were directed toward system testing at the DEC manufacturing facility. Tests performed at the customer site when the system is installed by Field Service personnel are equally important. Sections 2.3 and 3.1 of this manual include a few notes on the use of SYSTST for on-site testing. This section presents a few alternative procedures which may be useful for the installation tests.

Once the hardware has been uncrated and assembled, Field Service personnel should use the standard diagnostics to check each component. Neither the SYSTST exercisers nor the RSTS/E error logging routines can be as thorough as the diagnostics in checking correct operation of the hardware. Certain subtle hardware failures may have no affect on the operation of the current monitor but may prevent the use of another operating system or of a future release of RSTS/E. Installation testing, therefore, must include a thorough check of the processor and all peripherals before any attempt is made to bring up a RSTS/E system.

When the system generation is performed for on-site testing, the Record I/O software option must be configured into the system to use SYSTST. Other software options which affect the operation of individual exercisers have been mentioned in Section 2.3. The SYSGEN examples of Chapter 2, RSTS/E System Manager's Guide can serve as rough models even if specific configuration details are altered to installation requirements.

After generating a RSTS/E system for SYSTST, the user must build the system library. Procedures for this build are described in Chapter 4 of the RSTS/E System Manager's Guide. The standard system library and the Record I/O library must both be built. TSTBLD may be run under any account. The files it loads and compiles do not affect other system files. The reliability tests may be run under open time sharing.

CHAPTER 4
DEVICE EXERCISER ABSTRACTS

The SYSTST user should be familiar with the operation and limitations of each of the device exercisers before attempting to run the reliability test. This chapter contains descriptions of each of the exercisers included in the package.

4.1 DISK EXERCISERS

Three disk exercisers are included in the SYSTST package. DFEXER is used to test the RF11 controller with up to 8 RS11 disk platters. DKEXER is used for testing the RK11 controller and up to 8 RKØ3 or RKØ5 DECpack cartridge drives. DPEXER tests the RP11-C controller and up to 8 RPØ3 disk pack drives. The RK and RP exercisers are capable of sequentially testing all drives or any subset of drives connected to the controller. It is also possible to run several copies of the same exerciser in order to test several drives simultaneously or to put a heavier load on any single drive.

The disk exercisers begin by asking several questions to determine which drive(s) to test and the duration of the test. DKEXER and DPEXER will ask the operator to enter the number of drives (1-8) to be tested and the unit numbers (0-7) of those drives. All three exercisers ask the operator to enter the number of iterations (1-99) to be performed.

A disk exerciser performs pattern tests on a disk file using Record I/O GET and PUT operations. Patterns used include all zeroes, all ones, and two complementary one/zero patterns. The file size is computed by the exerciser based on available disk space on the drive to be tested. To limit exerciser run time, the file size is limited to a maximum of 400 disk blocks of 256 words each. The maximum size is the norm since SYSTST is usually run using new disks with a large amount of free space.

After completion of the dialogue and preliminary calculations, the disk exerciser proceeds to open and extend the file to the predetermined size. A pattern buffer is then loaded with the first of the four patterns and all file blocks are written from this buffer. Each block is then read and compared against the known correct pattern data. This procedure is repeated for the other three patterns. If any errors are detected, an error count is incremented for each incorrect word. The error count is cumulative over the four patterns. The file is deleted after the pattern tests and the exerciser starts again if more than one iteration was requested. Under normal conditions, a different area

of the disk is used on each successive iteration.

Upon completion of all iterations for a drive, a status report is printed and the exerciser proceeds to test the next drive, if any. The operator is given the option to rerun the exerciser or to log it off the system at the conclusion of the test for all drives.

The disk exercisers use very little processor time but do cause considerable activity on the disk device under test and on the UNIBUS. Some 400 write and 400 read operations are performed for each pattern for a total of 3200 disk transfers per iteration. Additional transfers are also required for window turns and for open, close, extend, and delete operations. Disk and bus activity can be further increased by running several disk exercisers. In particular, on a moving head device, arm motion is considerably increased if two or more exercisers are used to simultaneously test the same drive.

All DEC supplied disk devices have built in error checking circuitry which should signal bad data. RSTS systems will perform up to five retries when the hardware detects a soft data error. Hard disk errors or soft errors which persist over five retries cause the disk exercisers to abort with the message "USER DATA ERROR ON DEVICE". This condition is usually indicative of a bad disk block or a hardware malfunction. If the disk exercisers report a non-zero error count, this indicates hardware problems which were not detected by the error checking circuitry. Errors of this type may indicate disk or controller malfunction, bus noise problems, or memory errors.

The disk exercisers do not attempt to test all controller or drive functions and they do not access all sectors on a platter, cartridge, or disk pack. SYSTST is intended to test system integrity and not to exhaustively test or diagnose any type of device. However, disks which are to be accessed under RSTS/E must be initialized to the RSTS file structure using the DSKINT option at system start up time. DSKINT will perform pattern tests on any disk device supported under RSTS/E and can, therefore, be used to test basic read/write access to all sectors. Used in combination with stand-alone diagnostics, DSKINT and the SYSTST disk exercisers can insure a high level of confidence in the disk devices configured in a RSTS/E system.

4.1.1 DFEXER - RF11/RS11 Disk Exerciser

The RF11/RS11 exerciser is somewhat restricted in its application since it can only be used if the RF11 is configured as the system disk. User file data cannot reside on the RF11 if it is configured as a swapping disk. In either case, the RF11 will be exercised by normal swapping activity if the total size of all running jobs exceeds the available memory space. DFEXER is further restricted in that there is no explicit way to test one particular RS11 platter. RSTS treats a multi-platter RF11 as one large disk and hence the BASIC-PLUS program cannot easily control the physical location of disk blocks which comprise the test file. DFEXER will test the normal operation of the RF11 configured as a system disk and does serve to increase bus activity. It should, therefore, be used whenever possible despite restrictions mentioned.

DFEXER Example:

```
** JOB NAME TO START OR ATTACH ? DFEXER
** LOGGING IN NEW JOB NAMED 'DFEXER'.


DF*STARTING RF11/RS11 DISK EXERCISER
DF*ONE ITERATION ON THE RF DISK TAKES ABOUT 4 MINUTES.
DF*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 5
DF*DF EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR    MODE.

** REATTACHING SUBJOB DFEXER


DF*DFEXER ERROR STATISTIC FOR THE RF11

DRIVE           PASS         FILE SIZE     ERROR COUNT

DF               1             400            0
DF               2             400            0
DF               3             400            0
DF               4             400            0
DF               5             400            0

DF*DF EXERCISER DONE
DF*TO REATTTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F
```

THIS PAGE PURPOSELY LEFT BLANK.

4.1.2 DKEXER - RK11/RKØ3/RKØ5 Disk Exerciser

DKEXER will test all or any subset of RKØ3 or RKØ5 drives connected to the RK11 controller. All drives which are to be tested must be fitted with a DECpack cartridge which has been initialized to the RSTS file structure by the DSKINT initialization option. Disk initialization is described in Sections 3.3 and 3.3.2 of the RSTS/E System Manager's Guide and guidelines for initialization of disks for SYSTST have been presented in Sections 2.1.3 and 2.1.4 of this manual. Assuming these procedures have been followed, DKEXER can be run as described below.

DKEXER Example:

```
** JOB NAME TO START OR ATTACH ? DKEXER
** LOGGING IN NEW JOB NAMED 'DKEXER'.


DK*SYSTEM CONFIGURED FOR 2 DRIVES.
DK*HOW MANY DRIVES DO YOU WANT TO TEST ? 2
DK*WHICH DRIVE(S) ? 0,1
DK*ONE ITERATION ON A SINGLE RK DRIVE TAKES ABOUT 4 MINUTES.
DK*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 2
DK*DK EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /ALL:120

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 04:39 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           4              RN                 29.9
DKEXER           10             RN                  6.1
 some time and several status printouts later



** REATTACHING SUBJOB DKEXER


DK*DKEXER ERROR STATISTICS FOR DK 0

DRIVE           PASS            FILE SIZE       ERROR COUNT

DK 0             1               400             0
DK 0             2               400             0

DK*DK EXERCISER CONTINUING ON DRIVE 1
DK*DK EXERCISER DETACHING
```

```
** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB DKEXER


DK*DKEXER ERROR STATISTICS FOR DK 1

DRIVE          PASS          FILE SIZE      ERROR COUNT

DK 1            1              400            0
DK 1            2              400            0


DK*DK EXERCISER DONE
DK*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

4.1.3 DPEXER - RP11-C/RPØ3 Disk Exerciser

The RP11-C/RPØ3 exerciser is almost identical to DKEXER. It will test all or any subset of RPØ3 drives connected to the RP11-C controller. As was the case for RK drives, all RPØ3 drives must be fitted with an RPØ3 disk pack which has been initialized using DSKINT at system start up time. Sections 2.1.3 and 2.1.4 of this manual include guidelines for initialization of RPØ3 packs. In the previous example, a single copy of DKEXER was used to test two RK drives. The example below demonstrates use of two copies of DPEXER simultaneously exercising a single RPØ3 drive.

DPEXER Example:

```
** JOB NAME TO START OR ATTACH ? DPEXER                    First Copy
** LOGGING IN NEW JOB NAMED 'DPEXER'.


DP*SYSTEM CONFIGURED FOR 1 DRIVES.
DP*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DP*WHICH DRIVE(S) ? 0
DP*ONE ITERATION ON A SINGLE RP DRIVE TAKES ABOUT 4 MINUTES.
DP*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 4
DP*DP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? DPEXER                    Second Copy
** LOGGING IN NEW JOB NAMED 'DPEXER'.


