

# **RTEM-11 User's Guide**

AA-N435C-TK

**January 1984**

This manual describes the use of RTEM-11 software, which emulates the RT-11 program development system on RSX-11 and VAX/VMS operating systems.

This manual supersedes the *RTEM-11 User's Guide*, AA-N435B-TK.

**Operating Systems:** RSX-11M Version 4  
RSX-11M-PLUS Version 2  
VAX/VMS Version 3

**Software:** RTEM-11 Version 2

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## PREFACE

This manual introduces you to RTEM-11, the RT-11 emulator. The main purpose of RTEM-11 is to let you develop and debug RT-11 programs, using the facilities of a multiuser system such as RSX-11 or VAX/VMS. This manual gives you the information you need to do this.

DIGITAL recommends that you consult the RTEM-11 Release Notes that is shipped as part of the RTEM-11 documentation set. The release notes contain information on the latest features of RTEM-11.

### Intended Audience

To use this manual you should have some experience using RT-11, but you don't need to know too much about the host system (RSX-11 or VAX/VMS). All you need to know is some host system commands such as DIRECTORY, SHOW DEFAULTS, ALLOCATE, and MOUNT, and conventions for interacting with your host system through the terminal. These subjects are summarized in Chapter 1.

### Chapter Summary

Chapter 1 lists RTEM-11 features and describes RSX-11 and VAX/VMS concepts and conventions.

Chapter 2 tells you how to invoke RTEM-11 and alter the default operating conditions.

Chapter 3 describes the extended command string interpreter (ECSI).

Chapter 4 describes the jack-of-all-trades (JOAT) utility program, which performs many diverse operations specific to RTEM-11 such as securing additional devices, exiting from RTEM-11, and gaining the attention of RSX-11 or VAX/VMS.

Chapter 5 describes the RTEM-11 file interchange program (FIP), which transfers files between RT-11 volumes and RSX-11 or VAX/VMS volumes.

Chapter 6 describes RTEM-11 maintenance procedures.

A glossary defines RTEM-11 terms and compares RT-11 terms with those of RSX-11 and VAX/VMS.

### Associated Documents

RTEM-11 Installation Guide -- This document describes how to install and update RTEM-11.

RTEM-11 Release Notes -- This document summarizes the features that differentiate RTEM-11 V1.1 from RTEM-11 V2. It also includes technical information regarding RTEM's RT-11 monitor configuration and information on any known software problems.

## Documentation Conventions

Certain typographical devices are used in the manual to distinguish different kinds of information:

RED PRINT	User input. Where necessary, user input is in red to distinguish it from computer output.
<RET>	A carriage return. Unless the manual indicates otherwise, terminate all commands with a carriage return. The carriage return is not displayed on your terminal.
CTRL/x	A control character. To produce certain characters, you must type a combination of keys concurrently. For example, to produce CTRL/C, press the CTRL key and type C at the same time.
UPPERCASE	Required characters. In examples of command syntax, capital letters represent the command name.
lowercase	Variable characters. In examples of command syntax, lowercase letters represent a variable, for which you must supply a value.
[]	Optional item. You may include or omit the item in square brackets. However, the brackets are not part of the command and should not be included in the command line. The only exception to this rule is the syntax for a directory specification, described next.
[directory]	A directory specification. The directory specification is two numbers in the form [group,member] representing an account. When you type a directory specification in a command line, you must enclose it in brackets.
filespec	A file specification. The file specification includes a device name, a directory specification, a file name, and if applicable, a version number.
...	The vertical or horizontal ellipsis represents omission of optional repetitive information. You can repeat the item that precedes the ellipsis.
>	In a command line, the right angle bracket prompt indicates the line is valid only on an RSX-11 system.
\$	In a command line, the dollar sign prompt indicates that the line is valid on RSX-11 and VAX/VMS systems unless otherwise noted.

Block numbers are in decimal notation.

The term RSX-11 indicates RSX-11M or RSX-11M-PLUS; the term host system indicates an RSX-11 or VAX/VMS system.



## CHAPTER 1

### INTRODUCTION TO RTEM-11

RTEM-11 provides the RT-11 program development environment under the RSX-11M, RSX-11M-PLUS, and VAX/VMS operating systems. Thus, RTEM-11 allows many concurrent users to develop RT-11 applications on an RSX-11 or VAX/VMS host system. These application programs can be created, edited, assembled, linked, and debugged under RTEM-11 and then executed on RT-11.

This chapter introduces RTEM-11 (Section 1.1), the RSX-11 host (Sections 1.2 through 1.4), and the VAX/VMS host (Sections 1.5 through 1.7).

#### 1.1 RTEM-11 FEATURES

- RT-11 keyboard monitor commands and indirect command files
- Support for RT-11 programs:

BATCH	EDIT	MACRO	SLP
BINCOM	FILEX	PAT	SPLIT
BUP	HELP	PIP	SRCCOM
CREF	IND	QUEMAN	TECO
DATIME	KED/K52	QUEUE	TERMID
DIR	LET	RESORC	TRANSF
DUMP	LIBR	SETUP	UCL
DUP	LINK	SIPP	VDT

The DUP and FILEX programs are supported with restrictions, as described in Section 2.7.5.

- Two RTEM-11 utilities:

File interchange program (FIP), which enables transfer of files between RT-11 and host system

Jack-of-all-trades (JOAT) program, which performs a variety of system and device operations useful for application program development

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- Multiple terminal RT-11 foreground/background monitor with support for console terminal only

### 1.2 RSX-11 CONVENTIONS

The main difference between RSX-11 and RT-11 is that RSX-11 is a multiuser system, which means that two or more people can be using it at the same time. In multiuser systems, you need to protect your work from the work of other users. RSX-11 does this through system protection facilities, such as logging in and out, and through file protection features.

#### 1.2.1 Logging In

If you are authorized to use RSX-11, you have a name and password that RSX-11 will recognize. To gain access to the system, you log in by typing your name and password at an RSX-11 terminal.

As you start, the terminal should be displaying a right-angle bracket (>) at its left margin. This prompt informs you that RSX-11 is ready to accept input.

Press CTRL/C. You should now see a three-letter prompt in the form:

```
MCR>
```

MCR stands for monitor console routine. Respond by typing HELLO.

The system asks you to identify yourself. Type the account name you were given by the system manager.

The system asks for your password. Type the password for your account. The log-in dialog is similar to the following:

```
MCR>HELLO
ACCOUNT OR NAME: JONES
PASSWORD: (type password)
```

After you are logged in, set your terminal to DCL (DIGITAL command language) by typing:

```
SET /DCL=TI:
```

The remainder of this manual uses DCL in examples.

#### 1.2.2 Logging Off

When you are through using the system, log off by typing:

```
>LOGOUT
```

You'll get a response similar to the following:

```
HAVE A GOOD MORNING
21-MAY-83 10:25 TT6:  LOGGED OFF
```

## INTRODUCTION TO RTEM-11

In addition to logging you off, LOGOUT terminates your active tasks and returns allocated resources to the system. RSX-11M-PLUS systems with resource accounting provide additional information about your use of the system.

### 1.2.3 RSX-11 File Management

Every user on RSX-11 is assigned a directory for private file storage. Your directory is stored with other user directories on a volume. When you log in, you automatically have access to files stored in your directory. You do not have to name the device and directory to access a file. The file name alone is enough.

You can display your current default disk and directory by issuing the SHOW DEFAULTS command after you log in. For example:

```
>SHOW DEFAULTS
DM1:[230,72]
```

In this example, the default user storage volume on the RSX-11 host is device DM1. The directory is [230,72].

The DIRECTORY command displays information about files listed in your directory.

```
>DIRECTORY
```

The following example shows the output from a DIRECTORY command. Bracketed numbers denote lines explained in the following text.

```
[1]  DIRECTORY DM1:[230,72]
    18-APR-82 10:33

[2]  SUM.BAS;4          1.          11-FEB-83 12:10
    DEMO.MAC;1          4.          06-APR-83 16:20
    STARS.MAC;1         5.          30-SEP-82 12:30
    LOGIN.CMD;3         2.          18-AUG-82 10:20

[3]  TOTAL OF 12./50. BLOCKS IN 4. FILES
```

The DIRECTORY command produces a listing of all files stored on a particular mass storage device under the default account. The directory shown above is in the standard format and shows a directory listing for the default account, identified by the SHOW DEFAULTS command.

- [1] The directory heading identifies the name of the mass storage device where files are held. In this example, the device is DM1. The heading also identifies the directory in which files are stored. In this example, the directory is [230,72].
- [2] Each file in the directory listing is identified by name, type, and version number, and the date and time the file was placed in the directory. The number between the file specification and the date indicates how many blocks of disk space the file occupies.

File names can include numbers or letters, but not other characters. File names are from one to nine characters long. The period (.) separates the file name from the file type. File types can be from zero to three numbers or letters. The semicolon (;) separates the file type from the version number.

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RSX-11 assigns version numbers to all files created. Version numbers can be from one to five octal digits. The lowest version number is 1 and the highest is 77777. When you create a file, it is assigned version number 1. If you later create another file with the same name, the new file is version 2. Version 1 of the file remains on the mass storage volume. As new versions of the file are created, their predecessors remain on the volume until you delete them.

- [3] At the bottom of the directory is a decimal count of all the blocks used by files in the directory and of the number of files in the directory. The block count is given as two numbers separated by a slash (/) to indicate the number of blocks needed for the files and the number of blocks allocated.

A full RSX-11 file specification consists of a device name, a directory code, a file name, a file type, and a version number in the following form:

```
dev:[directory]filename.typ;version
```

All punctuation marks (colon, square brackets, period, semicolon) are required. These marks separate the various components of the file specification. The five elements of the file specification distinguish one file from all others on the system.

Various parts of the file specification, such as the device and directory, are automatically included (defaulted) by the system if you do not supply them. You listed these defaults earlier with the SHOW DEFAULTS command. If you want to specify a file that is not in your default directory or on your default device, include the explicit device name or directory in the file specification.

If you omit the version number, the system will read the highest numbered version of the file. The system will also create a new file by incrementing the highest existing version number by 1.

### 1.2.4 RSX-11 Device Usage

In addition to establishing private files, RSX-11 offers protections to users of individual devices. These protections include the ALLOCATE command and the MOUNT command.

The ALLOCATE command establishes a device as your private device, and prevents access to it by other users. Device allocation is optional but recommended.

You can place a volume in the drive before or after issuing the ALLOCATE command. The ALLOCATE command ensures that no other user can gain access to the device, so common practice is to place the volume in the drive after allocating it. The following example shows the simplest form of the ALLOCATE command:

```
ALLOCATE ddnn:
```

For RSX-11, the device specification (ddnn:) contains two fields. The first field is the device code (dd). The device code describes the type of device you are allocating; for example, DY identifies an RX02

## INTRODUCTION TO RTEM-11

diskette. The second field is the unit number of the device to be allocated (nn). If you omit this number, the system defaults to unit 0. The following command allocates RK05 unit 2:

>ALLOCATE DK2:

After allocating the device and placing a volume in the drive, use the MOUNT command to mount the volume. Mounting is the mechanism that provides a link between a volume, a device, and your process or task.

On RSX-11, you can access a volume that contains system programs and user directories without mounting it yourself. However, if you want exclusive use of a volume (for example, an RT-11 system volume) you must mount it.

RSX-11M-PLUS requires you to use the /FOREIGN option when you mount a volume that does not use the standard RSX-11M-PLUS format. The volume is foreign, although it can be accessed through RTEM-11. RSX-11M will ignore your use of the /FOREIGN option with MOUNT. Specify the volume with the device code you used in the ALLOCATE command. For example:

>MOUNT/FOREIGN DK2:

When you no longer need access to files on a device, release the volume with the DISMOUNT command. Specify the device with the code used in the MOUNT command. For example:

>DISMOUNT DK2:

If you allocated the device before using it, deallocate it so other users can obtain access to it. Specify the device with the code you used in the ALLOCATE command. Logging off the system automatically cancels the effects of MOUNT and ALLOCATE commands issued from your terminal. To promote the efficiency of the system, however, you should immediately deallocate any devices you no longer need.

>DEALLOCATE DK2:

For more information about allocating and mounting volumes, see the Introduction to RSX-11M/M-PLUS.

### 1.2.5 HELP Command

The HELP command displays information on your terminal about how to use the system. Type the command:

>HELP

RSX-11 will display a list of commands, and information about how to log in to the system and how to issue further commands. HELP is the only command you can issue before logging in. You should issue the command at least once to know the nature of the information it offers. Section 2.5.3 describes how to display the RTEM-11 HELP text.

### 1.3 SPECIAL CONSIDERATIONS FOR RTEM-11, RSX-11 USERS

You should be aware of the following differences between RSX-11 and RTEM-11.

## INTRODUCTION TO RTEM-11

### 1.3.1 Task or Job?

Everything that is done on or by an RSX-11 system is done by a task or group of tasks. RTEM-11 is itself a task that executes on the RSX-11 operating system. A task is the fundamental executable unit in RSX-11 just as a job is the fundamental executable unit in RT-11. When this document refers to a task, it is referring to the executable unit on RSX-11. When it refers to a job, it is referring to the executable unit controlled by the RTEM-11 monitor.

### 1.3.2 Files-11 or RT-11 Directory Structure?

Files are organized in directories, and directories are organized on volumes using structures known to the operating system.

RSX-11 uses the Files-11 file structure and assumes that all file-structured volumes are organized identically. The INITIALIZE command creates the Files-11 structure on disk or tape.

RTEM-11 uses the RT-11 directory structure to store files. To enable RTEM-11 users to transport files between operating systems, RTEM-11 includes the file interchange program (FIP). With FIP, you can transfer files between RT-11 directory structured volumes and host system volumes without exiting from RTEM-11.

### 1.3.3 Multiuser or Single-User?

RSX-11 systems are available to many simultaneous users. RT-11 is a single-user system, available to one user at a time. Most of the time you are using RSX-11, you will feel as though you are the only user. Since you are one of many active users, however, RSX-11 provides protection facilities to prevent users from interfering with one another.

One of the device protections is the ALLOCATE command, already discussed. RTEM-11 lets you pass a command line, such as ALLOCATE DX1:, to the RSX-11 command line interpreter. This lets you allocate a device directly from RTEM-11. You should always allocate a device when using RTEM-11.

### 1.3.4 Device Driver or Handler?

RSX-11 includes device drivers for transmitting data between main memory and peripheral devices (for example, disks and line printers). A device driver performs functions that enable physical I/O operations.

RTEM-11 includes device handlers (also known as drivers). To perform I/O under RTEM-11, the RTEM-11 handlers issue RSX-11 directives that cause RSX-11 device drivers to perform physical I/O.

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### 1.3.5 Device or Volume?

These terms are often used synonymously. This document identifies a device as a hardware unit such as a line printer, disk drive, or magtape drive. Device codes identify each device unit on a system. For example, the common device code for an RL02 disk in unit 1 is DL1:. This document identifies a volume as a mass storage medium that can be treated as host system or RTEM-11 file-structured data storage. For example, a diskette with structured data on it is a volume.

RT-11 and RSX-11 use different device names for certain physical devices. Only one of these devices is supported under RSX-11 and RTEM-11 -- the RK05 disk. Under RSX-11 the code for an RK05 is DK, and under RT-11 the code for an RK05 is RK. Further, the device code DK under RT-11 denotes the default storage volume. This conflict is discussed further in Section 2.6.

### 1.3.6 CTRL/C or CTRL/Z?

On RTEM-11 and RT-11, CTRL/C terminates job execution or cancels a command during processing. However, on RSX-11, CTRL/Z performs these functions; CTRL/C has a different purpose on RSX-11.

If you are running a task such as PIP, you can use CTRL/C to suspend PIP and invoke the command line interpreter. Then you can type a single command before control returns to PIP. You can also use CTRL/C on RSX-11 to invoke the command line interpreter when no other task is running.

## 1.4 RSX-11 DOCUMENTATION REFERENCES

The RSX-11 documentation set provides full explanations of all procedures mentioned here. This chapter provides a quick way to start using the host system. As you become comfortable using RSX-11, you should expand your knowledge and experience with the system to make full use of it. Further reading will prove helpful.

The RSX-11M/M-PLUS Documentation Directory describes each manual included in the system documentation. The system documentation includes a master index.

The Introduction to RSX-11M/M-PLUS is designed for any new user of the operating system. This manual uses terminal sessions to introduce and explain system conventions. RT-11 users who are new to RSX-11M are encouraged to work through this manual. Under its close supervision, you can learn how to experiment safely with the system while being taught fundamental concepts.

The RSX-11M/M-PLUS Command Language Manual describes the DIGITAL command language (DCL) and illustrates how to use it.

The RSX-11M/M-PLUS MCR Operations Manual contains information on the system from the operator's point of view. This manual describes the monitor console routine (MCR) which is an alternative command line interpreter to DCL.

The RSX-11 Utilities Manual describes each RSX-11M utility program in detail.

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### 1.5 VAX/VMS CONVENTIONS

The main difference between VAX/VMS and RT-11 is that VAX/VMS is a multiuser system, which means that two or more people can be using it at the same time. In multiuser systems, you need to protect your work from the work of other users. VAX/VMS does this through system protection facilities, such as logging in and out, and through file protection features.