DP*SYSTEM CONFIGURED FOR 1 DRIVES.
DP*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
DP*WHICH DRIVE(S) ? 0
DP*ONE ITERATION ON A SINGLE RP DRIVE TAKES ABOUT 4 MINUTES.
DP*HOW MANY ITERATIONS DO YOU WANT TO RUN (1-99) ? 4
DP*DP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /ALL:60

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 04:26 PM

NAME          JOB NO.       STATE          CPU-TIME
CONTRL          3           RN                19.5
DPEXER          8           RN                 7.3
DPEXER          9           DF                 7.4
```

```
<some time and several status printouts later>

** STATUS OF CONTROL SUBJOB(S) AT 05:05 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           3              RN                  42.2
DPEXER           8              RN                  13.1
DPEXER           9              RN                  13.3

** REATTACHING SUBJOB DPEXER


DP*DPEXER ERROR STATISTICS FOR DP 0

DRIVE           PASS            FILE SIZE       ERROR COUNT

DP 0             1               400             0
DP 0             2               400             0
DP 0             3               400             0
DP 0             4               400             0


DP*DP EXERCISER DONE
DP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB DPEXER


DP*DPEXER ERROR STATISTICS FOR DP 0

DRIVE           PASS            FILE SIZE       ERROR COUNT

DP 0             1               400             0
DP 0             2               400             0
DP 0             3               400             0
DP 0             4               400             0


DP*DP EXERCISER DONE
DP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

4.2 DTEXER - DECTAPE EXERCISER

DTEXER will test the TC11 DECtape control and up to 8 DECtape drives. If a single copy of DTEXER is used to test several drives, the individual drives are exercised one at a time. Multiple copies may be used to test several drives simultaneously.

The DECtape exerciser begins with a dialogue similar to the disk exercisers to determine which drives are to be tested. The operator is directed to enter the number (1-8) of drives to be tested and the unit numbers (0-7) of those drives. Before detaching to run the test, DTEXER will zero the tapes on all specified drives. In the detached state, DTEXER proceeds to open a file on the unit being tested and fills the file with floating point numbers. Out of a possible 578 tape blocks, 286 blocks are written if a 4-word math package is being used. 144 blocks are written if the system is configured with two word math. After the file is written, it is closed and reopened for input. Numbers written on the tape are read and checked keeping a count of incorrect values. If at the end of the test the error count is not zero, DTEXER will print the count before proceeding to test the next drive.

DTEXER Example:

```
** JOB NAME TO START OR ATTACH ? DTEXER
** LOGGING IN NEW JOB NAMED 'DTEXER'.


DT*SYSTEM CONFIGURED FOR 2 DRIVES.
DT*HOW MANY DRIVES DO YOU WANT TO TEST ? 2
DT*WHICH DRIVE(S) ? 0,1
DT*ARE DRIVE(S) 0,1 MOUNTED AND W/E? YES
DT*DT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 04:40 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           8              RN                29.9
DTEXER           12             RN                13.4

** REATTACHING SUBJOB DTEXER
```

```
DT*DT EXERCISER DONE FOR DRIVE(S):0,1
DT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

4.3 MTEXER - MAGTAPE EXERCISER

The magtape exerciser is used to check normal operation of the TM11 magtape control and up to 8 TU10 7-track or 9-track drives. MTEXER allows the operator to select the drive(s) to be tested, the length of tape to be written, and the number of repetitions to be performed. On each iteration, the tape is zeroed, a file is opened, and data is written until the specified length of tape has been used. The tape is then rewound, the file is opened for input, and the data is read and verified. If errors are detected, a count of the number of bytes found to be incorrect is printed before proceeding to the next iteration.

The data pattern used is a worst case NRZ pattern for 9-track drives. This pattern is not worst case for 7-track recording. The pattern is loaded into a 512 byte buffer and n PUT's are used to write the tape. The variable n is equal to the repetition number so that n identical records are written on repetition n. The pattern buffer is then changed and the process continues until the required length of tape has been written. Since the number of PUT's increases, tape speed increases on each successive iteration. Furthermore, the pattern base varies with n so that the contents of the pattern buffer also varies on successive iterations.

Problems with TM11/TU10 magtape drives are most likely to occur when running several drives simultaneously. It is therefore advantageous, if not imperative, that one copy of MTEXER be run for each drive on the RSTS/E system. To check for correct mechanical operation and to ensure no interaction between drives, MTEXER should be run for only a few feet of tape (i.e., 5-10 feet) but with many iterations (e.g., 30-40). This will force rewinds of some drives while read/write operations are performed on other drives. Conversely, to ensure data integrity, a large amount of tape should be written (e.g., 100-400 feet) with few iterations. (e.g., 1-5).

MTEXER Example:

```
** JOB NAME TO START OR ATTACH ? MTEXER
** LOGGING IN NEW JOB NAMED 'MTEXER'.
```

```
MT*SYSTEM CONFIGURED FOR 8 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 0
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 10
MT*ARE DRIVE(S) 0 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? MTEXER                    Second copy
** LOGGING IN NEW JOB NAMED 'MTEXER'.


MT*SYSTEM CONFIGURED FOR 8 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 1
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 10
MT*ARE DRIVE(S) 1 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? MTEXER                    Third copy
** LOGGING IN NEW JOB NAMED 'MTEXER'.


MT*SYSTEM CONFIGURED FOR 8 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 2
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 10
MT*ARE DRIVE(S) 2 MOUNTED AND W/E? YES
MT*ERROR AT LINE 165 :MAGTAPE SELECT ERROR (10-JUL-73,03:45 PM)
                                                          Drive was offline
MT*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.
? CONT
MT*SYSTEM CONFIGURED FOR 8 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 2
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 10
MT*ARE DRIVE(S) 2 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /MTEXER

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:47 PM

NAME          JOB NO.       STATE         CPU-TIME
MTEXER         12           RN              1:02.1
MTEXER         13           RN                45.4
MTEXER         15           RN                 5.7
```

```
** REATTACHING SUBJOB MTEXER

MT*MT 0 ERROR AT LINE 440 :MAGTAPE SELECT ERROR (10-JUL-73,03:47 PM)
MT*MAGTAPE STATUS SUMMARY :
MT*LAST COMMAND WAS READ
MT*      DENSITY PARITY  TRACKS
MT*       3      ODD     9
MT*      W-LOCK  EOT     BOT     EOF     RLE
MT*      NO      NO      NO      NO      NO
MT*      SELECTION ERROR OCCURED

MT*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.
? CONT
MT*SYSTEM CONFIGURED FOR 8 DRIVE(S).
MT*HOW MANY DRIVES DO YOU WANT TO TEST ? 1
MT*WHICH DRIVE(S) ? 0
MT*HOW MANY FEET OF TAPE DO YOU WANT TO WRITE ? 10
MT*HOW MANY REPETITIONS PER DRIVE ? 10
MT*ARE DRIVE(S) 0 MOUNTED AND W/E? YES
MT*MT EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /MTEXER

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:48 PM

NAME          JOB NO.       STATE         CPU-TIME
MTEXER         12           RN              1:07.2
MTEXER         13           RN                56.6
MTEXER         15           RN                22.2

** REATTACHING SUBJOB MTEXER


MT*MT EXERCISER DONE FOR DRIVE(S):1
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

** MTEXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #13 MTEXER
^^C
BYE/F$
READY



** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:59 PM

NAME          JOB NO.       STATE         CPU-TIME
CONTRL         4            RN                25.1
MTEXER         12           RN              2:42.8
MTEXER         15           HB SW           1:39.3
```

Drive was switched offline to force an error. Full Status printout only occurs if the test file was open at the time of the error.

```
** REATTACHING SUBJOB MTEXER


MT*MT EXERCISER DONE FOR DRIVE(S):2
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:59 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           4              RN                 25.9
MTEXER           12             HB               2:45.5

** REATTACHING SUBJOB MTEXER


MT*MT EXERCISER DONE FOR DRIVE(S):0
MT*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

4.4 CREXER - CARD READER EXERCISER

The card reader exerciser tests the CR11 and CD11 punched card readers. CREXER is intended for use with MAINDEC-89-D1B1-C entitled "ALPHA CARD DECK" which is supplied with the reader diagnostics. This deck consists of 80 cards punched with a rotating character set. As the deck is read and verified, if the data read does not agree with the MAINDEC, the actual and expected contents of each card is recorded in a disk file for later printing. Thus, if the MAINDEC is not available, any card deck (punched with DEC029 or an equivalent punch) can be read and printed for manual verification or a MAINDEC can be punched from the listing of expected card contents.

Standard card codes for RSTS/E are listed in Appendix D of the BASIC-PLUS Language Manual, DEC-11-ORBPA-C-D. The pattern used in the MAINDEC shifts 80 characters through all 80 column positions. Since the pattern repeats every 80 cards, several copies of the MAINDEC can be stacked for a more thorough test of reader operation. CREXER continues reading until a hopper empty or end of file condition is detected. End of file is generated with either an end of file card (12-11-0-1 punch in column 1) or with the end of file switch (1200 cpm CD11 only).