#### 1.5.1 Logging In

Press the <RET> key or CTRL/Y keys to signal the system that you want to log in. The system responds by prompting you for your user name. Enter your user name followed by a carriage return. The system then prompts you to enter your password. After typing your password, press the carriage return. This is an example of a log-in sequence:

```
Username: SMITH
Password:
      Welcome to VAX/VMS Version V3.n on Node EMANON
$
```

The dollar sign is a system prompting symbol; when this character appears on the far left of the terminal, it indicates that the log-in was successful and you can begin entering commands to the system. If your log-in sequence is entered incorrectly, the system displays an error message and you must repeat the log-in procedure.

#### 1.5.2 Logging Off

When you are through using the system, log off by typing:

```
$ LOGOUT
```

You will get a response similar to the following:

```
SMITH logged out at 11-DEC-1983 12:43:10.38
```

#### 1.5.3 VAX/VMS File Management

Every user on VAX/VMS is assigned a directory for private file storage. Your directory is stored with other user directories on a volume. When you log in, you automatically have access to files stored in your directory. You do not have to name the device and directory to access a file. The file name alone is enough.

You can display your current default device and directory by issuing the SHOW DEFAULT command after you log in. For example:

```
$ SHOW DEFAULT
DRAL:[SMITH]
```

The example shows the default user storage volume as device DRAL:. The directory is named [SMITH]. The device mnemonic is discussed in the next section. If the device DRAL: holds directories for most of the users on the system, it may be assigned the logical name USER. The SHOW DEFAULT command would then display the default device and directory as USER:[SMITH].



## INTRODUCTION TO RTEM-11

The following example shows the use of and output from the DIRECTORY command. The DIRECTORY command produces a listing of all files stored on a particular mass storage device under the default account. The example directory is in the standard format and shows a directory listing for the default account, identified by the SHOW DEFAULT command.

\$ DIRECTORY

```
[1]      DIRECTORY  DRA1:[SMITH]

[2]      BL2.RNO;1      CALEND.MEM;3      CHAPTER1.RNO;3
          RTFILE.SYS;3  RT11PR.SYS;1      LOGIN.COM;6
          RUNOFF.MEM;2  PHONE.MEM;1       BOOK.RNO;1

[3]      Total of 9 files.
$
```

[1] The directory heading identifies the name of the mass storage device where files are held. In this example, the device is DRA1:. The heading also identifies the directory from which files are being displayed. In this example, the directory is [SMITH].

[2] Each file in the directory listing is identified by name, type, and version number. The file name can include up to nine characters. File types can be from zero to three numbers or letters. The semicolon (;) separates the file type from the version number.

Version numbers are automatically assigned to all files created under VAX/VMS. Version numbers can be from one to five decimal digits. The lowest version number is 1 and the highest is 32767. When a file is first created, it is assigned version number 1. If another file is subsequently created with the same name, the new file is version 2. Version 1 of the file remains on the mass storage volume and becomes a backup.

[3] The last line of information tells you how many files are listed in the directory.

A full VAX/VMS file specification includes a node name in addition to the items already discussed. The node name identifies a computer system connected to your system through a DECnet communication network. However, RTEM-11 does not support DECnet, and node names cannot be specified in file names. The VAX/VMS file specification accepted by RTEM-11 consists of a device name, a directory code, a file name, a file type, and a version number in the following form:

dev:[directory]filename.typ;version

All punctuation marks (colon, square brackets, period, semicolon) are required syntax that separate the various components of the file specification.

The five elements of the file specification distinguish one file from all others on the system. Various parts of the file specification, such as the device and directory, are automatically included (defaulted) by the system if you do not supply them. You listed these defaults earlier with the SHOW DEFAULT command. If you want to specify a file that is not in your default directory or on your default device, include the explicit device name and directory in the file specification.

## INTRODUCTION TO RTE-11

If you do not supply a version number, the system will default to the highest numbered version of a file when reading. When creating a new file, the default version is the highest existing version plus 1. Some commands (such as DELETE) require an explicit version number.

### 1.5.4 VAX/VMS Device Usage

In addition to establishing private files, VAX/VMS offers protections to users of individual devices. These protections include the ALLOCATE command and the MOUNT command.

The ALLOCATE command establishes a device as your private device, and prevents access to it by other users. Device allocation is optional but recommended.

You can place a volume in the drive before or after issuing the ALLOCATE command. The ALLOCATE command ensures that no other user can gain access to the device, so common practice is to place the volume in the drive after allocating it. The following example shows the simplest form of the ALLOCATE command:

```
ALLOCATE dev[c][u:]
```

For VAX/VMS, the device specification (devcu:) contains three fields. The first field is the device mnemonic (dev). The device mnemonic describes the type of device you are allocating; for example, DX identifies a diskette. The second field is the controller character (c). The third field is the unit number of the device to be allocated (u). The controller character and unit number are optional, and if you omit them, the system allocates the first available controller and unit of the type specified. The ALLOCATE command accepts a device mnemonic without a controller character or unit number. The system displays the full mnemonic of the allocated device. The following command allocates RK07 device unit 1:

```
$ ALLOCATE DM1:
  _DM1: ALLOCATED
```

After allocating the device and placing a volume in the drive, use the MOUNT command to mount the volume. Mounting is the mechanism that provides a link between a volume, a device, and your process or task.

On VAX/VMS, you can access a volume that contains system programs and user directories without mounting it yourself. However, if you want exclusive use of a volume (for example, an RT-11 system volume) you must mount it.

VAX/VMS requires you to use the /FOREIGN option when you mount a volume that does not use the standard VAX/VMS format. The volume is foreign, although it can be accessed through RTE-11. Specify the volume with the full device specification used by the ALLOCATE command. For example:

```
$ MOUNT/FOREIGN DM1:
```

When you no longer need access to files on a device, release the volume with the DISMOUNT command. Specify the device with the code used in the MOUNT command. For example:

```
$ DISMOUNT DM1:
```

## INTRODUCTION TO RTEM-11

If you allocated the device before using it, deallocate it so other users can obtain access to it. Specify the device with the full specification used by the ALLOCATE command. Logging off the system automatically cancels the effects of MOUNT and ALLOCATE commands issued from your terminal. To promote the efficiency of the system, however, you should immediately deallocate any devices you no longer need.

\$ DEALLOCATE DMA1:

For more information about allocating and mounting volumes, see the VAX/VMS Command Language User's Guide.

### 1.5.5 HELP Command

The HELP command displays information on your terminal about how to use the system. Type the command:

\$ HELP

VAX/VMS will display a list of commands, and information about how to log in to the system and how to issue further commands. You should issue the command at least once so you know the nature of the information it offers. Section 2.5.3 describes how to display the RTEM-11 HELP text.

## 1.6 SPECIAL CONSIDERATIONS FOR RTEM-11, VAX/VMS USERS

You should be aware of the following differences between VAX/VMS and RTEM-11.

### 1.6.1 Process or Job?

Everything that is done on or by a VAX/VMS system is done by a process or group of processes. RTEM-11 is itself a process which executes on the VAX/VMS operating system. A process is the fundamental executable unit in VAX/VMS just as a job is the fundamental executable unit in RT-11. When this document refers to a process, it is referring to execution agents on the host system. When it refers to a job, it is referring to the executable unit controlled by the RTEM-11 monitor.

### 1.6.2 Files-11 or RT-11 Directory Structure?

Files are organized in directories. Directories are organized on volumes using structures known to the operating system. VAX/VMS uses the Files-11 file structure and assumes that all file-structured volumes are organized identically. The INITIALIZE command creates the Files-11 structure on disk or tape.

## INTRODUCTION TO RTEM-11

### 1.6.3 Multiuser or Single-User?

VAX/VMS systems are available to many simultaneous users. RT-11 is a single-user system, available to one user at a time. Most of the time you are using VAX/VMS, you will feel as though you are the only user. Since you are one of many active users, however, VAX/VMS provides protection facilities to prevent users from interfering with one another.

One of the device protections is the ALLOCATE command, already discussed. Under VAX/VMS, you must exit from RTEM-11 to allocate a device. The instructions in this document include this step.

### 1.6.4 Device Driver or Handler?

VAX/VMS includes device drivers for transmitting data between main memory and peripheral devices (for example, disks and line printers). A device driver performs functions that enable physical I/O operations.

RTEM-11 includes device handlers to perform I/O. RTEM-11 handlers issue host system directives that cause host system device drivers to perform physical I/O.

### 1.6.5 Device or Volume?

These terms are often used synonymously. This document identifies a device as a hardware unit such as a line printer, disk drive, or magtape drive. Device codes identify each device unit on a system. For example, the common device code for an RL02 disk in unit 1 is DL1:. This document identifies a volume as a mass storage medium that can be treated as host system or RTEM-11 file-structured data storage. For example, a diskette with structured data on it is a volume.

RT-11 and VAX/VMS use different device names for certain physical devices. VAX/VMS uses CSAl: for the console device, for example. On some VAX/VMS processors this device is an RX01; on others it is a TU58. RT-11 uses DX to refer to this device if it is an RX01, and DD if it is a TU58. See Section 2.6 for more information on this topic.

### 1.6.6 CTRL/C or CTRL/Y?

On RT-11, CTRL/C terminates job execution or cancels a command during processing. On VAX/VMS, CTRL/C cancels a keyboard command during processing or initiates the log-in sequence. CTRL/Y can also be used under VAX/VMS to cancel a keyboard command as well as to interrupt program execution. You can use CTRL/C on VAX/VMS the way you use it on RT-11. If CTRL/C is pressed to terminate a program that requires CTRL/Y, CTRL/C has the same effect as CTRL/Y and echoes as ^Y.

## INTRODUCTION TO RTEM-11

### 1.7 VAX/VMS DOCUMENTATION REFERENCES

The VAX-11 Information Directory and Index provides a summary of each document shipped with the current version of the VAX/VMS operating system. To help you locate information, an index is provided to direct you to the specific document containing that information.

The VAX/VMS Primer is a tutorial for new VAX/VMS users. It introduces the DIGITAL command language (DCL), file manipulation, program development, and elementary operating system concepts.

The VAX/VMS Command Language User's Guide describes the DIGITAL command language (DCL). It provides detailed reference information and examples of all commands available to users.



## CHAPTER 2

### RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

This chapter tells you how to start using RTEM-11. It describes the:

- RTEM-11 monitor
- System device
- Prompts and special function keys
- Start-up and shutdown procedures
- Start-up options
- Peripheral device support
- Restrictions on RT-11 features
- Command-line error messages

#### 2.1 RTEM-11 MONITOR

The RTEM-11 monitor is based on the RT-11 foreground/background (FB) monitor. The FB monitor accommodates two jobs that seem to run concurrently: a foreground job and a background job. Programs that run in the single-job environment, such as system utility programs and language processors, can run as background jobs in the foreground/background environment. Console input and output are independent functions for the foreground and background jobs.

The RTEM-11 FB monitor is a single-terminal version of the RT-11 FB multiterminal monitor. In the single-terminal system, foreground and background jobs share the console terminal. You cannot direct the foreground job to interact with another terminal, nor can you assign the console terminal to be an alternate terminal. However, the RTEM-11 monitor supports multiterminal programmed requests, and thus provides a development environment for multiterminal applications.

#### 2.2 RTEM-11 SYSTEM DEVICE

The RTEM-11 system device (SY:) is a virtual system device (the default) or a foreign volume system device. These are described in Sections 2.2.1 and 2.2.2 respectively.

## **RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES**

As in RT-11, the RTEM-11 system device is the device from which the system is bootstrapped. The default storage volume (DK:) is set initially to the system device. As in RT-11, if you assign DK to another device, that device becomes the default device and receives output not sent to the system device.

### **2.2.1 Virtual System Device**

The virtual system device is a pair of files on a Files-11 volume. To RTEM-11, the files appear to be a single physical device, hence they are termed a virtual device. Together, they provide a read-only shared area for files that all users may access, and a read/write private area for individual user file storage.

The shared area of the virtual system device contains directory entries and storage space for system files, utilities, handlers, and libraries. If your system manager installed RT-11 system programs on your RTEM-11 system device, they reside in the shared area. Only privileged users can alter the contents of the shared area. The shared area defaults to the file LB:[1,1]RT11SH.DSK on RSX-11 host systems and to SYS\$LIBRARY:RT11SH.DSK on VAX/VMS systems.

The private area of the virtual system device defaults to a read/write file named RT11PR.DSK.

All files in the shared area are read-only. If a shared file will be written to, it is placed in a section at the end of the shared area designated as the mark zone.

When you invoke RTEM-11, the system copies the files residing in the mark zone to a temporary read/write file in your default directory. Every time you access a file in the mark zone, you access the temporary file rather than the shared virtual device file.

When you exit from RTEM-11, the system deletes your temporary file, and the files in the mark zone of the shared area remain unchanged. Since all files in the mark zone have protected directory entries in the read-only shared directory, the mark zone files are protected from deletion. They are temporarily user-specific because they are copied to a user-owned temporary file.

The mark zone initially contains SWAP.SYS, IND.SAV, BAM.SYS, MFM.SYS, MTM.SYS, LDM.SYS, SLM.SYS, LSM.SYS and DUM.SYS (for all host systems), and MMM.SYS (for RSX-11 host systems). Your system manager may add other files.

### **2.2.2 Foreign Volume System Device**

You can use an RT-11 device, rather than the virtual system device, as your RTEM-11 system device. Because it is not in Files-11 format, an RT-11 volume is considered a foreign volume by the host system.

If you use an RT-11 device as your system device, it must contain the appropriate RTEM-11 system components. Table 2-1 lists the devices RTEM-11 supports and indicates which of them can serve as foreign volume system devices (see Section 2.6).



## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.3 RTEM-11 TERMINAL COMMUNICATION CONVENTIONS

You should be familiar with the prompt characters and special function keys used to control and communicate with RTEM-11.

#### 2.3.1 Prompt Characters

RTEM-11 uses the following characters and combinations to prompt for input from the terminal:

RTEM>	RTEM-11 job prompt
.	Keyboard monitor prompt
^	The prompt displayed when the console terminal is being used as an input file. Type a CTRL/Z to mark the end-of-file.
F>	Foreground job prompt
B>	Background job prompt
*	The asterisk is used by the command string interpreter (CSI) and the extended command string interpreter (ECSI) to prompt for input. With CSI, it is a prompt from an RT-11 system utility program. With ECSI, it is a prompt from an RTEM-11 utility program (FIP or JOAT). Type a line of specifications and options.

#### 2.3.2 Special Function Keys

The RTEM-11 special function keys operate as they do under RT-11 with a few exceptions. The following table describes the effect of special function keys under RSX-11, VAX/VMS, RT-11, and RTEM-11.

In the remainder of this chapter, the executing program is the user program or utility program currently running under RTEM-11.

Key	Function
RETURN	Terminates a line of input and advances the carriage or cursor to the first position of the next line.
ESC	RSX-11, VAX/VMS -- Terminates a line of input without moving the carriage or cursor. When used to terminate an MCR command, it suppresses the default MCR prompt. No echo.  RT-11, RTEM-11 -- Used to enter commands to EDIT and TECO.
RUBOUT or DELETE	Deletes the last character typed on the current line.

(Continued on next page)

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

TAB	Advances the cursor or printing position to the next tab stop. The system provides tab stops at every eight character positions on a line.
REPEAT	Repeats a key.
BREAK	RSX-11, VAX/VMS -- CTRL/U, echoes ^U. RT-11, RTEM-11 -- Ignored during normal system use.
LINE FEED	RSX-11, VAX/VMS -- Not a command terminator. RT-11, RTEM-11 -- Command terminator for certain system commands.
BACK SPACE	RSX-11, VAX/VMS -- Creates an invalid command at CLI level. RT-11, RTEM-11 -- Ignored during normal system use. CTRL/H, echoes ^H.
CTRL/A	RSX-11, VAX/VMS -- No function. RT-11 -- Used with display hardware. RTEM-11 -- Unsupported.
CTRL/B	RSX-11, VAX/VMS -- No function. RT-11, RTEM-11 -- Directs keyboard input to background job. Echoes B>.
CTRL/C	RSX-11 -- If typed as the first command on a line when no task is running, displays explicit prompt (MCR> or DCL>). If typed when a task is running from your terminal, gains the attention of MCR or DCL. You can type a single command and control reverts to the task. No echo.  VAX/VMS -- During command entry, cancels command processing. Before a terminal session, initiates log-in sequence. Certain system and user programs (such as RTEM-11) provide specific routines to respond to CTRL/C interrupts.  RT-11, RTEM-11 -- Terminates program execution and returns control to monitor. Echoes ^C.
CTRL/C CTRL/C	RSX-11, VAX/VMS -- Same effect as two CTRL/Cs. RT-11, RTEM-11 -- Aborts executing program regardless of status.
CTRL/E	RSX-11, VAX/VMS -- No function. RT-11 -- Used with display hardware to send terminal output to console and display screens. No echo. RTEM-11 -- Not supported.
CTRL/F	RSX-11, VAX/VMS -- No function. RT-11, RTEM-11 -- Directs keyboard input to foreground job. Echoes F>.

(Continued on next page)

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

CTRL/I Functions as a tab.

CTRL/K Performs a vertical tab by performing four line feeds.

CTRL/L Causes a form feed but does not perform paging.

CTRL/O Suppresses display of output at a terminal. Type CTRL/O again to resume output. Output sent to terminal between CTRL/O commands is lost.

CTRL/S CTRL/S stops display of output at your terminal until you type CTRL/Q to resume it. No terminal output is lost. No echo.

CTRL/R RSX-11, VAX/VMS -- Performs a carriage return and reprints the current line on your terminal, omitting any deleted characters, making the line easier to read. This function must be chosen during system generation of RSX-11M. It is always included in RSX-11M-PLUS. No echo.

RT-11, RTEM-11 -- No function.

CTRL/U Discards current line of terminal input if typed before a carriage return. Echoes ^U.

CTRL/X RSX-11, VAX/VMS -- Clears terminal type-ahead buffer and lets you type additional characters. The RSX-11M type-ahead buffer saves up to 36 characters. A bell rings for every character typed after the buffer is full (SYSGEN option for RSX-11M).

RT-11 -- EDIT command; ignore line. With system job support, causes system to prompt for a system job and then send all keyboard input to the system job specified.

RTEM-11 -- Same as RT-11, except no system job support.

CTRL/Y RSX-11 -- No function.

VAX/VMS -- Interrupts command or program execution and returns control to the command interpreter.

RT-11, RTEM-11 -- Used with SIPP to install code modifications.

CTRL/Z RSX-11 -- Exits from many RSX-11M system and user tasks and returns control to the command interpreter. Echoes ^Z.

VAX/VMS -- Signals end-of-file for data entered from the terminal.

RT-11, RTEM-11 -- If used with TT handler, terminates input. With SIPP, displays prompt. With PIP, used with /A to indicate end-of-file.

### 2.4 START-UP PROCEDURE

The start-up procedure varies according to your choice of system device: virtual system device (Section 2.4.1) or foreign volume system device (Section 2.4.2).

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.4.1 Start-up from Virtual System Device

The RTEM-11 monitor file and system device handler must reside on the virtual system device from which you wish to run RTEM-11. Your system manager is responsible for ensuring that these files are on the virtual system device.

You can invoke RTEM-11 in two ways. The first way uses the DCL RUN command as shown in the following command lines:

```
Under RSX-11: >RUN $RTEM
```

```
Under VAX/VMS: $ RUN SYSS$SYSTEM:RTEM
```

RTEM-11 prompts RTEM>. Type the start-up option /VS when you see the prompt (/VS indicates virtual system device).

```
RTEM>/VS
?RTEM-I-Creating default private file dev:[directory]RT11PR.DSK;0
```

The second way to invoke RTEM-11 uses a direct command line. This manual will use the direct command line, with the following format, to illustrate starting RTEM-11:

```
$ RTEM command string
```

Under RSX-11, this method works only if the system manager has installed the RTEM-11 task image. The task image is installed with the following privileged MCR command:

```
MCR>INS $RTEM
```

Under VAX/VMS, the RTEM-11 user must define the RTEM command with the following DCL command:

```
$ RTEM ::= $RTEM
```

After the required files are created, or located and loaded into memory, the keyboard monitor takes control and RTEM-11 displays its monitor prompt (.).

After taking control of the system, the RT-11 keyboard monitor attempts to execute commands from an indirect command file (STARTM.COM). You can use STARTM.COM to perform start-up tasks, such as displaying the time and date. After STARTM.COM terminates, the keyboard monitor prompts for input.

While you work from the virtual system device, files that you create or copy from other devices are stored in the private area. If you have device handler files in the private area, these are not automatically installed at start-up as they are in RT-11. You must install them yourself when necessary.

### 2.4.2 Start-up from Foreign Volume System Device

If you use an RT-11 foreign volume as your system device, the RTEM-11 monitor file (RTEMFB.SYS), SWAP.SYS, JOAT.SAV, and the device handler file for your system device must reside on that volume.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

You must allocate and mount the foreign volume before you invoke RTEM-11. After doing this, invoke RTEM-11 using the /RT option to indicate you are starting from an RT-11 volume.

```
$ RTEM DEV:/RT
```

The RT-11 keyboard monitor takes control of the system and attempts to execute commands from an indirect command file (STARTM.COM). You can use STARTM.COM to perform start-up tasks, such as assigning logical device names to physical devices. After STARTM.COM terminates, the keyboard monitor prompts for input.

See Section 2.5.8 for information on how to build a foreign volume system device for RTEM-11.

### 2.4.3 Exiting from RTEM-11

There are four ways to exit from RTEM-11 and return to the command interpreter. Two can be used by anyone running the program. Two can be used only by privileged users from a terminal not running the program.

#### Nonprivileged Exit

- The JOAT utility program provides the most common way to exit from RTEM-11. Use the JOAT command with the /E option to exit. JOAT prints a confirmation query and waits for you to respond Y or YES if you are sure that you want to exit from RTEM-11.

```
.R JOAT
*/E
?JOAT-I-/Exit RTEM-11; Are you sure? Y
$
```

The \$ prompt indicates you are back at the host system command level.

- If the RT-11 DUP.SAV program resides on your RTEM-11 system device, the RT-11 BOOT command may be used to exit RTEM-11. No confirmation query is printed for the BOOT command.

```
.BOOT SY:
$
```

The \$ prompt indicates you are back at the host system command level.

#### Privileged Exit

- On RSX-11, privileged users can halt the RTEM-11 process by issuing the MCR ABORT command:

```
MCR>ABO ...RTE
DCL>ABORT RTE
```

- On VAX/VMS, privileged users can halt the RTEM-11 process by issuing the DCL command STOP/ID=nnnn. See the VAX/VMS Command Language User's Guide for information on the STOP command.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

When you exit from RTEM-11, all devices are detached and all files, including files serving as RTEM-11 virtual devices, are closed. If you have used ALLOCATE or MOUNT to access volumes, use DEALLOCATE and DISMOUNT to free the volumes for other users.

### 2.5 RTEM-11 START-UP COMMAND OPTIONS

The RTEM-11 start-up command options let you override the job defaults, obtain help, and write-protect the system volume. The following table lists the options you can use with the start-up command line. Sections following the table describe the options in detail and give examples of each.

Option	Function
/[-]AB[:n]	Invokes RTEM-11 and provides an alternative method for exiting the RTEM-11 program by typing the abort character n. (See Section 2.5.1.)
/EX[:n]	Invokes RTEM-11 and extends the private area n blocks. (See Section 2.5.2.)
/HE	Displays information about RTEM-11 command line format and options. (See Section 2.5.3.)
/ID	Displays RTEM-11 version identifier. (See Section 2.5.4.)
/LP	Specifies device to be used as the RTEM-11 line printer spool device. (See Section 2.5.5.)
/PR[:n[:m]]	Invokes RTEM-11 from the virtual system device using specified file as private area. You can optionally create a private file of n blocks and m segments. (See Section 2.5.6.)
/RO	Invokes RTEM-11 and makes the system device read-only. (See Section 2.5.7.)
/RT	Invokes RTEM-11 and specifies an RT-11 directory-structured volume as foreign volume system device. (See Section 2.5.8.)
/SH	Invokes RTEM-11, specifying a Files-11 file as the shared area of the virtual system device. (See Section 2.5.9.)
/VS	Invokes RTEM-11 from default virtual system device. (See Section 2.5.10.)

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.5.1 Specifying an Abort Character Code (/[-]AB[:n])

The /AB option lets you abort the RTEM-11 program from the terminal involved, even if the RT-11 data structures or code have been destroyed. If RTEM-11 terminal service is still functional, you can specify an ASCII character for value n that, when encountered by RTEM-11, causes control to return to the host system command level. RTEM-11 then displays the following message:

?RTEM-U-Aborted by directive, CLI, or user

The default setting for this option is /-AB or AB disabled. If the option is disabled and the RTEM-11 data structures have been destroyed, you can terminate the RTEM-11 program only with the RSX-11 DCL ABORT command or the VAX/VMS DCL STOP command from another terminal.

If just /AB is specified, the default ASCII setting is 20 (octal), CTRL/P (echoes as ^P). During RTEM-11 installation, your system manager can change the default value for this option. Regardless of the default value, you can override it.

### 2.5.2 Extending the Private Area (/EX[:n])

Use the /EX option to extend the private area of the virtual system device. You cannot specify the /EX option without the /PR option. Do not combine /EX with /RO. See Chapter 6 for instructions on extending the shared area of the virtual system device.

The private area is extended by the number of blocks (n) you specify. If n is omitted, the extension is based on the current size of the private area. For example:

File Size Before Extension	Size of Default Extension
Up to 1024	256
1025 to 2048	512
2049 to 12288	1024
12289 or more	1536

You must compress the virtual system device (with SQUEEZE) after you invoke RTEM-11 with /EX.

The following example shows how to extend the default private area by 200 (decimal) blocks. After you invoke RTEM-11 with the /EX option, compress the virtual system device with the SQUEEZE command. The SQUEEZE command causes an exit to the host system at command level. You must invoke RTEM-11 again after extension of the private area.

```
$ RTEM/PR/EX:200.  
?RTEM-I-Extending private file DB0:[230,50]RT11PR.DSK;1  
?RTEM-I-Virtual device should be squeezed DB0:[230,50]RT11PR.DSK;1  
RTEM-11 (host type) V02.xx  
  
RT-11FB V05.xx  
  
.SQUEEZE SY:  
VS0:/Squeeze; Are you sure? Y  
  
$ RTEM/VS
```

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.5.3 Displaying HELP Text (/HE)

To list all the options that are valid with the start-up command, use the /HE option as follows:

```
$ RTEM /HE
```

### 2.5.4 Displaying Version Identifier (/ID)

To display the RTEM-11 version identifier, use the /ID option:

```
$ RTEM /ID
```

### 2.5.5 Changing Line Printer Spool Device (/LP)

The /LP option directs the output of the RTEM-11 line printer handler, LP or LS, to devices other than the default. The default device is SY for RSX-11M systems and LP0 for all other operating systems.

You may specify one of:

1. A Files-11 file-structured device and an optional directory (affects only the RTEM-11 LP handler):

```
Examples: $ RTEM DRB1:[WORRALL]/LP
          $ RTEM DL1:[200,200]/LP
```

2. A spooled device (affects only the RTEM-11 LP handler):

```
Example: $ RTEM LP4:/LP
```

Note: Spooled devices do not exist under RSX-11M.

3. Any record device (affects only the RTEM-11 LS handler):

```
Examples $ RTEM TT4:/LP
          $ RTEM TTB3:/LP
          $ RTEM LP4:/LP (Non-spooled line printer)
```

See Section 2.6.3 for a description of the RTEM-11 LP handler and the RTEM-11 LS handler.

### 2.5.6 Specifying Private Area of Virtual System Device (/PR[:n[:m]])

The /PR option invokes RTEM-11 from the virtual system device using the specified file as the private area. Specify the file with a host system file specification. If the file does not exist, it will be created. The default private area is the file RT11PR.DSK in your default directory.



## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

The /PR[:n] option is used with a host system file specification. The first optional value (n) indicates the size of the file in blocks. Use this value when you want to create a private area with a size other than the default set by your system manager. The value for n must be at least eight blocks, which the initial part of the directory needs for itself. This value cannot exceed the maximum number of available blocks, which can be calculated in three steps:

1. Get into RTEM-11
2. Attach the shared virtual system file with JOAT.
3. Use the RT-11 DIRECTORY/SUMMARY command.

The following example illustrates this procedure:

```
$ RTEM/VS
?RTEM-I-File not found; creating new private file DB0:[5,5]RT11PR.DSK;0

RTEM-11 (Host type) V02.xx

RT-11FB V05.xx
?KMON-F-File not found DK:STARTM.COM

.RUN SY:JOAT LB:[1,1]RT11SH/V/W           ;Under RSX-11
.RUN SY:JOAT SY$S$LIBRARY:RT11SH/V/W       ;Under VAX/VMS
?JOAT-I-Attached to VS1:
.DIR/SUM VS1:
14-Jun-82

    72 Files in segment 1
    72 Files in segment 2
    0 Files in segment 3

    3 Available segments, 3 in use

71 Files, 1744 blocks
0 Free blocks

.RUN SY:JOAT /E/Y
$
```

In the above example, 1744 blocks are already in use by the shared area of the virtual system device. To find the maximum number of blocks that are still usable for your private file, you subtract 1744 (blocks used) from 65535 (total blocks usable) and get 63791 (blocks left to use).

If you use the maximum number of blocks available for your private area of the virtual system device, and your system manager subsequently rebuilds and increases the size of the shared area, then you will no longer be able to use your private area. In other words, if the combined total number of blocks in use for the shared and the private areas of the virtual system device exceeds 65535, RTEM-11 will give the following error message when you try to call your private file:

```
?RTEM-F-Virtual system device too large filespec
```

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

To use your private area of the virtual system device, you will have to reenter RTEM-11 by specifying another private area of the virtual system device or by creating one. To do this, you must use the RTEM command line and a different file name from the one you have been using. For example:

```
$ RTEM filespec/PR
```

Then you attach the old file by using the JOAT utility /V command described in Section 4.2.11.

If the file specified with the /PR option is not found, RTEM-11 assumes you want to create a new private area. To create the private area, respond Y to the query:

```
?RTEM-I-File not found; creating new private file
dev:[directory]RT11PR.DSK;0 Are you sure?
```

You might choose to use the /PR option when you want a separate area for the development of BASIC-11/RT-11 or FORTRAN IV/RT-11 programs. For example, the shared area of your virtual system device might contain the FORTRAN IV compiler, object time system, and other system files essential to FORTRAN IV program development, and the private area might contain only FORTRAN IV user programs. The following command line invokes RTEM-11 using such a private area (the file RT11F4.DSK). The file resides in the current default directory.

```
$ RTEM RT11F4/PR
```

The /PR option can be combined with the /RO or /EX option.

The second value (m) is an optional number of directory segments. Use this when you require a value different from the default. The default number of directory segments is based on the creation size of the file as follows:

File Size In Blocks	Default Number Of Directory Segments
Up to 512	1
513 to 2048	4
2049 to 12288	16
12289 or more	31

### 2.5.7 Making System Device Read-Only (/RO)

To make the system device read-only, invoke RTEM-11 with the /RO option. If the system device is a foreign volume, the entire system device is write-protected. You cannot write to it after using /RO. If it is a virtual system device, the mark zone is not affected, but the shared and private areas are write-protected. The /RO option can be combined with the /PR, /SH, /VS, or /RT options. Do not combine /RO with the /EX option.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

You can invoke RTEM-11 with the /RO option by typing the following command:

```
$ RTEM /RO
```

A list of current device usage (displayed with the JOAT /L option) will show that the entire virtual system device is read-only. See Section 4.2.5 for a description of the JOAT /L option.

### 2.5.8 Specifying a Foreign Volume System Device (/RT)

The /RT option specifies an RT-11 directory-structured volume as the foreign volume system device. Table 2-1 indicates which RTEM-11 supported devices can serve as foreign volume system devices. Specify the device with the host system device name (for example, DKnn: for an RK05) as shown in Table 2-1.

To serve as an RTEM-11 system device, the RT-11 volume you specify must contain the RTEM-11 monitor file (RTEMFB.SYS), the swap file (SWAP.SYS), the RTEM-11 jack-of-all-trades utility (JOAT.SAV), and the device handler (xxM.SYS, where xx identifies the device). If you need to manipulate host system files while running RTEM-11 from the foreign device, the RT-11 volume must also contain the FIP.SAV program. If your RT-11 volume does not contain these files:

1. Allocate it using the host system ALLOCATE command.
2. Mount it using the host system MOUNT/FOREIGN command.
3. Invoke RTEM-11 from the virtual system device.
4. Attach your RT-11 volume using the JOAT utility /A command.
5. Copy the required files to the volume.

Thereafter, you can use the RT-11 volume as a system device for RTEM-11.

The /RT option can be combined with the /RO option.