CREXER Example:

```
** JOB NAME TO START OR ATTACH ? CREXER
** LOGGING IN NEW JOB NAMED 'CREXER'.


CR*STARTING CARD READER EXERCISER.

CR*LOAD MAINDEC-89-D1B1-C LABELLED 'ALPHA CARD DECK' INTO THE
CR*READER. THE DECK WILL BE READ AND VERIFIED. IF ANY ERRORS ARE
CR*DETECTED, THE EXPECTED AND ACTUAL CONTENTS OF THE BAD CARD
CR*WILL BE RECORDED IN A DISK FILE FOR LATER PRINTING ON EITHER
CR*THE CONSOLE TERMINAL OR THE LINE PRINTER. CARDS WILL BE READ
CR*UNTIL END OF FILE OR HOPPER EMPTY IS DETECTED. SEVERAL COPIES
CR*OF THE MAINDEC MAY BE STACKED FOR A MORE THOROUGH TEST.

CR*CARD READER READY ? YES
CR*CARD READER EXERCISER DETACHING.

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB CREXER
```

```
CR*OUT OF 640 CARDS READ, ERRORS WERE DETECTED ON 1 CARDS.

CR*TYPE 'LP:' TO LIST ERRORS ON THE LINE PRINTER OR TYPE 'TT:'
CR*TO LIST ERRORS ON THIS KEYBOARD.

CR*YOUR LISTING DEVICE ? KB:
```

Error was forced with one bad card.

```
CARD 5 EXPECTED : DEFGHIJK.<<4!$JKLMNOPQR)$*);^0/STUVWXYZ\,%.>? 1234567890:#@'="/
BCDEFGHIJK.<<4!&ABC

CARD 5 ACTUAL   : DEF&HIJK.<<4!$JKLMNOPQR)$*);^0/STUVWQYZ\,%.>? 1234567890:#@'="/
BCDEFGHIJK.<<4!&ABC
```

Note that the letter G(12-7 punch) was changed to & (12 punch) and the letter X(Ø-7 punch) was changed to Ø(Ø punch). This indicates occasional dropouts on row 7 of the card. This type of problem might be caused by dust on the head or marginal operation of the photo sensor or amplifier for row 7.

```
CR*CARD READER EXERCISER DONE.
CR*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F

** JOB NAME TO START OR ATTACH ?
```

4.5 LPEXER - LINE PRINTER EXERCISER

The line printer exerciser simply prints a rotating ASCII pattern on LP11 or LS11 printers. Up to 8 printers can be sequentially tested with one copy of LPEXER or several copies can be run simultaneously, each exercising a different printer.

LPEXER Example:

```
** JOB NAME TO START OR ATTACH ? LPEXER
** LOGGING IN NEW JOB NAMED 'LPEXER'.


LP*SYSTEM CONFIGURED FOR 2 PRINTER(S).
LP*HOW MANY PRINTERS DO YOU WANT TO TEST ? 1
LP*TYPE UNIT #'S OF PRINTER(S) TO BE TESTED ? 0
LP*ARE PRINTER(S) 0 ONLINE AND READY? YES
LP*HOW MANY PAGES OF OUTPUT DO YOU WANT? 2
LP*LP EXERCISER DETACHING.

** JOB NAME TO START OR ATTACH ?
** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 04:10 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           3              RN                 16.1
LPEXER           9              RN                 20.1


** STATUS OF CONTROL SUBJOB(S) AT 04:11 PM

NAME            JOB NO.         STATE           CPU-TIME
CONTRL           3              RN                 16.5
LPEXER           9              RN SW              34.8

** REATTACHING SUBJOB LPEXER


LP*LINE PRINTER EXERCISER DONE
LP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F

** JOB NAME TO START OR ATTACH ?
```

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4.6 PPEXER - PAPER TAPE PUNCH EXERCISER

The paper tape punch exerciser punches a tape which is used to test the paper tape reader. The tape consists of 32 repetitions of a binary count pattern. Each pattern includes all possible punches alternating with the complement punch, i.e., (in octal) 1, $\overline{1}$(=376), 2,$\overline{2}$(=375),...,376,$\overline{376}$(=1), 377,$\overline{377}$(=0), 0,$\overline{0}$(=377). This tape is identical to MAINDEC-ØØ-D2G4-PT labelled "SPECIAL BINARY COUNT PATTERN TAPE" supplied with the paper tape reader diagnostics.

PPEXER Example:

```
** JOB NAME TO START OR ATTACH ? PPEXER
** LOGGING IN NEW JOB NAMED 'PPEXER'.



PP*STARTING PP EXERCISER, PP READY ? YES
PP*THIS TEST WILL PUNCH A BINARY COUNT PATTERN TAPE.
PP*THE TAPE IS EQUIVALENT TO MAINDEC-00-D2G4-PT ENTITLED
PP*SPECIAL BINARY COUNT PATTERN TAPE. EITHER THE TAPE
PP*PUNCHED BY THIS EXERCISER OR THE SUPPLIED MAINDEC
PP*TAPE MAY BE USED TO TEST THE PAPER TAPE READER.

PP*I WILL PUNCH A LEADER AND THEN SLEEP 30 SECONDS
PP*WHILE YOU STRAIGHTEN OUT THE TAPE IN THE HOPPER.
PP*PP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:55 PM

NAME          JOB NO.       STATE         CPU-TIME
CONTRL         3            RN                12.5
PPEXER         9            RN                 3.5

** REATTACHING SUBJOB PPEXER


PP*PP EXERCISER DONE
PP*NOW USE THE GENERATED PAPER TAPE TO TEST THE READER
PP*TO REATTACH TO CONTROL TYPE 'BYE' TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

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4.7 PREXER - PAPER TAPE READER EXERCISER

The tape generated by PPEXER or MAINDEC-ØØ-D2G4-PT "SPECIAL BINARY COUNT PATTERN TAPE" may be used with PREXER to test a paper tape reader. PREXER reads and checks 30 repetitions of the binary count pattern described in the previous section and then skips any remaining tape in the reader. When end of file is encountered, PREXER reports any errors detected. If a large number of errors are reported, the operator should check the read station for dust and insure that the tape was correctly loaded into the reader. PREXER will report 15360 errors if the tape is loaded backwards. In the case of excessive errors, it may also be necessary to manually examine a tape punched by PPEXER to insure that the punch is functioning properly.

PREXER Example:

```
** JOB NAME TO START OR ATTACH ? PREXER
** LOGGING IN NEW JOB NAMED 'PREXER'.


PR*STARTING PR EXERCISER.
PR*LOAD MAINDEC-00-D2G4-PT OR THE BINARY COUNT PATTERN
PR*TAPE GENERATED BY THE PUNCH EXERCISER INTO THE READER
PR*WITH THE LEADER UNDER THE READ STATION. READER READY ? YES
PR*PR EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /

** CONTROL JOB ENTERING MONITOR MODE.
** REATTACHING SUBJOB PREXER


PR*ERROR AT LINE 120 :DEVICE HUNG OR WRITE LOCKED (06-JUL-73,04:02 PM)

PR*TO CONTINUE TYPE 'CONT', TO ABORT TYPE '^C'.? CONT      Reader was not ready.

PR*STARTING PR EXERCISER.
PR*LOAD MAINDEC-00-D2G4-PT OR THE BINARY COUNT PATTERN
PR*TAPE GENERATED BY THE PUNCH EXERCISER INTO THE READER
PR*WITH THE LEADER UNDER THE READ STATION. READER READY ? YES
PR*PR EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.
```

```
** STATUS OF CONTROL SUBJOB(S) AT 04:04 PM

NAME          JOB NO.       STATE          CPU-TIME
CONTRL          3           RN                13.7
PREXER          9           PR                 6.0


<some time and several status printouts later>


** REATTACHING SUBJOB PREXER


PR*PR EXERCISER DONE, ERROR COUNT= 0
PR*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

BYE/F


** JOB NAME TO START OR ATTACH ?
```

4.8 KBEXER - KEYBOARD EXERCISER

The SYSTST keyboard exerciser is used to test local and remote terminals connected to the RSTS/E system. Since terminals may not be connected at the DEC manufacturing facility, KBEXER will be used primarily at the customer site for field installation testing. KBEXER will test only one terminal at a time but may be transferred from one terminal to another. Several copies of KBEXER can be run if simultaneous testing of several terminals is desired.

RSTS/E supports a variety of terminals including the LA3Ø and LA3ØS DECwriters, VTØ5 and VTØ5B alphanumeric display terminals and Teletypes. Terminals may be connected to the UNIBUS via KL11 (A-E), DL11 (A-E), LC11 or DC11 single line interfaces, or the DH11 multiplexer. The DC11 and DH11 allow terminal characteristics to be varied under program control. RSTS/E will default variable parameters on these lines to ASR-33 characteristics, i.e., 110 baud, 1 start bit, 8 data bits, 2 stop bits, and no parity. The BASIC-PLUS program TTYSET, included in the standard library, can be used to change terminal characteristics if necessary for test purposes. Refer to Section 6.7 of the RSTS/E System Manager's Guide for instructions on the use of TTYSET and procedures for setting up the TTYSET.SPD file.

KBEXER implements four terminal tests. The SPACE test verifies that the terminal carriage (if a carriage exists) will return reliably from any position on the line. An ASCII pattern test verifies that the terminal will print the standard ASCII character set in all print positions. The WORST case pattern test forces the print head on ASR-33 Teletypes to rotate a half revolution at every print position. Finally the REPEAT test repeats everything typed on the terminal to verify two way communications. Commands are entered from the terminal being tested. One of the four tests is initiated by typing the test name and is terminated by typing CTRL/C (^C). Instructions for use of this exerciser are printed if the RETURN key (<CR>) or HELP is typed at command level.

Two additional commands are provided to transfer KBEXER to another terminal. The command /KBnn will transfer to keyboard number nn. All subsequent commands would be entered from that terminal. In testing remote terminals the telephone connection must be established prior to transferring to the remote keyboard. The remote terminal should not be logged in to the system since it would then appear busy when the transfer is attempted. The /CONTROL command transfers KBEXER back to the SYSTST control program.

KBEXER runs attached to the keyboard which initiated it until a transfer command is entered. Thereafter, the job is detached and communicates with terminals through an open file. In this detached state the exerciser cannot be terminated by typing CTRL/C (^C). When the job is reattached by the SYSTST control program (or by anybody else), it can be terminated with CTRL/C (^C) and can be logged off the system by typing BYE.

KBEXER Example:

```
** JOB NAME TO START OR ATTACH ? KBEXER
** LOGGING IN NEW JOB NAMED 'KBEXER'.


KB0   * KEYBOARD EXERCISER

KB0   * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0   * ENTER TEST NAME OR TRANSFER COMMAND: HELP

KB0   * THE KEYBOARD EXERCISER CAN BE USED TO TEST ANY LOCAL OR REMOTE
KB0   * TERMINAL CONNECTED TO THE RSTS/E SYSTEM.  ANY OF THE FOUR TESTS
KB0   * PROVIDED MAY BE INVOKED BY TYPING THE TEST NAME ON THE TERMINAL
KB0   * TO BE TESTED.  THE EXERCISER MAY BE TRANSFERRED FROM ONE TERMINAL
KB0   * TO ANOTHER BY USE OF THE TRANSFER COMMAND DESCRIBED BELOW:

KB0   * SPACE              SPACE AND CARRIAGE RETURN TEST
KB0   * ASCII              ROTATING ASCII CHARACTERS TEST
KB0   * WORST              WORST CASE (ASR33) PATTERN TEST
KB0   * REPEAT             REPEATS WHATEVER IS TYPED ON TERMINAL
KB0   * /KB21              TRANSFER EXERCISER TO KEYBOARD 21
KB0   * /CONTRL            TRANSFER EXERCISER BACK TO CONTROL JOB

KB0   * TO STOP ANY TEST FOR COMMAND ENTRY, TYPE CONTROL/C.
KB0   * BEFORE ATTEMPTING TO TRANSFER TO A REMOTE TERMINAL,
KB0   * THE TELEPHONE CONNECTION SHOULD BE ESTABLISHED.


KB0   * ENTER TEST NAME OR TRANSFER COMMAND: ASCII

KB0   * ROTATING ASCII CHARACTERS TEST

  !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$%
/ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#$
. / !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"#
-. / !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !"
,-. / !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_ !
+,-. / !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJ^C
```

```
KB0   * ENTER TEST NAME OR TRANSFER COMMAND: SPACE

KB0   * SPACING TEST

\
 \
  \
   \
    \
     \
      \
       \
        ^C

KB0   * ENTER TEST NAME OR TRANSFER COMMAND: WORST



KB0   * ROTATING WORST CASE (ASR33) PATTERN TEST

'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/
/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/'_W/^C

KB0   * ENTER TEST NAME OR TRANSFER COMMAND: REPEAT

KB0   * REPEAT TEST
? ABCDEFGHIJKLMNOPQRSTUVWXYZ
? ABCDEFGHIJKLMNOPQRSTUVWXYZ

? 1234567890
? 1234567890

? !"#$%&'()=
? !"#$%&'()=

? ^C

KB0   * ENTER TEST NAME OR TRANSFER COMMAND: /KB5
KB0   * KEYBOARD EXERCISER TRANSFERRING FROM KB0   TO KB5
KB0   * PLEASE ENTER SUBSEQUENT COMMANDS FROM KB5
KB0   * KEYBOARD EXERCISER DETACHING.
```

```
** JOB NAME TO START OR ATTACH ? /ALL

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:27 PM

NAME          JOB NO.       STATE         CPU-TIME
CONTRL         3            RN                10.3
KBEXER         12           KB                 6.8
```

At this point KBEXER is detached and is ready to test KB5. The same tests and commands are available at that keyboard except that the exerciser cannot be terminated by typing CTRL/C (^C). At the conclusion of tests on KB5, the exerciser can be transferred to another terminal or back to the control program as shown below.

```
KB5  * KEYBOARD EXERCISER
KB5  * ENTER TEST NAME OR TRANSFER COMMAND:  /CONTRL
KB5  * KEYBOARD EXERCISER TRANSFERRING TO CONTROL KEYBOARD
```

On the control keyboard KBEXER is reattached and waits for a command. In this case, the job is logged out.

```
** REATTACHING SUBJOB KBEXER


KB0  * KEYBOARD EXERCISER

KB0  * SYSTEM IS CONFIGURED FOR 32 TERMINALS (KB0 - KB31 )

KB0  * ENTER TEST NAME OR TRANSFER COMMAND: ^C

READY

BYE/F

** JOB NAME TO START OR ATTACH ?
```

4.9 CPEXER - PROCESSOR EXERCISER

The SYSTST processor exerciser is intended to put a heavy load on the central processor unit (CPU). CPEXER runs compute bound for short bursts and then sleeps for five seconds so that average processor loading is not sufficient to appreciably affect the performance of the peripheral exercisers. CPEXER was specifically designed to test the PDP-11/40 FIS or PDP-11/45 FPP options but also serves to verify general CPU integrity and correct PDP-11/40 EIS operation.

The FIS and FPP hardware options are fully utilized when the extended functions (sine, cosine, etc.) are configured in the system. Hence CPEXER asks the operator if the system is configured for extended functions. If the system does include functions, then all the tests described below are performed. If functions are not included, only those tests identified with an asterisk below are performed. There is no way for a BASIC-PLUS program to trap the error which occurs if an extended function is used but the RSTS/E system was not configured for this feature at SYSGEN time. If there is doubt that the functions were included, the operator should indicate that the system does include functions. CPEXER will then try one simple calculation, X=SIN (0.5), and will abort with the message "MISSING SPECIAL FEATURE" if the functions were actually not configured. CPEXER can then be rerun by simply typing "RUNNH".

The tests performed by CPEXER are described briefly below. In most of the tests, results are compared to known correct values. Two "grind" tests are also included to verify consistent results of duplicate calculations. Finally a few miscellaneous tests are performed which have detected hardware failures on test systems in the past.

CPEXER Test Descriptions:

SIN(X)	X=(Y/180)*PI FOR Y=10 TO 350 STEP 10 (Degrees) Uses SIN(X) extended function. Results are compared to known correct values.
SIN(X)*	FOR X=10 TO 350 STEP 10 (Degrees) Uses a polynomial approximation to SINE function. Results are compared to known correct values.
LOG(X)	FOR X=10 TO 500 STEP 10 FOR X=0.1 TO 1.0 STEP 0.1 Uses LOG(X) extended function. Results are compared to known correct values.

```
EXP(X)      FOR X= -10 TO +10 STEP 1
            FOR X=-0.9 TO 0.9 STEP 0.1
            Uses EXP(X) extended function.
            Results are compared to known correct values.

SQR(X)      FOR X=100 TO 5000 STEP 100
            Uses SQR(X) extended function.
            Results are compared to known correct values.

SQR(X)*     FOR X=100 TO 5000 STEP 100
            Uses Newton-Raphson method for square root.
            Results are compared to known correct values.

LOG(EXP(X))FOR X=1.0 TO 5000.0 STEP 3.0
           Grind test for consistent results using statement:
           IF EXP(LOG(EXP(LOG(EXP(LOG(EXP(LOG(EXP(LOG(X))))))))))
           <> EXP(LOG(EXP(LOG(EXP(LOG(EXP(LOG(EXP(LOG(X))))))))))
           THEN  <error>

ATN(TAN(X))FOR X=-1.50 TO 1.50 STEP 0.01
           Grind test for consistent results using statement:
           IF ATN(TAN(ATN(TAN(ATN(TAN(ATN(TAN(ATN(TAN(X))))))))))
           <> ATN(TAN(ATN(TAN(ATN(TAN(ATN(TAN(ATN(TAN(X))))))))))
           THEN  <error>

MISC.*      A=1.0/0.0
            Verify floating point divide by zero trap

            A%=1%/0%
            Verify integer divide by zero trap

            A%=60000.
            Verify integer conversion error trap

            IF INT(40.6621*100.+0.5)/100==40.66
            THEN <correct> ELSE  <error>
            This calculation failed on an 11/40 system which was
            having EIS problems
```

*These tests do not require extended functions.

CPEXER Example:

```
** JOB NAME TO START OR ATTACH ? CPEXER
** LOGGING IN NEW JOB NAMED 'CPEXER'.



CP*STARTING CPU/EIS/FIS/FPP EXERCISER

CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? HELP

CP*DURING THE RSTS/E SYSTEM GENERATION, YOU WERE ASKED WHETHER
CP*OR NOT THIS SYSTEM REQUIRED THE EXTENDED MATHEMATICAL FUNCTIONS
CP*(SINE, COSINE, ETC.). IF YOU ANSWERED 'YES' TO 'FUNCTIONS?' AT
CP*SYSGEN TIME, THEN REPLY 'YES' TO THE QUERY BELOW. IF YOU
CP*ANSWERED 'NO' AT SYSGEN, THEN YOU ARE NOT CONFIGURED FOR THE
CP*EXTENDED FUNCTIONS AND YOU SHOULD ANSWER 'NO' BELOW. IF YOU ARE
CP*UNSURE, THEN ANSWER 'YES' AND I WILL TRY TO USE ONE OF THE
CP*EXTENDED FUNCTIONS. IF THE OPERATION FAILS, AN ERROR MESSAGE
CP*WILL BE PRINTED AND THIS EXERCISER WILL ABORT. SHOULD THAT
CP*OCCUR, SIMPLY TYPE 'RUNNH' TO RERUN CPEXER AND REPLY 'NO'
CP*WHEN AGAIN ASKED IF YOU ARE CONFIGURED FOR EXTENDED FUNCTIONS.
```

```
CP*ARE YOU CONFIGURED FOR EXTENDED FUNCTIONS ? YES

CP*EACH ITERATION TAKES ABOUT 2 MINUTES
CP*HOW MANY ITERATIONS DO YOU WANT TO RUN ? 5

CP*CP EXERCISER DETACHING

** JOB NAME TO START OR ATTACH ? /ALL:60

** CONTROL JOB ENTERING MONITOR MODE.

** STATUS OF CONTROL SUBJOB(S) AT 03:31 PM

NAME          JOB NO.       STATE         CPU-TIME
CONTRL         8            RN                16.2
CPEXER         12           SL                 8.9


<several status printouts later>


** REATTACHING SUBJOB CPEXER


CP*CPU/EIS/FIS/FPP EXERCISER DONE.  TOTAL OF 0 ERRORS DETECTED
CP*TO REATTACH TO CONTROL TYPE 'BYE', TO RERUN TYPE 'RUNNH'.