The following example shows how the RTEM-11 files are added to a bootable RT-11 binary distribution volume residing in RL02 unit 1 on the host system:

#### Procedure

- ```
[1] $ MOUNT/NOSHARE/FOREIGN DL1:
[2] $ RTEM DL1:/RT
    ?RTEM-F-File not found DL1:RTEMFB.SYS
[3] $ RTEM/VS
    RTEM-11 (RSX-11M/+) V02.xx
    RT-11FB V05.xx
[4] .RUN SY:JOAT DL1:/A
```

# **RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES**

```

[5] .COPY SY:RTEFB.SYS,SY:SWAP.SYS,SY:RKM.SYS,SY:JOAT.SAV DL1:*.
    Files copied:
    SY:RTEFB.SYS to DL1:RTEFB.SYS
    ?PIP-E-Protected file already exists DL1:SWAP.SYS
    SY:RKM.SYS to DL1:RKM.SYS
    SY:JOAT.SAV to DL1:JOAT.SAV

[6] .COPY SY:FIP.SAV DL1:*.
    Files copied:
    SY:FIP.SAV to DL1:FIP.SAV

[7] .RUN SY:JOAT /E/Y

[8] $ RTEM DL1:/RT

    RTEM-11 (RSX-11M/+) V02.xx

    RT-11FB V05.xx

[9] .DIR *.SYS
    15-Mar-83
    TT .SYS 2P 12-Mar-83 LD .SYS 8P 12-Mar-83
    DX .SYS 3P 12-Mar-83 DY .SYS 4P 12-Mar-83
    DD .SYS 5P 12-Mar-83 PD .SYS 3P 12-Mar-83
    VM .SYS 3P 12-Mar-83 DT .SYS 3P 12-Mar-83
    RF .SYS 3P 12-Mar-83 DS .SYS 3P 12-Mar-83
    RK .SYS 3P 12-Mar-83 DL .SYS 4P 12-Mar-83
    RT11SJ.SYS 73P 12-Mar-83 RT11FB.SYS 86P 12-Mar-83
    DU .SYS 4P 12-Mar-83 DP .SYS 3P 12-Mar-83
    DM .SYS 5P 12-Mar-83 MT .SYS 9P 12-Mar-83
    MM .SYS 9P 12-Mar-83 MS .SYS 10P 12-Mar-83
    CT .SYS 6P 12-Mar-83 LP .SYS 2P 12-Mar-83
    LS .SYS 2P 12-Mar-83 PC .SYS 2P 12-Mar-83
    CR .SYS 3P 12-Mar-83 NL .SYS 2P 12-Mar-83
    RT11AI.SYS 73P 12-Mar-83 RT11XM.SYS 97P 12-Mar-83
    LDX .SYS 8P 12-Mar-83 DXX .SYS 4P 12-Mar-83
    DYX .SYS 4P 12-Mar-83 DDX .SYS 5P 12-Mar-83
    VMX .SYS 2P 12-Mar-83 RKX .SYS 3P 12-Mar-83
    DLX .SYS 5P 12-Mar-83 DUX .SYS 4P 12-Mar-83
    DMX .SYS 5P 12-Mar-83 MTX .SYS 9P 12-Mar-83
    MMX .SYS 10P 12-Mar-83 MSX .SYS 11P 12-Mar-83
    LPX .SYS 2P 12-Mar-83 LSX .SYS 3P 12-Mar-83
    NLX .SYS 2P 12-Mar-83 MTHD .SYS 4P 12-Mar-83
    MMHD .SYS 4P 12-Mar-83 MSHD .SYS 5P 12-Mar-83
    RT11BL.SYS 71P 12-Mar-83 SL .SYS 13P 12-Mar-83
    SLX .SYS 16P 12-Mar-83 RKM .SYS 3P 14-Mar-83
    SWAP .SYS 26P 12-Mar-83 RTEFB.SYS 88P 14-Mar-83
    52 Files, 737 Blocks
    532 Free blocks

[10] .RUN SY:JOAT /E/Y
    $
  
```

## **Explanation**

- [1] The user mounts the RT-11 volume using the host system mount command.
- [2] The user attempts to use the RT-11 volume as an RTEM-11 system device, without first copying the required files to the volume. An error message results.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

- [3] The user enters RTEM-11 using the virtual system device start-up mode.
- [4] The user attaches the RT-11 volume using the JOAT utilities /A command.
- [5] The user copies the required RTEM-11 system files to the RT-11 volume. The error copying SWAP.SYS occurs because it was already present on the user's RT-11 volume.
- [6] The user also copies the RTEM-11 utility FIP.SAV to the RT-11 volume.
- [7] The user exits RTEM-11 using the JOAT utilities /E command.
- [8] The user enters RTEM-11 using the RT-11 format volume in DL1: as the system device.
- [9] The user takes a directory of all the system files.
- [10] The user exits RTEM-11 using the JOAT utilities /E command.

### 2.5.9 Specifying the Shared Area (/SH)

The /SH option specifies a Files-11 file to be used as the shared area of the virtual system device. The default shared area is the file LB:[1,1]RT11SH.DSK on RSX-11 systems and SYSS\$LIBRARY:RT11SH.DSK on VAX/VMS systems. If you do not specify a file type, the default type is SYS.

RTEM-11 lets you create virtual system devices for specific purposes, such as FORTRAN IV development. For example, you can create a private area that contains all your FORTRAN IV user programs and a shared area that contains the RTEM-11 monitor and handlers, necessary utilities, FORTRAN IV compiler and object time system, and assorted libraries.

The following command invokes RTEM-11 specifying a FORTRAN IV-specific virtual system device:

```
$ RTEM RTSHF4/SH,RTPRF4/PR
```

The first file is RTSHF4.DSK in your default directory. It is specified as the shared area of the virtual system device with the /SH option. The second file is RTPRF4.DSK in the same directory. It is specified as the private area of the virtual system device with the /PR option.

### 2.5.10 Invoking RTEM-11 from Default Virtual System Device (/VS)

The RTEM-11 monitor file and system device handler must reside on the virtual system device before you invoke the program.

When you invoke RTEM-11 from a virtual system device, RTEM-11 opens the shared and private areas and copies the mark zone to a temporary file in your directory.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

The first time you invoke RTEM-11 from the default virtual system device, RTEM-11 creates a private file storage area for you. RTEM-11 displays the message ?RTEM-I-Creating default private file dev:[directory]RT11PR.DSK;0 to inform you of this.

The virtual system device is unit 0 of the virtual device set (VS0:).

To invoke RTEM-11 from the default virtual system device, type:

```
$ RTEM /VS
```

The /VS option cannot be combined with the /RT option. The /VS option is ignored if it is combined with the /PR or the /SH option.

### 2.6 PERIPHERAL DEVICE NAMES AND USAGE

The following sections describe host system devices that are supported by RTEM-11 as foreign devices. Some devices supported by RT-11 are not supported by RTEM-11. Section 2.6.1 summarizes RTEM-11 device support.

#### 2.6.1 Foreign Devices Supported by RTEM-11

Table 2-1 lists the physical names of host devices supported by RTEM-11 running under RSX-11 or VAX/VMS. The following information is supplied:

##### Device Name

This is the host system's name for the foreign device. This name is used initially by an RTEM-11 user to attach or boot the foreign device. The variable nn indicates one of the unit numbers 0 through 77 on an RSX-11 host or A0 through F7 on a VAX/VMS host.

##### RT-11 Name

This is the RT-11 device name for the foreign device. RT-11 programs use this name to refer to the host physical device. The variable n may be one of the unit numbers 0 through 7. In some cases, the host device name is not the same as the RT-11 device name. These differences are discussed in Section 2.6.2.

##### Host

Not all devices are supported by all RTEM-11 host systems. This column shows which host system supports each device. An entry of All indicates that RSX-11 and VAX/VMS support that device.

##### System Device

This indicates whether or not you can use the host device as an RTEM-11 foreign system device. If Yes, you can boot the device as your system volume using the RTEM-11 command line option /RT (see Section 2.5.8). If No, you can use the device only as a data device, by attaching it using the host device name with the JOAT /A command described in Chapter 4.

# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

## Device Type

This column shows the hardware name of the device.

Devices DU, MF, MM and MT include RT-11 SET options. These options and their default values are listed in Table 2-2.

When building a shared virtual system device file, JOAT copies all RTEM-11 handlers with SET options into the read/write mark zone. The SET option defaults in effect at that time will be in effect each time a user starts RTEM-11 using that shared virtual system device file.

Table 2-1  
Foreign Devices Supported by RTEM-11

| Device Name | RT-11 Name   | Host    | System Device | Device Type                         |
|-------------|--------------|---------|---------------|-------------------------------------|
| *           | BA:          | All     | No            | RT-11 batch handler                 |
| CSnn:       | DDn:<br>DXn: | VAX/VMS | No<br>Yes     | TU58 DEctape II<br>RX01 disk        |
| DDnn:       | DDn:         | All     | No            | TU58 DEctape II                     |
| DKnn:       | RKn:         | RSX-11  | Yes           | RK05 disk                           |
| DLnh:       | DLn:         | All     | Yes           | RL01, RL02 disk                     |
| DMnn:       | DMn:         | All     | Yes           | RK06, RK07 disk                     |
| DPnn:       | DPn:<br>DQn: | RSX-11  | Yes<br>Yes    | RP02, RP03 disk                     |
| DQnn:       | DLn:         | VAX/VMS | Yes           | RL02 disk                           |
| DSnn:       | DSn:         | RSX-11  | Yes           | RS03, RS04 disk                     |
| DTnn:       | DTn:         | RSX-11  | Yes           | DEctape                             |
| DUnn:       | DUn:         | All     | Yes           | MSCP class disks RA80,<br>RA81, ... |
| DXnn:       | DXn:         | RSX-11  | Yes           | RX01 diskette                       |
| DYnn:       | DYn:         | RSX-11  | Yes           | RX02 diskette                       |
| *           | LDn:         | All     | No            | RT-11 logical disk handler          |
| LP0:        | LP:          | All     | No            | Line printer                        |
| LP0:        | LS:          | All     | No            | Line printer                        |
| MFnn:       | MFn:         | All     | No            | TU78 magtape                        |
| MMnn:       | MMn:         | RSX-11  | No            | TE16/TU16/45/77/79<br>magtape       |

(Continued on next page)

# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Table 2-1 (Cont.)  
Foreign Devices Supported by RTEM-11

| Device Name | RT-11 Name | Host | System Device | Device Type                                                                       |
|-------------|------------|------|---------------|-----------------------------------------------------------------------------------|
| MSnn:       | MSn:       | All  | No            | TS11 or TSV05 magtape drive                                                       |
| MTnn:       | MTh:       | All  | No            | TU/TE10 tape drive under RSX-11 or TE16/TU16/45/77/78 magtape drive under VAX/VMS |
| NL0:        | NL:        | All  | No            | Null device                                                                       |
| *           | SL:        | All  | No            | RT-11 single-line editor                                                          |

\* The handler does not access host system devices and therefore has no equivalent host system device name.

Table 2-2  
SET Options for RTEM-11 Devices

| Permanent Name of Device | Set Option | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DUn:                     | PART=x     | Defines partition of a disk on which device unit n resides. Variable x is an integer in the range 0-266, depending on size of disk device (each partition is 64K blocks). Default for x is 0. See the <u>RT-11 Software Support Manual</u> for more information on MSCP disk partitioning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| LD:                      | CLEAN      | Verifies and corrects, if necessary, all current logical disk assignments by checking them against the files on volumes that are mounted. This option is useful if you have moved or removed files on a volume, or have removed a volume from a device. If a logical disk file has been moved, the new location is noted so you can continue to use that logical disk. If you have deleted a logical disk or the volume containing a logical disk file is no longer mounted, the logical disk assignment is disconnected. For a volume you have removed, the disconnect is only temporary. You can reestablish the assignment when you remount the volume by using the SET LD CLEAN command again. The keyboard commands SQUEEZE and BOOT automatically perform the SET LD CLEAN operation. |

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# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Table 2-2 (Cont.)  
SET Options for RTEM-11 Devices

| Permanent<br>Name of<br>Device | Set<br>Option | Description                                                                                                                                                                                                                                                          |
|--------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LDn:                           | WRITE         | Used during disk subsetting; defines logical disk unit n as being write-enabled (read/write allowed). The value n must be an integer in the range 0 through 7.                                                                                                       |
| LDn:                           | NOWRITE       | Used during disk subsetting; defines logical disk unit n as being write-locked (read-only access allowed). The value n must be an integer in the range 0 through 7.                                                                                                  |
| LS:                            | CR            | Sends carriage returns to printer. To allow overstriking on the printer, use CR (the default) for any FORTRAN program that uses formatted input and output. Also use CR for any LS11 or LP05 line printer to prevent loss of the last line in the buffer.            |
| LS:                            | NOCR          | Prevents handler from sending carriage returns to the printer. This setting can produce significant increases in printing speed on some line printers, where the printer controller causes a line feed to perform the functions of a carriage return. Default is CR. |
| LS:                            | CTRL          | Passes all characters including nonprinting control characters to the printer. Use CTRL to pass the bell character to the LA180 printing terminal. Default is NOCTRL.                                                                                                |
| LS:                            | NOCTRL        | Ignores nonprinting control characters. This is the default.                                                                                                                                                                                                         |
| LS:                            | FORM          | Declares that line printer has hardware form feeds, causing line printer handler to send form feeds to the controller. Line printer handler sends the form feed character to printer each time handler encounters a form feed. This is the default.                  |

(Continued on next page)

# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Table 2-2 (Cont.)  
SET Options for RTEM-11 Devices

| Permanent<br>Name of<br>Device | Set<br>Option | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LS:                            | NOFORM        | Causes line printer handler to simulate hardware form feeds by sending one or more line feeds to printer. Use the LENGTH=x setting and position paper at top of form (that is, at page perforation) before you start to use the printer. NOFORM is useful for preprinted forms that have nonstandard lengths. You must use this setting if your printer does not accommodate form feeds. FORM is default setting.                                                      |
| LS:                            | FORMØ         | Issues form feed before request to print block Ø. This is the default.                                                                                                                                                                                                                                                                                                                                                                                                 |
| LS:                            | NOFORMØ       | Turns off FORMØ (the default).                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| LS:                            | LC            | Lets line printer handler send lowercase characters to printer. Use this condition if printer has lowercase character set. This is the default.                                                                                                                                                                                                                                                                                                                        |
| LS:                            | NOLC          | Translates lowercase characters to uppercase before printing. The default is LC.                                                                                                                                                                                                                                                                                                                                                                                       |
| LS:                            | LENGTH=x      | Causes the printer to use x as number of lines per page. The default is 66. Use this option with NOFORM and SKIP=x settings.                                                                                                                                                                                                                                                                                                                                           |
| LS:                            | SKIP=x        | Causes line printer handler to send a form feed to printer when it comes within x lines of the bottom of the page. Use this setting to prevent the printer from printing over page perforations. The value for x should be an integer from Ø to maximum number of lines on the paper. If you set SKIP=Ø, the handler sends lines to the printer regardless of the position of paper. When you use this setting, you must also use LENGTH=x setting. Default is SKIP=Ø. |
| LS:                            | TAB           | Lets line printer handler send tab characters to printer. Default is NOTAB.                                                                                                                                                                                                                                                                                                                                                                                            |
| LS:                            | NOTAB         | Expands tabs by sending multiple spaces to printer. This is the default.                                                                                                                                                                                                                                                                                                                                                                                               |

(Continued on next page)

# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Table 2-2 (Cont.)  
SET Options for RTEM-11 Devices

| Permanent<br>Name of<br>Device | Set<br>Option | Description                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MFn:/MMn:/MTn:                 | DENSE=x       | Sets density for 9-track tape handler. Do not alter the density setting within a volume. Valid density settings for 9-track tape are:<br><br>800 -- Sets 800 bits/in. Default for MT and MM handlers.<br>1600 -- Sets 1600 bits/in, parity odd. Default for MF handler.<br>6250 -- Sets 6250 bits/in, parity odd. Valid for MF handler only.                                              |
| MFn:/MMn:/MTn:                 | ODDPAR        | Sets parity to odd for 9-track tape. DIGITAL recommends this setting (the default).                                                                                                                                                                                                                                                                                                       |
| MFn:/MMn:/MTn:                 | NOODDPAR      | Sets parity to even for 9-track tape. DIGITAL does not recommend this setting for normal operation, and provides it only for compatibility with other systems.                                                                                                                                                                                                                            |
| SL:                            | ASK           | Lets single-line editor determine type of terminal you are using, so SL can use proper escape sequences. SL prints on console the type of terminal you are using and the type of support SL will provide. If SL does not support the terminal, SL prints an error message.                                                                                                                |
| SL:                            | LEARN         | Helps you learn to use the single-line editor by letting you lock the help display on the top half of screen. You can use the bottom of screen to type command lines and display console output. After you issue the commands SET SL ON and SET SL LEARN, type the PF2 key to display the help frame and lock it on the screen. This option is valid for VT100-compatible terminals only. |
| SL:                            | NOLEARN       | Unlocks help display and lets it scroll off the screen so you can use the entire screen to display console input and output. This is the default. SET SL OFF performs an automatic SET SL NOLEARN.                                                                                                                                                                                        |
| SL:                            | ON            | Loads and enables the single-line editor.                                                                                                                                                                                                                                                                                                                                                 |
| SL:                            | OFF           | Unloads and disables the single-line editor.                                                                                                                                                                                                                                                                                                                                              |

(Continued on next page)

# RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Table 2-2 (Cont.)  
SET Options for RTEM-11 Devices

| Permanent<br>Name of<br>Device | Set<br>Option | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SL:                            | TTYIN         | Lets you edit responses to prompts printed by system utilities. When SET SL TTYIN is enabled, the prompt prints on one line and your response appears on the following line. (This option allows SL to intercept and edit input requests from .TTYIN. SL always intercepts and edits input requests from .CSIGEN, .CSISPC and .GTLIN).                                                                                                                                                                                                     |
| SL:                            | NOTTYIN       | Disables your ability to edit responses to prompts printed by system utilities. When SET SL NOTTYIN is enabled, the prompt and your response appear on the same line. (This option prevents SL from intercepting and editing input requests from .TTYIN. SL still intercepts and edits input requests from .CSIGEN, .CSISPC and .GTLIN). This is the default.                                                                                                                                                                              |
| SL:                            | VTxxx         | <p>Tells the single-line editor which type of terminal you are using, so SL can send the proper escape sequences. DIGITAL recommends that you use SET SL ASK instead of this option.</p> <p>This option supports the following terminals:</p> <p>VT52 (SET SL VT52)<br/> VT62 (SET SL VT62)<br/> VT100 (SET SL VT100)<br/> VT101 (SET SL VT101)<br/> VT102 (SET SL VT102)</p> <p>The default setting is SET SL VT100.</p>                                                                                                                  |
| SL:                            | WIDTH=x       | <p>Allows you to set the width of the terminal. The variable x represents the maximum number of characters on a single line. The maximum allowable width of a line you can input at the terminal is:</p> <p>n - (width of prompt string including monitor prompt) - 1</p> <p>For example, if you issue SET SL WIDTH=50, and the prompt consists of only the keyboard monitor prompt (.), then the maximum number of characters you can type as input on one line is:</p> <p>50 - 1 - 1 = 48 characters</p> <p>The default for x is 79.</p> |

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.6.2. Differences in Device Naming Conventions

Some host device names are different from their equivalent RT-11 device names. Always use the host device name when specifying command lines to RTEM-11 or when attaching a host device by means of the JOAT /A command (JOAT is described in Chapter 4).