READY

** CPEXER WAIT EXHAUSTED.
** CONTROL TERMINATING JOB #12 CPEXER
^^C
BYE/F$
READY


** JOB NAME TO START OR ATTACH ?
```

APPENDIX A

SPECIAL SYSGEN OPTIONS

During development of the RSTS/E system, several hidden options were built into the SYSGEN program to assist DEC development personnel with system generations and performance analysis. The hidden options are invoked through non-standard answers to several SYSGEN questions. Support for these features is neither expressed nor implied by this document. The SYSGEN questions of interest are listed below together with a brief explanation of the non-standard answers required to invoke the special options.

A.1 CLOCK ('L' OR 'P')?

L or P	Normal response to use the standard Line Time Clock (KW11L) or the Programmable Clock (KW11P).
H (High Speed)	Permits operation of the programmable clock at a frequency other than line frequency as specified below.
L/STAT P/STAT H/STAT	The modifier /STAT is used to include special statistics gathering code into the RSTS/E monitor. Includes code and tables to record job and disk access statistics. The statistics code is intended for performance analysis at DEC and is not a supported feature of RSTS/E.

A.2 AC FREQ?

50 or 60 (Hz)	Normal response for either 50 or 60 Hz operation of the KW11L or KW11P clock.
50,100,...950,1000	If high speed clock operation was requested above, the answer to this question specifies the clock frequency desired. Entry must be a multiple of 50 Hz in the range 50 to 1000 Hz.

The RK11 and RP11C disk controllers will allow several drives to perform seek operations simultaneously. Since the controller is not busy while seeks are in progress, data transfers may be overlapped with the seek operations in progress on other drives. Disk subsystem throughput is substantially increased. Overlapped seek drivers are included in the standard RSTS/E V05B distribution kits and are available through hidden SYSGEN options. These drivers had not been thoroughly tested at the time of the V05B code freeze. This is the reason for the hidden option. The overlapped seek drivers will not be supported by DEC until further testing is performed. An Installation Note or Software Dispatch article will be used to announce full availability of these drivers and to publish any required patches or hardware notes. The hidden option is documented below for completeness.

A.3 RKØ3/RKØ5's?

0 to 8	Normal response is the number of RK03 or RK05 drives attached to the RK11 controller. Standard (non-overlapped) RK11 driver will be used.
O2 to O8	Preceding the number of RK drives with the letter "O" will force SYSGEN to substitute the RK11 overlapped seek driver in place of the non-overlapped driver.

A.4 RPØ3's?

0 to 8	Normal response is the number of RPØ3 drives attached to the RP11C controller. Standard RP11C driver (non-overlapped) will be used.
O2 to O8	Preceding the number of RPØ3 drives with the letter "O" will force SYSGEN to substitute the RP11C overlapped seek driver in place of the non-overlapped driver.

RSTS/E standardly supports the LP11 and LS11 (dot matrix) line printers. The printer device is also coded to handle the LV11 electrostatic printer/plotter in print mode only. The LV11 is not a supported device and has not been tested with the RSTS/E driver. A hidden option is used to set the line printer characteristics to those of an LV11.

A.5 LPn: TYPE?

LP or LS	Normal response for LP11 or LS11 printers.
LV	Response to set LV11 printer characteristics. LV11 can only be used in print mode. No plotting capability is provided.

A.6 BASIC-PLUS PATCH?

YES or NO	Normal response determines whether 64 words of patch space is included in the BASIC-PLUS Run Time System.
O(DT)	Causes patch space to be included in the BASIC-PLUS Run Time System and the Online Debugging Tool to be linked with the Run Time System code. BASIC-PLUS ODT is used to debug the Run Time System during normal time sharing operations. It is beyond the scope of this document to address actual use of any ODT.

APPENDIX B

ADDRESS AND VECTOR ASSIGNMENTS

The RSTS/E system assumes that all devices attached to the PDP-11 UNIBUS have been assigned addresses and vectors according to manufacturing standards. Several devices have so called "Floating Addresses." This means that the presence or absence of any floating address device will affect the assignment of addresses to other floating address devices. Similarly, several devices have "Floating Vectors." Interrupt vectors must be assigned in a specific sequence and the presence of one type of device will affect the correct assignment of interrupt vectors for other devices. There are also many standard options which have fixed addresses and vectors. This Appendix presents the algorithms for assignment of floating addresses and vectors, and lists the fixed assignments for devices supported under RSTS/E.[1]

B.1 FLOATING ADDRESSES

Currently the floating address devices include the DJ11 Multiplexor, DH11 Multiplexor, DQ11 Synchronous Line Interface, and the DU11 Synchronous Line Interface. The following ground rules apply to these devices and future floating address devices:

1. Only new devices will be assigned floating addresses. Devices now in production will keep their old addresses.
2. Future devices may float both their addresses and interrupt vectors.
3. The floating address space starts at 760010(8) and proceeds upward to 764000(8).
4. A gap in the address space (no slave SYNC) implies a device does not exist.

---

[1] The information in this Appendix is extracted from three memos:

John Hittell, "Specification for Assignment of Floating Addresses," revised from 10/31/72.

John Hittell, "Floating Vectors for the PDP-11," updated from 10/27/74

John Friedrich, "Addresses and Vectors," April 3, 1974

5. The first address of a new type device will always be on a 2↑N word boundary, where N is the integer value of (LOG_2M+.9999999), and M is the number of device registers.

Number of Registers In Device	Possible Boundaries
1	Any Word
2	XXXXXØ, XXXXX4
3,4	XXXXXØ
5,6,7,8	XXXXØØ, XXXX2Ø, XXXX4Ø, XXXX6Ø
9 thru 16	XXXXØØ, XXXX4Ø

6. A "gap" of at least one word will be left after each type of device, starting on the same boundary the device would start on. Note that the gap must be at least one word in length but may be longer than one word. Gap length is determined by the boundary on which the next device must begin.