When RTEM-11 or JOAT detects a device naming conflict during an attach operation, an informational message is printed. An example of this is the RSX-11 host device DK. The RT-11 name for this device is RK. The following example displays both RTEM-11's and JOAT's reaction to using the host device name.

```
>RUN $RTEM
RTEM> DK1:/RT
?RTEM-I-Host device DK1: attached as RT-11 device RK1:

RTEM-11 V02.xx

RT-11FB V05.xx

.DIRECTORY RK1:

SWAP .SYS 25P 21-Feb-82 PIP .SAV 23 21-Feb-82
MTHD .SYS 4P 21-Jul-82 MT .SYS 9P 21-Jul-82
.
.
GRAPH .FOR 2 15-Aug-82 DEMOX1.LST 9 07-Aug-82
RTSJ .MAP 16P 02-Aug-82 DEMOBG.OBJ 1 13-Jun-82
202 Files, 4333 Blocks
429 Free blocks

.R JOAT
*DK2:/A
?JOAT-I-Host device DK2: attached as RT-11 device RK2:
*/L
RK1: RW (DK1:)
RK2: RW (DK2:)
*RK2:/D/Y
*^C
```

Note that while the host device name must be used to attach foreign devices, the RT-11 device name must be used to detach them.

### 2.6.3 Line Printer Support

RTEM-11 uses two device handlers to support the RT-11 line printer interface. The first device handler (LP), is a file-structured handler. It takes the data written to the RT-11 LP device, and stores it in a host system file for spooling by the host system's queue manager. The second device handler (LS), is a non-file-structured handler. It takes the data written to the RT-11 LS device, and transmits it directly to a host system terminal or line printer.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

Which handler you use depends on your host system configuration. If your system runs the normal queue manager package supplied by DIGITAL, then the LP handler will always work. If your system does not run the queue manager package, you can use the LS handler to do I/O directly to a terminal or line printer.

When you enter RTEM-11, the LP handler or the LS handler (but not both) will be installed in the running RT-11 system, depending on the device type specified by the dev:/LP command line option.

The default device for the dev:/LP option depends on the host system. For RSX-11M systems the default device is SY:[UIC]. This means that the RT-11 LP device will always be installed by default on an RSX-11M system. For all other host systems, the default device is LP0. This means that either the RT-11 LP or LS device handler could be installed, depending on the pointing characteristics of device LP0. If LP0 points at a file-structured or spooled device, the LP handler is installed. If LP0 points directly at a line printer or terminal, the LS handler is installed.

Because the RTEM-11 LP handler uses the host system's queue manager for spooling, it has no SET options. The RTEM-11 LS handler supports the standard line printer options described in Table 2-2.

### 2.6.4 RP02/RP03 Device Support on RSX-11

RTEM-11's support of RP02 and RP03 devices differs from RT-11's support of these devices, as described in the following paragraphs.

The RT-11 file structure can accommodate a maximum of 65536 (decimal) blocks. The RP02 disk contains 40000 (decimal) blocks, and RT-11 treats it as a single logical unit. The RP03 disk contains 80000 blocks, which RT-11 treats as two logical units of 40000 blocks each. That is, an RP03 appears to be two RP02s.

An RP03 disk on physical unit *n* is identified as logical units DP<sub>*n*</sub> and DP<sub>*n*+4</sub>. For example, an RP03 in unit 0 is DP0 and DP4, and an RP03 in unit 1 is DP1 and DP5. Each logical unit has its own directory and data space. RT-11 can support up to eight RP02s or four RP03s. You can mix RP02s and RP03s, as long as the total number of units (physical drives) on the system does not exceed four.

RSX-11 supports up to eight units of a combination of RP02s and RP03s. This additional support of physical drives allows RTEM-11 to support four additional units or up to eight units of a combination of RP02s and RP03s. RTEM-11 uses the DQn handler to accommodate the additional four units.

If you have a mixture of RP02s and RP03s, four additional units are available. RTEM-11 device names DP0 through DP3 refer to RSX-11 DP0 through DP3. RTEM-11 device names DQ0 through DQ3 refer to RSX-11 device units DP4 through DP7. As in RT-11, if any of these drives are RP03s, the device names refer to the first half of the volume only. In this case, RTEM-11 DP4 through DP7 and DQ4 through DQ7 are used to indicate the second half of their respective RP03s.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

If you have RP02s only, you can access eight units as in RT-11, although they are addressed differently. Refer to the first four units as DP0 through DP3, and to the second four as DQ0 through DQ3. The following table lists examples of RP02/RP03 usage.

| Physical Unit  | RT-11 Logical Unit | RTEM-11 Logical Unit |
|----------------|--------------------|----------------------|
| RP02 in unit 0 | DP0                | DP0                  |
| RP03 in unit 0 | DP0 and DP4        | DP0 and DP4          |
| RP02 in unit 3 | DP3                | DP3                  |
| RP03 in unit 2 | DP2 and DP6        | DP2 and DP6          |
| RP02 in unit 7 | DP7                | DP7                  |
| RP03 in unit 5 | No support         | DQ1 and DQ5          |

### 2.7 RESTRICTIONS ON USING RT-11 FEATURES

The following sections summarize restrictions imposed on RT-11 features by RTEM-11.

#### 2.7.1 Using DATE and TIME Commands

You cannot use the DATE and TIME commands to change the RTEM-11 values, because these values are obtained from the host system. The date and time are automatically initialized when you invoke RTEM-11. The correct date and time appear in volume directories and listings produced by the various language processors and utility programs.

You can obtain the date and time at your terminal by typing the RT-11 DATE and TIME commands.

#### 2.7.2 Using COPY/BOOT Command

The COPY/BOOT command is not restricted under RTEM-11; however, you should carefully consider its effects before you use it.

Under RT-11, COPY/BOOT copies the bootstrap information from a monitor and handler file to blocks 0 through 5 of a direct-access volume, permitting you to use that volume as a system volume. Under RTEM-11, you can use COPY/BOOT for the same purpose.

On virtual devices, COPY/BOOT copies the bootstrap information from the specified monitor and handler files, which reside in the shared area, to blocks 0 through 5 of the private area. The monitor and system handler files must reside in the shared area. You can rename the monitor file and copy the bootstrap blocks to a private area as long as the monitor file resides in the shared area.

RTEM-11 does not require you to alter the bootstrap blocks of a foreign system volume. You can use a bootable RT-11 volume as an RTEM-11 system volume and subsequently boot RT-11 as a stand-alone system from the same volume. The only requirement in this case is that the RT-11 volume contain an RTEM-11 monitor and system device handler as well as the RT-11 monitor and handlers.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

If you use COPY/BOOT to copy the bootstrap of the RTEM-11 monitor, RTEMFB.SYS, to an RT-11 directory-structured foreign volume, you will not be able to boot the volume as a stand-alone RT-11 system.

If you use COPY/BOOT to copy the bootstrap of an RT-11 monitor file to a virtual device, you will not be able to invoke RTEM-11 from the virtual device.

### 2.7.3 Using COPY/DEVICE Command

After using the monitor COPY/DEVICE command to copy a device to a virtual device, you must use JOAT (/U) to reformat the virtual device. After using the /U option, you must compress the volume with SQUEEZE.

Section 4.2.10 describes how to use JOAT (/U) to reformat a virtual device copied from another device.

### 2.7.4 Debugging with Virtual Debugging Technique (VDT)

Instead of using ODT (on-line debugging technique) to debug programs, use VDT (virtual debugging technique). Use VDT.OBJ the same way you use ODT.OBJ; link it with the program you want to debug. The transfer address is 0.ODT, which is the same as the transfer address for ODT.

The command syntax for VDT is the same as the syntax for ODT. Refer to the RT-11 System Utilities Manual for instructions on using ODT. VDT is part of the RT-11 distribution kit.

### 2.7.5 Summary of Restrictions

RTEM-11 supports nearly every feature supported under the RT-11 multiterminal FB monitor. This section lists unsupported and restricted RT-11 features.

In addition to unsupported and restricted RT-11 features, two features operate differently under RTEM-11 and RT-11:

Under RTEM-11, the BATCH program runs from a read-only virtual system device. Under RT-11, the system volume must be read/write.

Under RTEM-11, compressing the virtual system device with the SQUEEZE command causes an exit to the host system at command level.

The following subsections summarize unsupported and restricted keyboard monitor commands, utility programs, programmed requests, devices, and terminal control characters.



## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.7.5.1 Keyboard Monitor Commands -

| Unsupported Monitor Command |              | Comments                                                                                                                                                                                        |
|-----------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FORMAT                      |              | Requires direct access to I/O page. Use host system utilities to format.                                                                                                                        |
| GT                          |              | Graphics display hardware is not supported.                                                                                                                                                     |
| SRUN                        |              | System jobs are not supported. Two DIGITAL-supplied system jobs are Error Logger and Queue program. Queue program can be run as a foreground job.                                               |
| Restricted Monitor Command  |              | Restricted Option                                                                                                                                                                               |
| BOOT                        |              | Returns user to host system at command level.                                                                                                                                                   |
| COPY                        | /TOPS        | Requires direct access to I/O page.                                                                                                                                                             |
|                             | /INTERCHANGE | Requires physical I/O privilege, RTEM-11/VAX only.                                                                                                                                              |
| DATE                        | dd-mmm-yy    | Host operating system maintains date and time, therefore you cannot set date under RTEM-11.                                                                                                     |
| DELETE                      | /INTERCHANGE | Requires physical I/O privilege, RTEM-11/VAX only.                                                                                                                                              |
| DIRECTORY                   | /TOPS        | Requires direct access to I/O page.                                                                                                                                                             |
|                             | /INTERCHANGE | Requires physical I/O privilege, RTEM-11/VAX only.                                                                                                                                              |
| FRUN                        |              | If overlayed .REL file resides in a shared virtual device file, it must be placed in the mark zone because this type of .REL file must reside in a read/write device in order for FRUN to work. |
|                             | /NAME        | Applies to monitors that have system job support.                                                                                                                                               |
|                             | /TERMINAL    | Only the console terminal can be specified under RTEM-11.                                                                                                                                       |

(Continued on next page)

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

|            |              |                                                                                                                                                                                                                                                                                                                                   |
|------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INITIALIZE | SY:          | You can't initialize virtual system device.                                                                                                                                                                                                                                                                                       |
|            | /INTERCHANGE | Requires physical I/O privilege, RTEM-11/VAX only.                                                                                                                                                                                                                                                                                |
| SET        | Any handler  | <p>You cannot use SET commands to modify a handler file residing in the read-only shared area of a virtual system device. The handler device must reside in the mark zone.</p> <p>All distributed RTEM-11 handlers that have SET commands are placed in read/write mark zone by JOAT when a shared virtual device is created.</p> |
| SHOW       | ERRORS       | You cannot show error statistics unless you have error logging support in your monitor. RTEM-11 does not support error logging.                                                                                                                                                                                                   |
| TIME       |              | Host operating system maintains time, therefore you cannot set time under RTEM-11.                                                                                                                                                                                                                                                |

### 2.7.5.2 RT-11 Utility Programs -

| Unsupported<br>Utility Program | Option   | Comments                                                |
|--------------------------------|----------|---------------------------------------------------------|
| ERROUT                         |          | RTEM-11 does not support error logging.                 |
| FORMAT                         |          | Requires direct access to I/O page.                     |
| MDUP                           |          | Requires direct access to I/O page.                     |
| ODT                            |          | Use VDT instead of ODT.                                 |
| DUP                            | /O       | Returns user to host system at command level.           |
| FILEX                          | /T       | Requires direct access to I/O page.                     |
|                                | /U       | Requires physical I/O privilege, RTEM-11/VAX only.      |
| LINK                           | /V:n[:m] | Creates .SAV images that cannot be executed on RTEM-11. |

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.7.5.3 RT-11 Programmed Requests -

| Unsupported Request | Comments                                                                                                      |
|---------------------|---------------------------------------------------------------------------------------------------------------|
| .CRAW               | XM monitor request.                                                                                           |
| .CRRG               | XM monitor request.                                                                                           |
| .CTIMIO             | SYSGEN option not enabled in RTEM-11.                                                                         |
| .ELAW               | XM monitor request.                                                                                           |
| .ELRG               | XM monitor request.                                                                                           |
| .GMCX               | XM monitor request.                                                                                           |
| .MAP                | XM monitor request.                                                                                           |
| .RDBBK              | XM monitor request.                                                                                           |
| .RDBDF              | XM monitor request.                                                                                           |
| .SDTTM              | You cannot set date or time under RTEM-11.                                                                    |
| .TIMIO              | SYSGEN option not enabled in RTEM-11.                                                                         |
| .UNMAP              | XM monitor request.                                                                                           |
| .WDBBK              | XM monitor request.                                                                                           |
| .WDBDF              | XM monitor request.                                                                                           |
| .CMKT               | Does not return number of ticks remaining in request; returns 0.                                              |
| .CNTXSW             | Do not specify I/O page locations.                                                                            |
| .DEVICE             | Do not specify I/O page locations.                                                                            |
| .DRxxx              | Device handlers with these requests can be used only with RT-11.                                              |
| .MTxxx              | Single terminal only (console).                                                                               |
| .MTSET              | Hardware characteristics cannot be set.                                                                       |
| .PROTECT            | Protects vector pair in 0-476. Not useful under RTEM-11 because programs cannot directly access I/O devices.  |
| .SPFUN              | Supported if corresponding function is available through host operating system device handler for the device. |

(Continued on next page)

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

|            |                                                                                                                |
|------------|----------------------------------------------------------------------------------------------------------------|
| .TTINR     | Use with caution. Causes RTEM-11 to become compute-bound which degrades host operating system response time.   |
| .UNPROTECT | Unprotects vector pair in 0-476. Not useful under RTEM-11 because programs cannot directly access I/O devices. |

### 2.7.5.4 Unsupported RT-11 Devices -

| Permanent Name | Device                                                             |
|----------------|--------------------------------------------------------------------|
| CR:            | CR11/CM11 card reader.                                             |
| CT:            | TAl1 cassette.                                                     |
| EL:            | Error logging handler.                                             |
| PC:            | PC11 high-speed paper tape reader/punch.                           |
| PD:            | Mass storage volume for PDT-130/150 intelligent terminal.          |
| RF:            | RF11 fixed-head disk drive.                                        |
| VM:            | Virtual memory handler.                                            |
| XTn:           | Down-line load handler; used with MRRT-11 (memory-resident RT-11). |
| SP:            | Spooling handler.                                                  |
| XL:            | Communications handler.                                            |
| XC:            | Communications handler, Professional 300 series.                   |
| PI:            | Professional interface handler.                                    |

### 2.7.5.5 Unsupported Control Characters -

| Control Character | Comments          |
|-------------------|-------------------|
| CTRL/A            | Display hardware. |
| CTRL/E            | Display hardware. |
| CTRL/X            | System jobs.      |

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### 2.8 COMMAND-LINE ERROR MESSAGES

This section lists the error messages produced by the RTEM-11 bootstrap program and by the RTEM-11 monitor bootstrap (BOOT).

Several messages describe error conditions detected by the hardware. These errors are described in the RT-11 System Message Manual.

Some error messages are followed by a numeric FCS or DIRECTIVE error code value. This value identifies the cause of the error. If your system includes the file LB:[1,2]QIOSYM.MSG, RTEM-11 will also provide error text that describes the error. This file is distributed on all host operating systems. If your system does not have this file, you can refer to the RSX-11M-PLUS I/O Operations Manual which describes the error code values. An example of an error message, error code value, and error text follows:

```
$ RTEM FOO:/RT          ; an attempt to boot an invalid device
?RTEM-F-Unable to assign LUN to FOO:
?RTEM-F-FCS error code -55. * Bad Device *
```

#### ?BOOT-F-Unexpected trap

A system error occurred during the secondary bootstrap operation.

Try to invoke RTEM-11 again. Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the host system version number, and the RTEM-11 version number.

#### ?BOOT-U-Host system incorrect for RTEM

RTEM-11 was not invoked on a valid host. This error results if RTEM-11 is booted as a stand-alone system. That is, this error occurs if you copy the bootstrap of RTEMFBSYS to the bootstrap blocks of a foreign volume and attempt to boot that volume as a stand-alone RT-11 system.

Do not try to run RTEM-11 as a stand-alone system.

#### ?RTEM-F-Boot block input error filespec

An input error occurred while the bootstrap blocks of the RTEM-11 system device were being read. RTEM-11 reads these blocks to check for an alternate monitor file name to boot. The likely error is in physical block 5 of a foreign volume system device or virtual block 6 of a private or shared file of a virtual system device. This error message includes the error code value and may include the error code text.