7. Multiple devices of the same type must be addressed contiguously.

Address 76ØØ1Ø is reserved for the first DJ11. Since the DJ11 has four registers, additional DJ11's are assigned addresses modulo 1Ø (base 8) immediately following the first DJ11 (i.e. 76ØØ1Ø, 76ØØ2Ø, etc.). The modulo 1Ø (base 8) address following the last DJ11 is left empty and is known as the DJ11 gap. If there are no DJ11's, the gap is at 76ØØ1Ø. If there is one DJ11, the gap will be at 76ØØ2Ø. All gaps must be at least one word in length.

After all DJ11 addresses and the DJ11 gap are defined, the address for the first DH11 can be assigned. DH11's have eight registers which implies a modulo 2Ø (base 8) boundary. The address of the first DH11 is the first modulo 2Ø address following the DJ11 gap. If there are no DJ11's (DJ11 gap at 76ØØ1Ø), the first DH11 is assigned address 76ØØ2Ø. Similarly, if there is one DJ11, the DJ11 gap will begin at 76ØØ2Ø and the next available mod 2Ø boundary is 76ØØ4Ø. All additional DH11's are assigned addresses modulo 2Ø immediately after the first DH11. The DH11 gap begins on the 2Ø boundary following the last DH11.

After all DH11 addresses and the DH11 gap are defined, DQ11 addresses may be assigned. Since the DQ11 has four registers, a modulo 1Ø boundary is required. This will be the first mod 1Ø boundary following the DH11 gap. On a system with one DJ11 and one DH11, the DH11 gap would be at address 76ØØ6Ø and the first available DQ11 address would be 76ØØ7Ø. All additional DQ11's are assigned addresses

immediately following the first DQ11. The DQ11 gap address is the mod 1Ø boundary following the last DQ11. Again a gap of at least one word is required.

Finally DU11 addresses can be defined in a similar manner. The DU11 has four registers and requires a modulo 1Ø boundary, for example, assume a system has one DJ11, one DH11, no DQ11, and at least one DU11. As mentioned above, the DH11 gap would be at 76ØØ6Ø. Since there are no DQ11's, the DQ11 gap must be located at the first modulo 1Ø boundary following the DH11 gap. The DQ11 gap would, therefore, be at address 76ØØ7Ø. The first available DU11 address would be 76Ø1ØØ and additional DU11 units would be assigned mod 1Ø addresses immediately following the first DU11.

Addresses for any future floating address devices will be assigned in a similar manner following the DU11 gap.

FLOATING ADDRESS TABLE
DJ11, DM11, DQ11, DU11

DQ	DU	DJ 0 DM 0	0 1	0 2	0 3	0 4	1 0	1 1	1 2	1 3	1 4	2 0	2 1	2 2	2 3	2 4	3 0	3 1	3 2	3 3	3 4	4 0	4 1	4 2	4 3	4 4
0	0	----	-B--	-B--	-B--	-B--	A---	AD--	AD--	AD--	AD--	A---	AD--	AD--	AD--	AD--	A---	AF--	AF--	AF--	AF--	A---	AF--	AF--	AF--	AF--
		----	----	-D--	-D--	-D--	----	----	-F--	-F--	-F--	B---	B---	BF--	BF--	BF--	B---	B---	BH--	BH--	BH--	B---	B---	BH--	BH--	BH--
		----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
		----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
0	1	---D	-B-F	-B-H	-B-J	-B-L	A--F	AD-H	AD-J	AD-L	AD-N	A--F	AD-H	AD-J	AD-L	AD-N	A--H	AF-J	AF-L	AF-N	AF-P	A--H	AF-J	AF-L	AF-N	AF-P
		----	----	-D--	-D--	-D--	----	----	-F--	-F--	-F--	B---	B---	BF--	BF--	BF--	B---	B---	BH--	BH--	BH--	B---	B---	BH--	BH--	BH--
		----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
		----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
0	2	---D	-B-F	-B-H	-B-J	-B-L	A--F	AD-H	AD-J	AD-L	AD-N	A--F	AD-H	AD-J	AD-L	AD-N	A--H	AF-J	AF-L	AF-N	AF-P	A--H	AF-J	AF-L	AF-N	AF-P
		---E	---G	-D-I	-D-K	-D-M	---G	---I	-F-K	-F-M	-F-O	B---G	B---I	BF-K	BF-M	BF-O	B---I	B---K	BH-M	BH-O	BH-Q	B---I	B---K	BH-M	BH-O	BH-Q
		----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
		----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
0	3	---D	-B-F	-B-H	-B-J	-B-L	A--F	AD-H	AD-J	AD-L	AD-N	A--F	AD-H	AD-J	AD-L	AD-N	A--H	AF-J	AF-L	AF-N	AF-P	A--H	AF-J	AF-L	AF-N	AF-P
		---E	---G	-D-I	-D-K	-D-M	---G	---I	-F-K	-F-M	-F-O	B---G	B---I	BF-K	BF-M	BF-O	B---I	B---K	BH-M	BH-O	BH-Q	B---I	B---K	BH-M	BH-O	BH-Q
		---F	---H	---J	-F-L	-F-N	---H	---J	---L	-H-N	-H-P	---H	---J	---L	-H-N	-H-P	C---J	C---L	C---N	CJ-P	CJ-R	C---J	C---L	C---N	CJ-P	CJ-R
		----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
0	4	---D	-B-F	-B-H	-B-J	-B-L	A--F	AD-H	AD-J	AD-L	AD-N	A--F	AD-H	AD-J	AD-L	AD-N	A--H	AF-J	AF-L	AF-N	AF-P	A--H	AF-J	AF-L	AF-N	AF-P
		---E	---G	-D-I	-D-K	-D-M	---G	---I	-F-K	-F-M	-F-O	B---G	B---I	BF-K	BF-M	BF-O	B---I	B---K	BH-M	BH-O	BH-Q	B---I	B---K	BH-M	BH-O	BH-Q
		---F	---H	---J	-F-L	-F-N	---H	---J	---L	-H-N	-H-P	---H	---J	---L	-H-N	-H-P	C---J	C---L	C---N	CJ-P	CJ-R	C---J	C---L	C---N	CJ-P	CJ-R
		---G	---I	---K	---M	-H-O	---I	---K	---M	---O	-J-Q	---I	---K	---M	---O	-J-Q	---K	---M	---O	---Q	-L-S	D---K	D---M	D---O	D---Q	DL-S

WHAT IS THIS ?

THIS IS A SYMBOLIC TABLE OF UNIBUS ADDRESSES FOR THE FLOATING ADDRESS DEVICES DJ11,DM11, DQ11, AND DU11. THE LETTERS A THRU W CORRESPOND TO UNIBUS ADDRESSES SHOWN IN THE LIST TO THE RIGHT.

THE TABLE CONTAINS ALL POSSIBLE COMBINATIONS OF UP TO FOUR OF EACH TYPE OF DEVICE. THIS SHOULD COVER MOST OF THE PDP-11 CONFIGURATIONS. THE TABLE SHOULD NOT BE USED FOR ANY MACHINE CONFIGURED FOR MORE THAN FOUR DJ'S,DM'S,DQ'S, OR DU'S.

COLUMN HEADERS ARE THE NUMBER OF DJ11'S AND DM11'S. ROW HEADERS ARE THE NUMBER OF DQ11'S AND DU11'S.

HOW TO USE THE TABLE

DETERMINE THE NUMBER OF DJ11'S, DM11'S, DQ11'S, AND DU11'S TO BE INCLUDED IN THE HARDWARE CONFIGURATION.

FIND THE COLUMN CORRESPONDING TO THE NUMBER OF DJ11'S AND DM11'S. SCAN DOWN THIS COLUMN FOR THE ROW CORRESPONDING TO THE DESIRED NUMBER OF DQ11'S AND DU11'S.

AT THE INTERSECTION POINT IS A 4 BY 4 BLOCK OF SYMBOLS INCLUDING DASHES AND LETTERS A THRU W. THE LETTERS REPRESENT THE PROPER UNIBUS ADDRESS FOR EACH DEVICE. THE LIST TO THE RIGHT SHOWS THE ADDRESS CORRESPONDING TO EACH LETTER. THE DASHES INDICATE NON-EXISTENT DEVICES. THE 4X4 BLOCK IS INTERPRETED AS SHOWN BELOW:

	D J	D H	D Q	D U
1ST	A	D	K	M
2ND	B	F	-	N
3RD	-	H	-	O
4TH	-	-	-	P

ADDRESSES

A	760010
B	760020
C	760030
D	760040
E	760050
F	760060
G	760070
H	760100
I	760110
J	760120
K	760130
L	760140
M	760150
N	760160
O	760170
P	760200
Q	760210
R	760220
S	760230
T	760240
U	760250
V	760260
W	760270

EXAMPLE

CONSIDER A SYSTEM TO INCLUDE TWO DJ'S, 3 DM'S, 1 DQ, AND 4 DU'S.

THE COLUMN CORRESPONDING TO 2 DJ'S AND 3 DM'S IS FOUND AT THE CENTER OF THE TABLE. THE ROW FOR 1 DQ AND 4 DU'S IS LOCATED ON PAGE 2 OF 3. THE BLOCK AT THE INTERSECTION IS THE ONE SHOWN TO THE LEFT BELOW.

USING THE 4 X 4 BLOCK AND THE LIST OF ADDRESSES, THE CORRECT FLOATING ADDRESSES CAN BE READ IMMEDIATELY.

1ST DJ11	=	A	= 760010
2ND DJ11	=	B	= 760020
1ST DM11	=	D	= 760040
2ND DM11	=	F	= 760060
3RD DM11	=	H	= 760100
1ST DQ11	=	K	= 760130
1ST DU11	=	M	= 760150
2ND DU11	=	N	= 760160
3RD DU11	=	O	= 760170
4TH DU11	=	P	= 760200

DJ	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
DH	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
DQ DU																									
1 0	--C-	-BE-	-BG-	-BI-	-BK-	A-E-	ADG-	ADI-	ADK-	ADM-	A-E-	ADG-	ADI-	ADK-	ADM-	A-G-	AFI-	AFK-	AFM-	AFO-	A-G-	AFI-	AFK-	AFM-	AFO-
	----	----	-D--	-D--	-D--	----	----	-F--	-F--	-F--	B---	B---	BF--	BF--	BF--	B---	B---	BH--	BH--	BH--	B---	B---	BH--	BH--	BH--
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
1 1	--CE	-BEG	-BGI	-BIK	-BKM	A-EG	ADGI	ADIK	ADKM	ADMO	A-EG	ADGI	ADIK	ADKM	ADMO	A-GI	AFIK	AFKM	AFMO	AFOQ	A-GI	AFIK	AFKM	AFMO	AFOQ
	----	----	-D--	-D--	-D--	----	----	-F--	-F--	-F--	B---	B---	BF--	BF--	BF--	B---	B---	BH--	BH--	BH--	B---	B---	BH--	BH--	BH--
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
1 2	--CE	-BEG	-BGI	-BIK	-BKM	A-EG	ADGI	ADIK	ADKM	ADMO	A-EG	ADGI	ADIK	ADKM	ADMO	A-GI	AFIK	AFKM	AFMO	AFOQ	A-GI	AFIK	AFKM	AFMO	AFOQ
	---F	---H	-D-J	-D-L	-D-N	---H	---J	-F-L	-F-N	-F-P	B--H	B--J	BF-L	BF-N	BF-P	B--J	B--L	BH-N	BH-P	BH-R	B--J	B--L	BH-N	BH-P	BH-R
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
1 3	--CE	-BEG	-BGI	-BIK	-BKM	A-EG	ADGI	ADIK	ADKM	ADMO	A-EG	ADGI	ADIK	ADKM	ADMO	A-GI	AFIK	AFKM	AFMO	AFOQ	A-GI	AFIK	AFKM	AFMO	AFOQ
	---F	---H	-D-J	-D-L	-D-N	---H	---J	-F-L	-F-N	-F-P	B--H	B--J	BF-L	BF-N	BF-P	B--J	B--L	BH-N	BH-P	BH-R	B--J	B--L	BH-N	BH-P	BH-R
	---G	---I	---K	-F-M	-F-O	---I	---K	---M	-H-O	-H-Q	---I	---K	---M	-H-O	-H-Q	C--K	C--M	C--O	CJ-Q	CJ-S	C--K	C--M	C--O	CJ-Q	CJ-S
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
1 4	--CE	-BEG	-BGI	-BIK	-BKM	A-EG	ADGI	ADIK	ADKM	ADMO	A-EG	ADGI	ADIK	ADKM	ADMO	A-GI	AFIK	AFKM	AFMO	AFOQ	A-GI	AFIK	AFKM	AFMO	AFOQ
	---F	---H	-D-J	-D-L	-D-N	---H	---J	-F-L	-F-N	-F-P	B--H	B--J	BF-L	BF-N	BF-P	B--J	B--L	BH-N	BH-P	BH-R	B--J	B--L	BH-N	BH-P	BH-R
	---G	---I	---K	-F-M	-F-O	---I	---K	---M	-H-O	-H-Q	---I	---K	---M	-H-O	-H-Q	C--K	C--M	C--O	CJ-Q	CJ-S	C--K	C--M	C--O	CJ-Q	CJ-S
	---H	---J	---L	---N	-H-P	---J	---L	---N	---P	-J-R	---J	---L	---N	---P	-J-R	---L	---N	---P	---R	-L-T	D--L	D--N	D--P	D--R	DL-T
2 0	--C-	-BE-	-BG-	-BI-	-BK-	A-E-	ADG-	ADI-	ADK-	ADM-	A-E-	ADG-	ADI-	ADK-	ADM-	A-G-	AFI-	AFK-	AFM-	AFO-	A-G-	AFI-	AFK-	AFM-	AFO-
	--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
2 1	--CF	-BEH	-BGJ	-BIL	-BKN	A-EH	ADGJ	ADIL	ADKN	ADMP	A-EH	ADGJ	ADIL	ADKN	ADMP	A-GJ	AFIL	AFKN	AFMP	AFOR	A-GJ	AFIL	AFKN	AFMP	AFOR
	--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
2 2	--CF	-BEH	-BGJ	-BIL	-BKN	A-EH	ADGJ	ADIL	ADKN	ADMP	A-EH	ADGJ	ADIL	ADKN	ADMP	A-GJ	AFIL	AFKN	AFMP	AFOR	A-GJ	AFIL	AFKN	AFMP	AFOR
	--DG	--FI	-DHK	-DJM	-DLO	--FI	--HK	-FJM	-FLO	-FNQ	B-FI	B-HK	BFJM	BFLO	BFNQ	B-HK	B-JM	BHLO	BHNQ	BHPS	B-HK	B-JM	BHLO	BHNQ	BHPS
	----	----	----	-F--	-F--	----	----	----	-H--	-H--	----	----	----	-H--	-H--	C---	C---	C---	CJ--	CJ--	C---	C---	C---	CJ--	CJ--
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
2 3	--CF	-BEH	-BGJ	-BIL	-BKN	A-EH	ADGJ	ADIL	ADKN	ADMP	A-EH	ADGJ	ADIL	ADKN	ADMP	A-GJ	AFIL	AFKN	AFMP	AFOR	A-GJ	AFIL	AFKN	AFMP	AFOR
	--DG	--FI	-DHK	-DJM	-DLO	--FI	--HK	-FJM	-FLO	-FNQ	B-FI	B-HK	BFJM	BFLO	BFNQ	B-HK	B-JM	BHLO	BHNQ	BHPS	B-HK	B-JM	BHLO	BHNQ	BHPS
	---H	---J	---L	-F-N	-F-P	---J	---L	---N	-H-P	-H-R	---J	---L	---N	-H-P	-H-R	C--L	C--N	C--P	CJ-R	CJ-T	C--L	C--N	C--P	CJ-R	CJ-T
	----	----	----	----	-H--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
2 4	--CF	-BEH	-BGJ	-BIL	-BKN	A-EH	ADGJ	ADIL	ADKN	ADMP	A-EH	ADGJ	ADIL	ADKN	ADMP	A-GJ	AFIL	AFKN	AFMP	AFOR	A-GJ	AFIL	AFKN	AFMP	AFOR
	--DG	--FI	-DHK	-DJM	-DLO	--FI	--HK	-FJM	-FLO	-FNQ	B-FI	B-HK	BFJM	BFLO	BFNQ	B-HK	B-JM	BHLO	BHNQ	BHPS	B-HK	B-JM	BHLO	BHNQ	BHPS
	---H	---J	---L	-F-N	-F-P	---J	---L	---N	-H-P	-H-R	---J	---L	---N	-H-P	-H-R	C--L	C--N	C--P	CJ-R	CJ-T	C--L	C--N	C--P	CJ-R	CJ-T
	---I	---K	---M	---O	-H-Q	---K	---M	---O	---Q	-J-S	---K	---M	---O	---Q	-J-S	---M	---O	---Q	---S	-L-U	D--M	D--O	D--Q	D--S	DL-U

FLOATING ADDRESS TABLE
DJ11, DH11, DQ11, DU11

DQ	DU	DJ / DH	0 / 0	0 / 1	0 / 2	0 / 3	0 / 4	1 / 0	1 / 1	1 / 2	1 / 3	1 / 4	2 / 0	2 / 1	2 / 2	2 / 3	2 / 4	3 / 0	3 / 1	3 / 2	3 / 3	3 / 4	4 / 0	4 / 1	4 / 2	4 / 3	4 / 4
3	0		--C-	-BE-	-BG-	-BI-	-BK-	A-E-	ADG-	ADI-	ADK-	ADM-	A-E-	ADG-	ADI-	ADK-	ADM-	A-G-	AFI-	AFK-	AFM-	AFO-	A-G-	AFI-	AFK-	AFM-	AFO-
			--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			----	----	----	----	-M--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
3	1		--CG	-BEI	-BGK	-BIM	-BKO	A-EI	ADGK	ADIM	ADKO	ADMQ	A-EI	ADGK	ADIM	ADKO	ADMQ	A-GK	AFIM	AFKO	AFMQ	AFOS	A-GK	AFIM	AFKO	AFMQ	AFOS
			--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			----	----	----	----	-M--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
3	2		--CG	-BEI	-BGK	-BIM	-BKO	A-EI	ADGK	ADIM	ADKO	ADMQ	A-EI	ADGK	ADIM	ADKO	ADMQ	A-GK	AFIM	AFKO	AFMQ	AFOS	A-GK	AFIM	AFKO	AFMQ	AFOS
			--DH	--FJ	-DHL	-DJN	-DLP	--FJ	--HL	-FJN	-FLP	-FNR	B-FJ	B-HL	BFJN	BFLP	BFNR	B-HL	B-JN	BHLP	BHNR	BHPT	B-HL	B-JN	BHLP	BHNR	BHPT
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			----	----	----	----	-M--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
3	3		--CG	-BEI	-BGK	-BIM	-BKO	A-EI	ADGK	ADIM	ADKO	ADMQ	A-EI	ADGK	ADIM	ADKO	ADMQ	A-GK	AFIM	AFKO	AFMQ	AFOS	A-GK	AFIM	AFKO	AFMQ	AFOS
			--DH	--FJ	-DHL	-DJN	-DLP	--FJ	--HL	-FJN	-FLP	-FNR	B-FJ	B-HL	BFJN	BFLP	BFNR	B-HL	B-JN	BHLP	BHNR	BHPT	B-HL	B-JN	BHLP	BHNR	BHPT
			--EI	--GK	--IM	-FKO	-FMQ	--GK	--IM	--KO	-HMQ	-HOS	--GK	--IM	--KO	-HMQ	-HOS	C-IM	C-KO	C-MQ	CJOS	CJQU	C-IM	C-KO	C-MQ	CJOS	CJQU
			----	----	----	----	-M--	----	----	----	----	-J--	----	----	----	----	-J--	----	----	----	----	-L--	D---	D---	D---	D---	DL--
3	4		--CG	-BEI	-BGK	-BIM	-BKO	A-EI	ADGK	ADIM	ADKO	ADMQ	A-EI	ADGK	ADIM	ADKO	ADMQ	A-GK	AFIM	AFKO	AFMQ	AFOS	A-GK	AFIM	AFKO	AFMQ	AFOS
			--DH	--FJ	-DHL	-DJN	-DLP	--FJ	--HL	-FJN	-FLP	-FNR	B-FJ	B-HL	BFJN	BFLP	BFNR	B-HL	B-JN	BHLP	BHNR	BHPT	B-HL	B-JN	BHLP	BHNR	BHPT
			--EI	--GK	--IM	-FKO	-FMQ	--GK	--IM	--KO	-HMQ	-HOS	--GK	--IM	--KO	-HMQ	-HOS	C-IM	C-KO	C-MQ	CJOS	CJQU	C-IM	C-KO	C-MQ	CJOS	CJQU
			---J	---L	---N	---P	-M-R	---L	---N	---P	---R	-J-T	---L	---N	---P	---R	-J-T	---N	---P	---R	---T	-L-V	D---N	D---P	D---R	D---T	DL-V
4	0		--C-	-BE-	-BG-	-BI-	-BK-	A-E-	ADG-	ADI-	ADK-	ADM-	A-E-	ADG-	ADI-	ADK-	ADM-	A-G-	AFI-	AFK-	AFM-	AFO-	A-G-	AFI-	AFK-	AFM-	AFO-
			--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			--F-	--H-	--J-	--L-	-HN-	--H-	--J-	--L-	--N-	-JP-	--H-	--J-	--L-	--N-	-JP-	--J-	--L-	--N-	--P-	-LR-	D-J-	D-L-	D-N-	D-P-	DLR-