Retry the operation. If you are using a foreign volume system device, invoke RTEM-11 using a virtual system device and access the foreign volume as a nonsystem device. Use the COPY/BOOT command to rewrite the boot blocks of the foreign volume. If you are using a virtual system device, invoke RTEM-11 using different shared and private files and access the original shared and private files as nonsystem virtual devices. Try to use COPY/BOOT to rewrite the boot blocks of these files.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Boot block output error filespec

An error occurred while RTEM-11 was writing the bootstrap block of the virtual system device private file just created. This error message includes the error code value and may include the error code text.

### ?RTEM-F-Conflicting directory parameters filespec

The directory parameters, for example the number of extra bytes per directory entry for the shared and private files, do not match.

Invoke RTEM-11 specifying a different private file. Use the JOAT /V option (Section 4.2.11) to access the original private file as VS<sub>n</sub>: and copy its contents to VS<sub>0</sub>: or to a virtual device you create.

### ?RTEM-F-Conflicting SYSGEN options dev:

The SYSGEN options of the RTEM-11 monitor file differ from the SYSGEN options of the system device driver. If you have renamed an RT-11 handler file to an RTEM-11 handler file name, RTEM-11 returns this error when it tries to use the handler.

Select a compatible monitor/handler combination.

### ?RTEM-F-Device not directory structured dev:

The RTEM-11 foreign system device specified with the /RT option is not a directory-structured device.

Devices specified with the /RT option must be RT-11 directory structured.

### ?RTEM-F-Directive rejected while trying to attach dev:

An internal RTEM-11 error occurred. A directive was rejected for reasons other than lack of dynamic memory. This error message includes the error code value and may include the error code text.

Try to invoke RTEM-11 again. Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of your host system, and the version number of RTEM-11.

### ?RTEM-F-Directory file not found dev:[directory]

The specified directory does not reside on the specified volume.

Check your command line for typing errors.

### ?RTEM-F-Directory input error dev:

An error occurred while the directory of the RTEM-11 system device was being read. This error message includes the error code value and may include the error code text.

Check for a bad block in the directory of the RTEM-11 system device. If the RTEM-11 system device is a virtual system device, check the directories of the shared and private areas. To do this: invoke RTEM-11 with alternate shared and private areas, attach the former shared and private areas with JOAT, and use DIRECTORY/BAD on the former areas.

Check for hard error conditions, such as device off-line.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Directory output error filespec

An error was detected while the directory of the newly created private area was being initialized. This error message includes the error code value and may include the error code text.

Ask the system manager to scan the host system device (on which your directory resides) for bad blocks. Retry the operation, specifying for the private area an explicit size that is different from the default or that is different from the explicit size originally specified.

### ?RTEM-F-Directory too large filespec

The file specified as the shared and/or private area of the virtual system device contains too many directory segments.

Try to invoke RTEM-11 with a different private and/or shared area. Use the JOAT /V option (Section 4.2.11) to access the original private area as a nonsystem virtual device (VS1: to VS7:) and use SQUEEZE to try to compress the original private area. If the error persists, the directory of the shared or private file may have become corrupted or linked circularly. The total number of active directory segments in the shared and private areas cannot exceed 31 (decimal).

### ?RTEM-F-Duplicate options

The same valid option was used more than once in the command line to RTEM-11. The command line is printed below the error message.

Check the command line for errors and retry the operation.

### ?RTEM-F-Error closing file filespec

An error was detected while the newly created file that will serve as the private area of the virtual system device was being closed. This error message includes the error code value and may include the error code text.

Retry the operation. Try installing RTEM-11 again, using your distribution kit. Try to invoke RTEM-11 again specifying that a different size private file be created. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11.

### ?RTEM-F-Error during extend filespec

An error was detected while RTEM-11 was extending the virtual device file specified. This error message includes the error code value and may include the error code text.

### ?RTEM-F-Error from PARSE filespec

An error was returned from the system PARSE subroutine while parsing the file specification given. This error message includes the error code value and may include the error code text.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Failed to attach dev:

RTEM-11 could not attach the device specified as the foreign volume system device. This error message includes the error code value and may include the error code text.

It is likely that another user has allocated the specified device. If the device is allocated, you cannot use it until it is deallocated. If the device is not allocated, allocate it, mount it as foreign, and try to invoke RTEM-11 again.

### ?RTEM-F-Failed to delete spool file filespec

An error was returned when RTEM-11 attempted to delete the temporary line printer spool file. This error message includes the error code value and may include the error code text.

### ?RTEM-F-Failed to mark read/write temporary file for delete filespec

An error was returned when RTEM-11 attempted to mark the read/write temporary file for deletion. This error message includes the error code value and may include the error code text.

### ?RTEM-F-Failed to obtain system date and time

An internal system error causes this error. The message indicates that the directive to obtain the host system date and time was rejected. This error message includes the error code value and may include the error code text.

Try to invoke RTEM-11 again. Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11.

### ?RTEM-F-File already in use; cannot open filespec

The file cannot be opened because another user is writing to it.

Try the operation again when the file is free.

### ?RTEM-F-Filename is invalid with /LP

The /LP option was used to specify an invalid RSX-11M line printer spool device. The invalid command is displayed below the error message.

Do not specify a file or RTEM-11 foreign volume with the /LP option.

### ?RTEM-F-Filename or directory is invalid with /RT

The /RT option was used to specify a device that is not a foreign volume. The invalid command line is displayed below the error message.

Use the /RT option to specify that a foreign volume will be used as the RTEM-11 system device. Do not use a file or directory specification with the /RT option.



## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-File not found filespec

A required system file was not found on the RTE-11 system device. This message is displayed if the monitor file RTEMFBSYS, the swap file SWAP.SYS, or the system device handler file xxM.SYS does not reside on the system device. Another cause of this error is failure to locate a specified shared or private file.

Check for typing errors in the command line typed to the RTE prompt. If necessary, retype the command. Use the format described in this chapter for the command. Make sure the necessary RTE-11 system files reside on the system device. Be sure to specify existing files to be used as shared or private files.

### ?RTEM-F-File too large filespec

The highest block number of the shared and/or private file of the virtual system device is larger than one word.

RTE-11 cannot represent block numbers this large in its I/O structures. Use a different shared or private file. Try to truncate the file to not more than a single word (65535 decimal).

### ?RTEM-F-File too small DEV:SWAP.SYS

The SWAP.SYS file on the RTE-11 system device is too small for the current version of RTE-11. The SWAP.SYS file must be at least 26 blocks for RTE-11 V5.0.

Delete and recreate the SWAP.SYS file with the proper number of blocks. Then retry the command.

### ?RTEM-F-Home block input error filespec

An error was detected when RTE-11 tried to read the home block of the foreign volume system device or of the virtual system device private file. The device or file may have a bad block in the home block (physical block 1 of foreign volumes, virtual block 2 of virtual devices). This error message includes the error code value and may include the error code text.

Retry the operation. If you are using a virtual system device, try copying the private file using the host system COPY command. If you are using a foreign volume, invoke RTE-11 from a virtual system device (using /VS) and access the volume as a nonsystem device using JOAT.

### ?RTEM-F-Home block output error filespec

An error was detected when RTE-11 tried to write to the home block of the private file just created. This error message includes the error code value and may include the error code text.

Ask the system manager to scan the host system device (on which your directory resides) for bad blocks. Retry the operation, specifying for the private area an explicit size that is different from the default or from the explicit size originally specified.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Host system device driver not loaded dev:

The host system device driver for the RTEM-11 foreign volume system device is not resident in memory.

Ask the system manager to load the correct host system driver, then retry the operation.

### ?RTEM-F-Input error creating read/write temporary file filespec

The read/write temporary file is created by copying SWAP.SYS and all the files after it in the shared directory to a temporary file. An error was detected while these files were being copied from the virtual system device to the temporary file. This error message includes the error code value and may include the error code text.

Ask the system manager about the error code value. If the system manager cannot correct the error, submit an SPR to DIGITAL.

### ?RTEM-F-Input error filespec

A hard error occurred while the specified file or device was being read. This error message includes the error code value and may include the error code text.

See the section on hard error conditions in the RT-11 System Message Manual.

### ?RTEM-F-Invalid command line

An invalid command was entered. The command is printed below the error message.

Check for a missing device or file name in the command line. Correct the syntax of the command and retype it.

### ?RTEM-F-Invalid directory dev:

The specified RTEM-11 system device does not contain a valid RT-11 format directory structure.

If you are using a foreign volume system device, it must have a valid RT-11 directory structure.

### ?RTEM-F-Invalid option combination

An invalid combination of options was specified in the command line. The invalid command is displayed below the error message.

Check this chapter for valid combinations of options that are directed to the bootstrap task.

### ?RTEM-F-Invalid private directory filespec

The file specified as the private area of the virtual system device does not contain a valid RTEM-11 directory.

Check for typing errors in the command line.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Invalid shared directory filespec

The file specified as the shared area of the virtual system device does not contain a valid RTEM-11 directory.

Check for typing errors in the command line.

### ?RTEM-F-Missing device specification

The /RT or /LP option was specified without a corresponding device specification.

Use the /RT option to specify an RTEM-11 foreign volume as the system device. Use the /LP option to specify a Files-11 device for use as the default line printer spooling device.

### ?RTEM-F-Missing option

An option is missing from a command line that includes a device, directory, or file name. The command line is displayed below the error message.

Retype the command line, including an appropriate option.

### ?RTEM-F-Monitor version mismatch filespec

An attempt was made to boot an RT-11 monitor that does not have the RTEM-11 bootstrap module or is out of date.

Install RTEM-11 again, using your distribution kit.

### ?RTEM-F-Non-bootable handler xxM.SYS

The specified system device handler is not a bootable handler. The handler does not contain a primary bootstrap routine.

Invoke RTEM-11 from a bootable device.

### ?RTEM-F-Output error creating read/write temporary file filespec

The read/write temporary file is created by copying SWAP.SYS and all the files after it in the shared directory to a temporary file. An error was detected while writing these files to the temporary file. This error message includes the error code value and may include the error code text.

Ask the system manager about the error code value. If the system manager cannot correct the error, submit an SPR to DIGITAL.

### ?RTEM-F-Private file directory may be corrupt filespec

The directory segments corresponding to the private area indicate that the Files-11 file is larger than it actually is. The private area may have become corrupted.

Invoke RTEM-11 from a different private area. Use the JOAT /V option (Section 4.2.11) to attach the corrupted file as a nonsystem virtual device. Examine the device's directory. If the directory is corrupted, try to copy all the RTEM-11 files to another virtual device.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Private file too large

The virtual system device private file is too large. This occurs if the file is extended by a large amount.

Truncate the private file to not more than the number of blocks available for RTEM-11 file storage.

### ?RTEM-F-Shared directory not squeezed filespec

The shared directory was not squeezed after being extended, or some files in the shared directory are not protected.

Tell your system manager about the problem. See Chapter 6 for information about modifying the virtual system device shared area. Follow the procedures in that chapter for invoking RTEM-11 from a different shared area, attaching the original shared area as a nonsystem device, and using JOAT and FIP to make the original shared area a valid RTEM-11 shared file. Alternatively, try creating a new shared area using JOAT /S and copying all the files from the original shared area to it.

### ?RTEM-F-Timed out before attaching dev:

1. After waiting for the specified foreign volume system device to be attached, RTEM-11 returns this error message.

If no one else is using the device, retry the operation.

2. Another user may have attached the specified device without allocating it.

Try again when the device is free.

3. This error can also occur if the system is heavily loaded, and the RTEM-11 timeout period expires before the host system processes the attach request.

Try again.

### ?RTEM-F-Unable to assign LUN to dev:

The logical unit number (LUN) for the RTEM-11 system device (SY:) is in use, or the specified device is not a valid RTEM-11 system device. This error message includes the error code value and may include the error code text.

Check the syntax of your command and retry the operation.

### ?RTEM-F-Unable to get LUN information

An internal error occurred. Information about the logical unit number (LUN) for the specified foreign volume system device should be available to RTEM-11. This error message includes the error code value and may include the error code text.

Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-F-Unable to open filespec

This error message includes the error code value and may include the error code text.

1. The file specified as the shared or private file of the virtual system device could not be opened.

Check the command line for typing errors. Check the appropriate directories to make sure the specified file exists.

2. The line printer spool file could not be opened.

Make sure that the specified device contains a directory corresponding to your UIC.

### ?RTEM-F-Unable to open for output filespec

An error occurred when RTEM-11 attempted to open the specified file for output. This error message includes the error code value and may include the error code text.

Ask the system manager about the error code value. If the system manager cannot correct the error, submit an SPR to DIGITAL.

### ?RTEM-F-Unable to specify SREX\$ abort ast

RTEM-11 was unable to execute the RSX-11 directive SREX\$. This error occurs when RTEM-11 is running under the wrong version of RSX-11 or when the RSX-11 system has not been generated with the SREX\$ directive.

Have your system manager update your RSX-11 operating system with the correct version and/or system generation options.

### ?RTEM-F-Use of '\*' or '=' is invalid

The entered command contained an asterisk (\*) or equal sign (=). These symbols are invalid in commands directed to the bootstrap task, RTE. The invalid command is displayed below the error message.

Check the command line for typing errors and retry the operation.

### ?RTEM-F-Virtual device too small filespec

An attempt was made to create a virtual device file with an initial allocation of less than eight blocks. If allowed, this would create a file with no free blocks, as the boot blocks and directory take up at least eight blocks.

### ?RTEM-F-Virtual system device too large filespec

The file specified as the shared or private area of the virtual system device is too large, or the combined sizes of the shared and private files produce a virtual system device that is too large. You can still access the file by using the JOAT utilities /A command, discussed in Section 4.2.1.

See Section 2.5.6 for information on calculating the maximum size of the virtual system device. Make sure the directory of the shared or private file is not corrupted.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-I-Cannot open for write; opening read-only filespec

You do not have read/write access to the specified file. RTEM-11 tries to open the same file read-only. Your system manager may have built the RTEM-11 task so it prompts "Are you sure?" before opening the file read-only. If the file is opened read-only, the resulting virtual system device will be permanently write-locked.

This is an informational message. If your message is followed by "Are you sure?", type Y to open the file read-only.

### ?RTEM-I-Extending private file filespec

The virtual system device private file is being extended in response to the /EX command line option.

This is an informational message.

### ?RTEM-I-File not found; creating new private file dev:[directory]RT11PR.SYS;Ø

The default virtual system device private file was not located.

This is an informational message indicating that a private file is being created for you.

### ?RTEM-I-File not found; creating new private file dev:[dir]RT11PR.SYS;Ø Are you sure?

The specific file requested as the private area could not be located.

Type Y to create a file with the specified name; any other response will prevent creation of the file.

### ?RTEM-I-Host device Dev: attached as RT-11 device Dev:

This message informs you that, after booting the host device named, you must use the RT-11 device name to refer to it under RTEM-11. See Table 2-1 for more information on device naming conventions.

This is an informational message.

### ?RTEM-I-/LP switch ignored

The /LP option was specified on a command line while running under RSX-11M-PLUS or VAX/VMS. The /LP option is meaningful only under RSX-11M.

This is an informational message.

### ?RTEM-I-Virtual device should be squeezed dev:[directory]filename.ext;ver

The /EX option to extend a virtual device was used without a subsequent SQUEEZE command.

This message reminds you to use the SQUEEZE command with the virtual device, so the RT-11 directory can be updated correctly with the new file size.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-U-Aborted via directive, CLI, or user

RTEM-11 has closed all open files and devices and has returned control to the host operating system. This message can indicate one of the following conditions:

1. RTEM-11 encountered the abort character code specified in the RTEM-11 command line option /AB (Section 2.5.1).
2. RTEM-11 encountered the default abort character code specified by the system manager during RTEM-11 installation (Section 2.5.1).
3. RTEM-11 was aborted by the RSX-11 MCR ABORT command. If the abort was accidental, invoke RTEM-11 again with the appropriate command line.

### ?RTEM-U-Command file input error dev:[directory]filename.ext;ver

The specified file containing the RTEM-11 command line could not be opened. The message could indicate, for example, that the command line \$ RTEM @FOO.CMD was given, and that the Files-11 file FOO.CMD could not be found in the default directory.

Make sure the filespec is correct and retry the operation.

### ?RTEM-U-Error reading KMON

RTEM-11 detected an error while reading the keyboard monitor (KMON) from the RTEMFB.SYS file on the RTEM-11 system device.

Copy the RTEMFB.SYS file from your distribution kit onto your RTEM-11 system device, then try to invoke RTEM-11 again.

### ?RTEM-U-Extend task directive failed

RTEM-11 was unable to extend itself to the proper size for correct operation. This error message includes the error code value and may include the error code text.

Check with your system manager to ensure that RTEM-11 was installed as checkpointable. Try having your system manager reinstall RTEM-11 from your distribution kit. If the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration, the version number of the host system, and the version number of RTEM-11.

### ?RTEM-U-Insufficient memory

The RTEM-11 bootstrap program does not have enough memory to boot the RTEM-11 monitor. RTEM-11 needs at least 24K (decimal) words to run.

Have your system manager try to install RTEM-11 again. If the error persists, submit an SPR to DIGITAL.

### ?RTEM-U-Invalid host system

RTEM-11 was invoked on an invalid host system.

RTEM-11 will not run on RSX-11D, RSX-11S, IAS, or RSTS/E.

## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-U-Not installed properly

RTEM-11 was invoked before being successfully installed. The message could indicate, for example, that the RTEM-11 file was copied by hand, directly from the distribution medium, and then run.

Refer to the RTEM-11 Installation Guide for instructions on installing RTEM-11.