4	1		--CH	-BEJ	-BGL	-BIN	-BKP	A-EJ	ADGL	ADIN	ADKP	ADMR	A-EJ	ADGL	ADIN	ADKP	ADMR	A-GL	AFIN	AFKP	AFMR	AFOT	A-GL	AFIN	AFKP	AFMR	AFOT
			--D-	--F-	-DH-	-DJ-	-DL-	--F-	--H-	-FJ-	-FL-	-FN-	B-F-	B-H-	BFJ-	BFL-	BFN-	B-H-	B-J-	BHL-	BHN-	BHP-	B-H-	B-J-	BHL-	BHN-	BHP-
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			--F-	--H-	--J-	--L-	-HN-	--H-	--J-	--L-	--N-	-JP-	--H-	--J-	--L-	--N-	-JP-	--J-	--L-	--N-	--P-	-LR-	D-J-	D-L-	D-N-	D-P-	DLR-
4	2		--CH	-BEJ	-BGL	-BIN	-BKP	A-EJ	ADGL	ADIN	ADKP	ADMR	A-EJ	ADGL	ADIN	ADKP	ADMR	A-GL	AFIN	AFKP	AFMR	AFOT	A-GL	AFIN	AFKP	AFMR	AFOT
			--DI	--FK	-DHM	-DJO	-DLQ	--FK	--HM	-FJO	-FLQ	-FNS	B-FK	B-HM	BFJO	BFLQ	BFNS	B-HM	B-JO	BHLQ	BHNS	BHPU	B-HM	B-JO	BHLQ	BHNS	BHPU
			--E-	--G-	--I-	-FK-	-FM-	--G-	--I-	--K-	-HM-	-HO-	--G-	--I-	--K-	-HM-	-HO-	C-I-	C-K-	C-M-	CJO-	CJQ-	C-I-	C-K-	C-M-	CJO-	CJQ-
			--F-	--H-	--J-	--L-	-HN-	--H-	--J-	--L-	--N-	-JP-	--H-	--J-	--L-	--N-	-JP-	--J-	--L-	--N-	--P-	-LR-	D-J-	D-L-	D-N-	D-P-	DLR-
4	3		--CH	-BEJ	-BGL	-BIN	-BKP	A-EJ	ADGL	ADIN	ADKP	ADMR	A-EJ	ADGL	ADIN	ADKP	ADMR	A-GL	AFIN	AFKP	AFMR	AFOT	A-GL	AFIN	AFKP	AFMR	AFOT
			--DI	--FK	-DHM	-DJO	-DLQ	--FK	--HM	-FJO	-FLQ	-FNS	B-FK	B-HM	BFJO	BFLQ	BFNS	B-HM	B-JO	BHLQ	BHNS	BHPU	B-HM	B-JO	BHLQ	BHNS	BHPU
			--EJ	--GL	--IN	-FKP	-FMR	--GL	--IN	--KP	-HMR	-HOT	--GL	--IN	--KP	-HMR	-HOT	C-IN	C-KP	C-MR	CJOT	CJQV	C-IN	C-KP	C-MR	CJOT	CJQV
			--F-	--H-	--J-	--L-	-HN-	--H-	--J-	--L-	--N-	-JP-	--H-	--J-	--L-	--N-	-JP-	--J-	--L-	--N-	--P-	-LR-	D-J-	D-L-	D-N-	D-P-	DLR-
4	4		--CH	-BEJ	-BGL	-BIN	-BKP	A-EJ	ADGL	ADIN	ADKP	ADMR	A-EJ	ADGL	ADIN	ADKP	ADMR	A-GL	AFIN	AFKP	AFMR	AFOT	A-GL	AFIN	AFKP	AFMR	AFOT
			--DI	--FK	-DHM	-DJO	-DLQ	--FK	--HM	-FJO	-FLQ	-FNS	B-FK	B-HM	BFJO	BFLQ	BFNS	B-HM	B-JO	BHLQ	BHNS	BHPU	B-HM	B-JO	BHLQ	BHNS	BHPU
			--EJ	--GL	--IN	-FKP	-FMR	--GL	--IN	--KP	-HMR	-HOT	--GL	--IN	--KP	-HMR	-HOT	C-IN	C-KP	C-MR	CJOT	CJQV	C-IN	C-KP	C-MR	CJOT	CJQV
			--FK	--HM	--JO	--LQ	-HNS	--HM	--JO	--LQ	--NS	-JPU	--HM	--JO	--LQ	--NS	-JPU	--JO	--LQ	--NS	--PU	-LRW	D-JO	D-LQ	D-NS	D-PU	DLRW

B.2 FLOATING VECTORS

Many devices have floating vectors. The vector assignment sequence will normally be the same sequence as that in which the devices enter production. A new option's vector will never be inserted before the vector for a device that is already in production. There are no vector gaps required. The floating vectors begin at address 3ØØ and proceed upwards. The vector assignment sequence for current devices is defined below.

Device	First Address	Next Addr.	Vector Size	Max # Units	BR Level	RSTS/E Notes
DC11	774ØØØ	+1Ø	1Ø	32	BR5	
KL11,DL11A,B	7765ØØ	+1Ø	1Ø	16	BR4	NON-CONSOLE
DP11	77477Ø	-1Ø	1Ø	32	BR5	278Ø ONLY
DM11A	775ØØØ	+1Ø	1Ø	16	BR5	NOT SUPPORTED
DN11	7752ØØ	+1Ø	4	16	BR4	NOT SUPPORTED
DM11BB	77Ø5ØØ	+1Ø	4	16	BR4	
DR11A,C	76777Ø	-1Ø	1Ø[1]	32	BR5	NOT SUPPORTED
PA611 READER	7726ØØ	+ 4	4[1]	16	BR4	NOT SUPPORTED
PA611 PUNCH	7727ØØ	+ 4	4[1]	16	BR4	NOT SUPPORTED
DT11 (DTØ3-FP)	7742ØØ	+ 2	1Ø[1]	8	BR7	NOT SUPPORTED
DX11	7762ØØ	+4Ø	1Ø[1]	4	BR4	NOT SUPPORTED
DL11C,D,E	77561Ø	+1Ø	1Ø[1]	31	BR4	
DJ11	FLOAT	+1Ø	1Ø[1]	16	BR4	NOT SUPPORTED
DH11	FLOAT	+2Ø	1Ø[1]	16	BR5	
GT4Ø	772ØØØ		1Ø[1]		BR4	NOT SUPPORTED
LPS11	77Ø4ØØ	+4Ø	3Ø[1]	14	BR5,6	NOT SUPPORTED
DQ11	FLOAT	+1Ø	1Ø[1]	16	BR5	NOT SUPPORTED
KW11W	7724ØØ	NA	1Ø[1]	1		NOT SUPPORTED
DU11	FLOAT	+1Ø	1Ø[1]	16	BR5	278Ø ONLY

Floating address and vector devices which are not supported under RSTS/E must be identified during system generation so that the system is configured for the correct addresses and vectors.

[1]The first vector for the first device of this type must always be on a 1Ø(8) boundary.

B.3 FIXED ADDRESSES AND VECTORS

The table below lists the devices supported under RSTS/E which have fixed addresses and vectors.

Device	Address	Vector	BR Level	RSTS/E Notes
RC11	777440	210	BR5	UP TO 4 PLATTERS
RF11	777460	204	BR5	UP TO 8 PLATTERS
RK11	777400	220	BR5	UP TO 8 DRIVES
RP11C	776710	254	BR5	UP TO 8 DRIVES
RJS03/RJS04	772040	204	BR5	UP TO 4 DRIVES
TC11	777340	214	BR6	UP TO 8 DRIVES
TM11	772520	224	BR5	UP TO 8 DRIVES
LP11,LS11 (LP0)	777514	200	BR4	UP TO 8 PRINTERS
(LP1)	764004	170	BR4	DEPENDING ON
(LP2)	764014	174	BR4	SPEED.
(LP3)	764024	270	BR4	
(LP4)	764034	274	BR4	
(LP5)	764044	774	BR4	
(LP6)	764054	770	BR4	
(LP7)	764064	764	BR4	
CR11,CM11	777160	230	BR5	
CD11	772460	230	BR4	
KW11L	777546	100	BR6	
KW11P	772540	104	BR6	
KG11	770700	NONE	NONE	2780 ONLY
KL11,DL11A,DL11B	777560	60	BR4	CONSOLE INTERFACE

HOW TO OBTAIN SOFTWARE INFORMATION

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Maynard, Massachusetts 01754

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The Hague, Holland	Geneva, Switzerland
Tel Aviv, Israel	Munich, West Germany

Software Problem Report (SPR) forms are available from the specialists or from the Software Distribution Centers cited below.

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Software Distribution Center	Software Distribution Center
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Maynard, Massachusetts 01754	Mountain View, California 94043

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Digital Equipment Corporation	Digital Equipment Corporation
146 Main Street	International (Europe)
Maynard, Massachusetts 01754	P.O. Box 340
	1211 Geneva 26
	Switzerland

RSTS/E
System Reliability Test
DEC-11-ORSRB-A-D

READER'S COMMENTS

NOTE: This form is for document comments only. Problems with software should be reported on a Software Problem Report (SPR) form (see the HOW TO OBTAIN SOFTWARE INFORMATION page).

Did you find errors in this manual? If so, specify by page.

Did you find this manual understandable, usable, and well-organized? Please make suggestions for improvement.

Is there sufficient documentation on associated system programs required for use of the software described in this manual? If not, what material is missing and where should it be placed?

Please indicate the type of user/reader that you most nearly represent.

- ☐ Assembly language programmer
- ☐ Higher-level language programmer
- ☐ Occasional programmer (experienced)
- ☐ User with little programming experience
- ☐ Student programmer
- ☐ Non-programmer interested in computer concepts and capabilities

Name _____ Date _____

Organization _____

Street _____

City _____ State _____ Zip Code or Country _____

If you do not require a written reply, please check here. ☐

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