### ?RTEM-U-RTEM-11 system halt

A fatal error occurred within an RTEM-11 system routine. In this case, the RTEM-11 monitor aborts. This error also occurs if the stack overflows in a user program, and there is no user-specified initial stack value (location 42 in SYSCOM) to reset the stack.

Make sure the system volume is mounted and ready. Invoke RTEM-11 using a new copy of the monitor from your distribution kit.

### ?RTEM-U-System error

A fatal internal error occurred in RTEM-11.

Try having your system manager reinstall RTEM-11 from your distribution kit. Invoke RTEM-11 again; if the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration, the version number of the host system, and the version number of RTEM-11.

### ?RTEM-U-Unable to attach terminal

The terminal initiating the RTEM-11 bootstrap could not be attached by the program. This error message includes the error code value and may include the error code text.

Make sure a task is not attached to the initiating terminal. Try to invoke RTEM-11 again.

### ?RTEM-U-Unable to get task parameters

An internal system error occurred. This error message includes the error code value and may include the error code text.

Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11.

### ?RTEM-U-Unable to specify SST vector table

An internal system error occurred. The directive to set up a vector table for fielding synchronous traps failed. This error message includes the error code value and may include the error code text.

Try installing RTEM-11 again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11.



## RTEM-11 SYSTEM CONCEPTS AND OPERATING PROCEDURES

### ?RTEM-W-Required terminal driver options missing

The host system's terminal driver has not been through a system generation to include all the support RTEM-11 requires. This message is a warning, since RTEM-11's terminal service generally will not work properly.

Have your system manager include the correct support in your host system, as described in the RTEM-11 Installation Guide.

### ?RTEM-W-Unable to get terminal driver options

RTEM-11 was unable to execute the SF.GMC QIO to get the host system terminal driver options. This implies that the host system's terminal driver was not generated with the SYSGEN option "Get terminal driver options". This is only a warning, as RTEM-11's terminal service may not work correctly. This error message includes the error code value and may include the error code text.

Have your system manager include the correct support in your host system, as described in the RTEM-11 Installation Guide.

### ?RTEM-W-Unable to set terminal characteristics

This error occurred when RTEM-11 attempted to set the terminal to PASSALL mode. PASSALL mode is required for the RTEM-11/RT-11 terminal service to work correctly under VAX/VMS. This is a warning, as the RTEM-11 terminal service will not work correctly. This error message includes the error code value and may include the error code text.

Have your system manager include the correct support in your host system, as described in the RTEM-11 Installation Guide.



## CHAPTER 3

### EXTENDED COMMAND STRING INTERPRETER (ECSI)

RTEM-11 provides two command string interpreters: CSI and ECSI. RTEM-11's CSI is the same as RT-11's CSI. ECSI (extended command string interpreter) allows RTEM-11's utility programs (FIP and JOAT) to gain access to files on RSX-11.

The main difference between ECSI and CSI is that ECSI supports the host system file specifications as well as RT-11 file specifications. FIP and JOAT require ECSI because they run solely in the RTEM-11 environment and directly access host system files. RT-11 utility programs, such as MACRO and PIP, do not require ECSI because they do not directly access host system files.

#### 3.1 CALLING ECSI

To invoke a utility program, respond to the keyboard monitor prompt (.) by typing R followed by a utility program name and a carriage return. This example calls the RTEM-11 file interchange program (FIP):

```
.R FIP
*
```

ECSI prompts for input by printing an asterisk (\*) at the left margin of the terminal. To enter valid input, you must obey ECSI's syntax rules described in the following sections.

#### 3.2 ECSI SYNTAX

Input specifications to ECSI must be in the following syntax:

```
output-filespecs/option=input-filespecs/option
```

The syntax for output-filespecs is:

```
dev:[dir]filename.typ[;v][n],...
```

The syntax for input-filespecs is:

```
dev:[dir]filename.typ[;v],...
```

## EXTENDED COMMAND STRING INTERPRETER (ECSI)

The syntax for /option is:

/o[:oval]

or

/o[:dval.]

Each syntactic element is described in the following paragraphs.

### dev:

The logical or physical device name. For RTEM-11 input or output, a one- to three-character name from Table 2-1. For RSX-11 input or output, a two- to four-character name (see the RSX-11M/M-PLUS MCR Operations Manual). For VAX/VMS input or output, a physical device name of up to 15 characters from the list of supported devices in the VAX/VMS Command Language User's Guide.

If you do not supply a device name, FIP uses the default storage volume DK: for the RTEM-11 device or the default user volume for the Files-11 device.

If you specify a device, it becomes the default device for subsequent files in the specification list until you specify a different device name.

### [dir]

The directory specification. The directory contains the Files-11 input file or will contain the Files-11 output file. If the input or output device is an RT-11 format volume, the directory specification is ignored. If you omit the directory specification and input or output is from a Files-11 volume, the default is the current directory.

The directory specification must be a pair of octal values for RSX-11. For VAX/VMS it can be a pair of values or an alphabetic string.

If you specify a directory, it becomes the default directory for subsequent files in the specification until you specify a different directory. The following example uses FIP to transfer files from unit 1 of an RSX-11 RP02 to unit 1 of an RT-11 format diskette:

```
*DX1:A.BAS,B.DAT,C.OBJ=DPl:[120,40]A.BAS,B.DAT,[240,40]C.OBJ/F
```

This command is interpreted as follows:

```
*DX1:A.BAS,B.DAT,C.OBJ=DPl:[120,40]A.BAS,DPl:[120,40]B.DAT,DPl:[240,40]C.OBJ/F
```

In this example, the RSX-11 input files A.BAS and B.DAT reside in [120,40] and the file C.OBJ resides in [240,40]. These files are transferred under the same names from the RSX-11 volume on DPl: to the RT-11 format foreign volume on DX1:.

### filename

The file name, an alphanumeric string of one to nine characters. You can include as many as three output file names and six input file names. RTEM-11 accepts up to six characters in a file name. VAX/VMS and RSX-11 accept up to nine characters in a file name. FIP truncates RTEM-11 output file names to six characters if necessary.

## EXTENDED COMMAND STRING INTERPRETER (ECSI)

### **.typ**

The file type. A one- to three-character file type preceded by a period. If you omit the period and the file type, the running program may apply a default file type.

### **[:v]**

The version number. An octal or decimal number, preceded by a semicolon, that distinguishes host system files that have the same name and type. The default for host system input files is the highest existing version number. For output files, it is one number higher than the highest existing version number.

### **[n]**

Optional: indicates the number of blocks (n) needed for an RTEM-11 output file. The value n is a decimal number (up to 65535) enclosed in square brackets, immediately following the output file to which it applies.

### **/o[:oval] or /o[:dval.]**

One or more options whose functions vary according to the program you are using. The value oval is an octal number or one to three alphanumeric characters (the first of which must be alphabetic). The value dval. is a decimal number followed by a decimal point. You can use a minus sign (-) to denote negative octal or decimal numbers. These options and their values should follow the device and file name to which they apply. You can mix octal, Radix-50, and decimal values.

=

A delimiter that separates the output and input fields. You can omit the delimiter if there are no output files.

## **3.3 WILDCARD USAGE**

Rules governing the use of wildcards under RT-11 also apply under RTEM-11. This section summarizes wildcard usage.

Some commands accept wildcards (%) and (\*) in place of the file name, file type, or characters in the file name or file type. The system ignores the contents of the wildcard field and selects all the files that match the remaining fields. The percent sign (%) ignores the contents of one character in the field; the asterisk (\*) ignores the contents of any number of characters in the field.

An asterisk (\*) can replace a file name:

**\*.MAC**

All files on device DK that have a .MAC file type are selected, regardless of their name.

An asterisk (\*) can replace a file type:

**TEST.\***

All files on device DK that are named TEST are selected, regardless of their file type.

## EXTENDED COMMAND STRING INTERPRETER (ECSI)

An asterisk (\*) can replace both name and type:

\*.\*

All files on device DK are selected.

An embedded asterisk (\*) can replace any number of characters in the input file name or file type:

A\*B.MAC

All files on device DK with a file type of .MAC whose file names start with A and end with B are selected. For example, AB.MAC, AXB.MAC, and AXYB.MAC are selected.

The percent symbol (%) is always considered to be an embedded wildcard. It can replace a single character in the input file name or file type:

A%B.MAC

All files on device DK with a file type of .MAC whose file names are three characters long, start with A and end with B, are selected. For example, AXB.MAC, AYB.MAC, and AZB.MAC are selected.

## CHAPTER 4

### JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

The jack-of-all-trades (JOAT) utility program performs a variety of system and device operations. For example, while you can do most program development using just the system device, console terminal and line printer, you may occasionally require other peripheral devices. JOAT lets you use any host system device supported by RTEM-11. You can also use JOAT to terminate RTEM-11, to suspend RTEM-11 and pass command lines to RSX-11, and to show current device usage.

#### 4.1 CALLING AND TERMINATING JOAT

To call JOAT, type:

```
.R JOAT
```

JOAT prints an asterisk and waits for a command string.

To terminate JOAT and return control to RTEM-11, type CTRL/C when JOAT prompts for input. You can type two CTRL/Cs to terminate JOAT while it is executing a command. To restart JOAT, type R JOAT.

##### 4.1.1 JOAT Command String

JOAT commands vary in form according to their purpose. Thus, a command can include a file name, a device code, and an option specification, or any combination of these elements. In general, the syntax of a JOAT command is:

```
[filespec][=][dev:][ /o]
```

where filespec represents the output file name.

= is the delimiter between the input side and the output side of the command string.

dev: represents a device code.

/o represents an option.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

### 4.1.2 HELP Command

To display information about JOAT command syntax, type HELP JOAT when you see the keyboard monitor prompt. Note that the RT-11 HELP.SAV program must reside on the current RTEM-11 system device for the HELP command to work.

.HELP JOAT

JOAT Does various and sundry useful things.

#### SYNTAX

|                      |                          |
|----------------------|--------------------------|
| dev:/option          | /A, /D, /L, /U, /W       |
| filespec/option      | /C, /C/Z, /V, /V/T, /V/U |
| filespec=dev:/option | /S, /S/O                 |
| /option              | /E, /M, /L               |

.  
.  
.

### 4.2 JOAT COMMAND OPTIONS

JOAT command options are divided into three categories: file options, device options, and options that take no specification. JOAT options can be placed on the input or output side of a command string. The following table summarizes JOAT options. The options and their syntax are described in Sections 4.2.1 through 4.2.14.

| Option | Explanation                                                                                                                                                                                                      |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /A     | Attaches an RT-11 format device for use by an RTEM-11 user or program. /A is the only JOAT option that requires a host system device specification. (See Section 4.2.1.)                                         |
| /C[:n] | Creates a file for use as a virtual device. The optional value n is the size of the file in blocks. The default size is 494 blocks. Specify the file with a host system file specification. (See Section 4.2.2.) |
| /D     | Detaches a device that was previously attached with /A, /V, or /C. Specify the device with an RT-11 device name. (See Section 4.2.3.)                                                                            |
| /E[:n] | Exits from RTEM-11. Control returns to host system. The optional value n specifies the RTEM-11 task exit status that is returned to the host system. Default value is 1. (See Section 4.2.4.)                    |
| /L     | Lists current device usage. (See Section 4.2.5.)                                                                                                                                                                 |
| /M     | Temporarily interrupts RTEM-11 and gives control to RSX-11 host system. (See Section 4.2.6.)                                                                                                                     |

(Continued on next page)



## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

|          |                                                                                                                                                                                                                                     |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /O[:xxx] | Used with /S to establish the order of files in read/write area of a shared virtual device file. Options for :xxx are ADD, NEW, SAV, UPD. The system manager uses /O when modifying the virtual system device. (See Section 4.2.7.) |
| /S       | Creates a shared area from an RT-11 format volume or an existing virtual device. The system manager uses /S when modifying the virtual system device. (See Section 4.2.8.)                                                          |
| /T:n     | Used with /V to extend a virtual device by n (octal) blocks. (See Section 4.2.9.)                                                                                                                                                   |
| /U       | Converts a shared area into a private area for update purposes. Use /U after using COPY/DEVICE. The system manager uses it to modify the virtual system device. (See Section 4.2.10.)                                               |
| /V[:VSn] | Specifies a host system file to be used as a virtual device by RTEM-11. Units 0 through 6 may be specified (n). (See Section 4.2.11.)                                                                                               |
| /W[:NO]  | Write-protects a device. To write-enable the device, use :NO. Specify the device with an RT-11 device name. (See Section 4.2.12.)                                                                                                   |
| /Y       | Suppresses queries that appear before an /A, /D or /E option is executed. (See Section 4.2.13.)                                                                                                                                     |
| /Z       | Used with /C to create a virtual device temporary file. The file is automatically deleted when detached by the /D option or when you exit RTEM-11. (See Section 4.2.14.)                                                            |

### 4.2.1 Attaching a Physical Device (/A)

JOAT lets you use additional devices for mass storage.

When you invoke RTEM-11, the RTEM-11 program attaches to your terminal. To acquire additional storage, you must attach devices to your terminal.

The /A option attaches a physical device. You can use /A to attach RT-11 format foreign volumes to your terminal and acquire more storage space. You can attach any device supported by RTEM-11 and installed on the host operating system. (Table 2-1 lists the devices RTEM-11 supports.)

Because you are attaching a volume that is foreign to the host operating system, you must allocate and mount the volume before using /A. You can use the /A option with the /L or /W options.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

The /A option is the only JOAT option that requires a host system device name. The syntax of the command is:

```
dev:/A
```

If you are attaching an RK05, remember to use the RSX-11 device name DKn. The following example attaches RK05 unit 0 under RSX-11:

```
.R JOAT
*DK0:/A
```

RT-11 can accommodate up to eight units of one type of device. The host operating system, however, permits access to more than eight devices of one type. JOAT lets you access all devices on the host system by truncating host device unit numbers to the unit number range 0 through 7. Host device units above 7 are mapped by JOAT to unit numbers in the range of 0 through 7. This is shown for device xx in the following table.

| RSX-11<br>Unit | VAX/VMS<br>Unit | RT-11<br>Unit |
|----------------|-----------------|---------------|
| xx0            | xxA0            | xx0           |
| .              | .               | .             |
| xx7            | xxA7            | xx7           |
| xx10           | xxB0            | xx0           |
| xx11           | xxB1            | xx1           |
| .              | .               | .             |
| .              | .               | .             |

You cannot simultaneously use two devices of the same type if their unit numbers map to the same value. For example, you cannot use xx0 and xx10 at the same time.

### 4.2.2 Creating a Virtual Device (/C[:n])

You can use the /C option to create a file and attach it to a virtual device unit. The /C option can be combined with /L, /V, /W, or /Z.

Specify the file with a host system file specification. You can specify the size of the virtual device with any value n between 8 and 65535 blocks. While you can create a virtual device file of any size up to 65535 blocks, you may not be able to use a large virtual device file as the private area of the virtual system device pair. See Section 2.5.6 for information about calculating the maximum size of a private area of the virtual system device. The default size is set by the system manager during RTE-11 installation. The default location for the file is the current account.

The syntax of the command is:

```
filespec/C[:n]
```

After it is created, the file is attached as a virtual device to RTE-11. JOAT assigns the first free unit number to the virtual device and displays the message:

```
?JOAT-I-Attached to VSn:
```

This message tells you which unit was assigned.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

Before you use /C, you should use the JOAT /L option to list the device units currently in use. If no virtual device units are available when the file is created, RTE-11 displays the following message:

?JOAT-F-No VS unit available

Detach a virtual device and retry the operation.

To override JOAT's unit assignment, combine the /V:VS $n$  option with the /C option, specifying a value for  $n$  (unit number). Unit numbers range from 0 to 7. Do not use unit number 0 if you are running from a virtual system device. The virtual system device is VS0.

The following command creates the file NEWRTFILE.DSK and attaches it as virtual device unit 3:

\*NEWRTFILE.DSK/C/V:VS3

The following command also creates the file NEWRTFILE.DSK, but this file is deleted automatically when it is detached or when you exit RTE-11.

\*NEWFILE.DSK/C/V:VS3/Z

When JOAT initializes the virtual device file, the default number of directory segments is based on the size of the virtual device as follows:

| File Size<br>in Blocks | Default Number of<br>Directory Segments |
|------------------------|-----------------------------------------|
| Up to 512              | 1                                       |
| 513 to 2048            | 4                                       |
| 2049 to 12288          | 16                                      |
| 12289 or more          | 31                                      |

If you require some other number of directory segments, use the RTE-11 INITIALIZE command after creating the virtual device with the JOAT /C option.

### 4.2.3 Detaching a Device (/D)

You can use /D to detach a foreign or virtual device from RTE-11. After you detach a virtual device, the unit is available for reassignment. You can use /D with the /L option.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

Specify the device to be detached with an RTEM-11 device name from Table 2-1. When you use /D, JOAT prints:

```
?JOAT-I-dev:/Detach; Are you sure?
```

You must type Y<RET> to execute the command.

The syntax of the command is:

```
dev:/D
```

The following example detaches unit 1 of an RL01:

```
.R JOAT
*DL1:/D
?JOAT-I-DL1:/Detach; Are you sure? Y
*
```

If you attempt to detach the RTEM-11 system device, the following error message is displayed.

```
?JOAT-F-Cannot detach RTEM system device dev:
```

Always detach any foreign RT-11 RK06/RK07 and RL01/RL02 disk volumes using /D before you switch the disk cartridges. After you have inserted a new cartridge and turned on the disk drive, attach the new device with the /A option.

RT-11 supports bad block replacement on these disks. Since the RTEM-11 device handlers have bad block information in memory and cannot tell when power is turned off to a disk pack, failure to detach any foreign volumes may result in the corruption of data on the substituted disk pack(s).

### 4.2.4 Exiting from RTEM-11 (/E[:n])

Use the /E option to exit from RTEM-11. After you type /E, JOAT queries:

```
?JOAT-I-/Exit RTEM-11; Are you sure?
```

Respond with a Y to exit from RTEM-11. For example:

```
.R JOAT
*/E
?JOAT-I-/Exit RTEM-11; Are you sure? Y
$
```

The prompt (\$) indicates the host operating system is ready to accept a command. At this point, all RTEM-11 devices are detached and all files, including files serving as RTEM-11 virtual devices, are closed.

The optional value n specifies the exit status that is returned to the host operating system when RTEM-11 exits. The default value is 1.

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### 4.2.5 Listing RTEM-11 Device Usage (/L)

The /L option lists all devices currently attached to RTEM-11. Use this option to find out what devices are attached to RTEM-11 before you attach or detach a device, or create a virtual device.

The /L option accepts no file or device specifications. It can be combined with any other JOAT option except /E and /M.

The listing consists of two sections. The first section lists all attached virtual device files; the second lists all attached foreign devices. The first section has five columns:

Virtual device file (VS0: through VS7:)

Access code, RW (read/write) or RO (read-only)

Temporary-file marker (/TMP) indicating the file was created by means of JOAT's /Z option, and will be deleted automatically when detached or on exit from RTEM-11.

Number of blocks in virtual device file (decimal)

Host system file to which the RT-11 virtual device is attached

The second section of the listing has three columns:

RT-11 physical device name

Access code (RW or RO)

Host device name, if it differs from RT-11 device name (see Table 2-1)

The listing format is illustrated in the following example.

```
.R JOAT
*/L

VS0:    RO      [3092]    DR0:[SYS0.SYSLIB]RT11SH.DSK;1
        RW                      DB0:[SMITH]RT11PR.DSK;1
VS1:    RO      [10320]   DB0:[SMITH.RTEM]FORTRAN.DSK;1
VS2:    RW/TMP  [1000]    DB0:[SMITH]TEMP.DSK;1
DL0:    RO
DX1:    RW      (CS1:)
*
```

In the example, three virtual devices are attached. The first (VS0:) is the virtual system device, consisting of two files. The first file listed comprises the shared area and is assigned read-only access (RO). The second file comprises the private area and is assigned read/write access (RW). The number of blocks in the virtual system device pair (3092) represents the combined size of the shared file and the private file.

The second virtual device (VS1:) is attached read-only to the file DB0:[SMITH.RTEM]FORTRAN.DSK;1. It comprises 10320 blocks.

The third virtual device (VS2:) is attached to the file DB0:[SMITH]TEMP.DSK;1. It is assigned read-write access, and is marked /TMP to indicate it was created by JOAT's /Z option. VS2: will be deleted when detached or on exit from RTEM-11.

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Two foreign devices are attached. The first is RL01/RL02 unit 0, attached with read-only access. The second is the VAX/VMS console diskette, attached with read/write access. Because the host device name (CS1:) differs from RT-11's (DX1:), the host device name is shown in parentheses.

### 4.2.6 Passing Commands to RSX-11 (/M)

The /M option temporarily suspends RTE-11 and gains the attention of the RSX-11 command interpreter. By using this option, you can perform RSX-11 functions without exiting from RTE-11.

The /M option accepts no file or device specification. When you use /M, JOAT first returns the following message:

```
?JOAT-I-Returning to host system
```

A second message tells you how to restart RTE-11 after you have performed the required operations:

```
?JOAT-I-Type "DCL>START taskname" or "MCR>UNSTOP taskname" to
continue
```

The command to restart RTE-11 includes the task identifier "taskname". Depending on the system you are using, this is either RTETn (n being your terminal number) or ...RTE.

If you're not sure which command interpreter is running at your terminal, type CTRL/C when the implicit prompt (>) appears after you suspend RTE-11. The explicit prompt DCL> or MCR> will be displayed. If your terminal is set to DCL, type START taskname when you want to restart RTE-11. If your terminal is set to MCR, type UNSTOP taskname to restart RTE-11. The following example uses the /M option to get a directory listing of the host system directory:

```
.R JOAT
*/M
?JOAT-I-Returning to host system
?JOAT-I-Type "DCL>START RTET4" or "MCR>UNSTOP RTET4" to continue

>DIR

DIRECTORY DM1:[230,72]
16-OCT-81 11:04

FLY.TXT;1          2.      12-OCT-82  10:23
RT11PR.SYS;4      494.     20-AUG-82  15:10
RTFILE.SYS;3      494.     16-SEP-82  13:15
RTF4.SYS;6        494.     02-NOV-82  12:00

TOTAL OF 1484./2000. BLOCKS IN 4. FILES

>START RTET4
*
```

The asterisk indicates that JOAT is ready to accept another command.

DCL command syntax is described in the RSX-11M/M-PLUS Command Language Manual. MCR command syntax is described in the RSX-11M/M-PLUS MCR Operations Manual.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

### 4.2.7 Ordering Files on a Virtual System Device (/O[:xxx])

Use the /O option with /S to establish the order of files in the shared area of a virtual system device. The system manager uses the /O option to update the virtual system device. Section 6.1.5 describes the /O option as one step in the modification procedure.

The following command line illustrates the use of the /O option:

```
*output-filespec=input-device:/S/O[:xxx]
```

The values for xxx are ADD, NEW, SAV, and UPD.

ADD causes files that reside in the mark zone (all blocks following SWAP.SYS) to remain unchanged, and prompts for additional files to be copied to this area. When you see the prompt File?, type the names of files you want to move from the read-only area of the volume to the mark zone. The ADD option is the operational equivalent of the SAV and NEW options. Files added to the volume are positioned in the order in which they are specified.

NEW is the default for /O. Option /O adds files you specify to the mark zone. The files are added after SWAP.SYS, BAM.SYS, and IND.SAV. The NEW option prompts File?. Type the names of files that you want to move from the read-only area to the mark zone. Files added to the volume are positioned in the order in which they are specified.

SAV causes the position of files that reside in blocks following SWAP.SYS to remain unchanged.

UPD lists every file in the mark zone following the SWAP.SYS file and prompts "Include file filnam.typ?" for each file. Type Y followed by a carriage return if you want the specified file to remain in the mark zone. Type N followed by a carriage return if you want the file to be moved to the read-only area. N is the default. After all files in the mark zone have been listed, the prompt File? is displayed. Type the names of files you want to move from the read-only area of the volume to the mark zone. Files added to the volume are added in the order in which they are specified.

The following example illustrates the /O:UPD option:

#### Procedure

```
[1] $ RTEM/VS  
    RTEM-11 (Host type) V02.xx  
    RT-11FB V05.xx  
  
[2] .R JOAT  
    *INPUT.DSK/V:VS1  
    *^C
```

# JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

```
[3] .DIR VS1:/FAST
    22-Apr-82
    RTEMF.B.SYS      DDM      .SYS      DLM      .SYS      DMM      .SYS      DPM      .SYS
    DQM      .SYS      DTM      .SYS      DXM      .SYS      DYM      .SYS      NLM      .SYS
    RKM      .SYS      VSM      .SYS      LPM      .SYS      MSM      .SYS      WRITE   .SAV
    FIP      .SAV      JOAT     .SAV      DUP      .SAV      KED      .SAV      HELP     .SAV
    SIPP     .SAV      VDT      .OBJ      BATCH    .SAV      DUMP     .SAV      BINCOM   .SAV
    SRCCOM   .SAV      LIBR     .SAV      LINK     .SAV      CREF     .SAV      MACRO    .SAV
    DIR      .SAV      RESORC   .SAV      PIP      .SAV      SYSMAC   .SML      SYSLIB   .OBJ
    SWAP     .SYS      BAM      .SYS      IND      .SAV
    38 Files, 901 Blocks
    0 Free blocks

[4] .R JOAT
    *OUTPUT.DSK=VS1:/S/O:UPD
    ?JOAT-I-Attached to VS2:
    Include file BAM      .SYS? YES

    Include file IND      .SAV? YES
    File? WRITE.SAV
    File?
    *^C

[5] .DIR VS2:/FAST
    22-Apr-82
    RTEMF.B.SYS      DDM      .SYS      DLM      .SYS      DMM      .SYS      DPM      .SYS
    DQM      .SYS      DTM      .SYS      DXM      .SYS      DYM      .SYS      NLM      .SYS
    RKM      .SYS      VSM      .SYS      LPM      .SYS      MSM      .SYS      FIP      .SAV
    JOAT     .SAV      DUP      .SAV      KED      .SAV      HELP     .SAV      SIPP     .SAV
    VDT      .OBJ      BATCH    .SAV      DUMP     .SAV      BINCOM   .SAV      SRCCOM   .SAV
    LIBR     .SAV      LINK     .SAV      CREF     .SAV      MACRO    .SAV      DIR      .SAV
    RESORC   .SAV      PIP      .SAV      SYSMAC   .SML      SYSLIB   .OBJ      SWAP     .SYS
    BAM      .SYS      IND      .SAV      WRITE    .SAV
    38 Files, 901 Blocks
    0 Free blocks
```

## Explanation

- [1] The user enters RTEM-11 from the host system command level.
- [2] The user invokes JOAT and attaches the input virtual file on unit VS1:.
- [3] A directory of the input virtual file shows the current ordering of the files.
- [4] Using JOAT, the user creates the shared file OUTPUT.DSK, with the input virtual device file INPUT.DSK on unit VS1:. Responding to the prompts presented through the /O:UPD option, the user includes the files BAM.SYS, IND.SAV, and WRITE.SAV in the read/write mark zone of the output shared file OUTPUT.DSK.
- [5] A directory of the newly created shared file shows that the file WRITE.SAV was included in the read/write mark zone. Remember that the read/write mark zone of a shared virtual device file is defined as all files including and following the file SWAP.SYS.



## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

### 4.2.8 Creating a Shared Area (/S)

The /S option creates a shared area from an existing virtual device or RT-11 format foreign volume. After modifying a shared area, the system manager uses /S to modify the directory. The following command line illustrates the use of the /S option:

```
*output-filespec=input-device:/S
```

Use of the /S option with the /O option is described in Section 4.2.7. Section 6.1.4 describes the /S option as a part of the modification procedure.

### 4.2.9 Extending a Virtual Device (/T:n)

Use the /T option with /V to extend a virtual device by adding storage space. You must specify the number (n) of blocks to be added to the device. There is no default extension value. The /T option must be used with /V and may be combined with /L or /W.

The command syntax is:

```
filespec/V[:VSn]/T:n
```

You must compress the volume (with the monitor SQUEEZE command) or initialize it (with the monitor INITIALIZE command) to obtain the correct size of the volume. For example:

```
*RTFILE.DSK/V/T:50
?JOAT-I-Virtual device should be squeezed RTFILE.DSK;1
?JOAT-I-Attached as VS2:
```

A DIRECTORY/FREE command shows the free blocks on VS2: before the volume was extended:

```
.DIRECTORY/FREE VS2:
22-OCT-80

<UNUSED>      4
<UNUSED>      3
<UNUSED>     445
0 Files, 0 Blocks
452 Free blocks
```

After the volume is squeezed, a DIRECTORY/FREE command shows the new size of the volume:

```
.SQUEEZE VS2:
VS2:/SQUEEZE; Are you sure? y
.DIRECTORY/FREE VS2:
16-OCT-80

<UNUSED>     492
0 Files, 0 blocks
492 Free Blocks
```

Chapter 6 shows how to extend the virtual system device.

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### 4.2.10 Updating a Virtual Device (/U)

The /U option converts a shared area into a private area where you can add, delete, move or modify files. This option also reformats the virtual device specified as the target in a COPY/DEVICE command. The virtual device that is the copy must be reformatted with /U after COPY/DEVICE is used.

The syntax of the command is:

```
*dev:/U
```

After you copy a device to a virtual device with the COPY/DEVICE command, use /U to reformat the virtual device. After using the /U option, you must compress the volume (with SQUEEZE). For example:

```
.COPY/DEVICE VS2: VS4:
VS4:/Copy; Are you sure? y
.R JOAT
*VS4:/U
*^C
.SQUEEZE VS4:
VS4:/Squeeze; Are you sure? y
.
```

The system manager uses the /U option to modify the virtual system device (see Chapter 6).

### 4.2.11 Attaching a Virtual Device (/V[:VS<sub>n</sub>])

The /V option attaches a Files-11 file to RTEM-11 as an RTEM-11 virtual device. If you do not specify a value, JOAT attaches the file to the first free virtual device unit. JOAT displays a message to tell you which unit was assigned. You can combine the /V option with /C, /L, /O, /S, /T, /W, or /Z.

Once specified, VS<sub>n</sub> is an RTEM-11 physical device name. You can specify eight different virtual device units (VS0 through VS7) with VS<sub>n</sub>.

The syntax of the command is:

```
filespec/V[:VSn]
```

The following command specifies the file RTFILENAM.DSK in the default directory to be used as virtual device unit 2. The specified file is opened for read/write access as device VS2.

```
*RTFILENAM.DSK/V:VS2
```

If a virtual device file was attached to unit VS2 when the above command was executed, JOAT asks for verification of the command with the following prompt:

```
?JOAT-I-VS2:/Attach supersedes existing assignment; Are you sure?
```

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

If you want to complete the operation, enter Y or YES. If you enter anything else, the operation will abort. By specifying the option /Y with the RTFILENAM.DSK/VS2 command, you can suppress the verification query. With the /Y option, JOAT will attach the superseding device without question.

If you are using a virtual system device, it is always VS0. Do not reassign VS0 in this case. If you are using a foreign volume system device, you can attach VS0 as a storage device.

### 4.2.12 Write-Protecting a Volume (/W[:NO])

Use the /W option to write-protect a volume. This option prevents a volume from being accidentally corrupted. Specify the volume with an RT-11 device name. The /W option cannot be combined with /D, /E, or /M.

To write-enable a volume, use /W with the :NO option. The syntax of the command is:

```
dev:/W[:NO]
```

For example, to write-protect the system device:

```
.R JOAT  
*SY:/W
```

You can also specify the virtual system device as VS0.

### 4.2.13 Suppressing Query Message (/Y)

Use the /Y option with the /A, /D, /E, or /V:VS<sub>n</sub> option to suppress the query message:

```
Are you sure?
```

If you specify /Y, JOAT executes the command immediately. It does not wait for you to confirm your intentions. A command such as the following causes JOAT to exit without asking if you are sure you wish to do so:

```
*/E/Y  
$
```

### 4.2.14 Creating Temporary Virtual Device (/Z)

Use the /Z option with the /C[:<sub>n</sub>] option to create a temporary virtual device file. A temporary virtual device file will be deleted automatically when you:

Detach the device with the JOAT /D option or

Exit RTEM-11.

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The JOAT /L option identifies temporary virtual devices with the flag /TMP.

The following commands illustrate the creation of a temporary virtual device and a listing displaying it. After the temporary virtual device has been detached, an attempt to reattach it fails. The device file has been deleted automatically on detachment.

```
*TEMP.DSK/C:100./Z
?JOAT-I-Attached to VS2:
*/L

VS0:    RO      [3092]  DR0:[1,1]RT11SH.DSK;3
        RW                      DB0:[230,72]RT11PR.DSK;3
VS1:    RW      [932]   DB0:[230,72]RTFILE1.DSK;1
VS2:    RW/TMP   [100]   DB0:[230,72]TEMP.DSK;1
*VS2:/D/Y
*TEMP.DSK/V
?JOAT-F-File not found DR0:TEMP.DSK;0
*^C
```

### 4.3 JOAT ERROR MESSAGES

**?JOAT-F-Cannot detach RTEM-11 device dev:**

An internal JOAT error occurred.

Exit using JOAT /E. Invoke RTEM-11 and retry the operation. Try the operation again, using your distribution kit. If the error persists, submit an SPR to DIGITAL, including a description of the host system hardware configuration and version number, and the version number of RTEM-11 and JOAT.

**?JOAT-F-Cannot detach RTEM-11 system device dev:**

The device specified with the /D option is the RTEM-11 system device.

You cannot detach the system device. If you meant to detach a device other than the system device, type the command again and specify the appropriate device.

**?JOAT-F-Channel in use dev:**

An internal JOAT error occurred.

Exit using JOAT /E. Invoke RTEM-11 and retry the operation. Try the operation again, using your distribution kit. If the error persists, submit an SPR to DIGITAL, including a description of the host system hardware configuration and version number, and the version number of RTEM-11 and JOAT.

**?JOAT-F-Channel not open dev:**

An internal error occurred in JOAT.

Exit using JOAT /E. Invoke RTEM-11 and retry the operation. Try to use a copy of the distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11 and JOAT.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT).

### ?JOAT-F-Device in use dev:

The device specified with the /A option is attached to another program. The device was not attached to your terminal.

Retype the request to attach the device, or type CTRL/C to return to the RTE-11 keyboard monitor.

### ?JOAT-F-Device not mounted dev:

A device specified with /A was not mounted (with MOUNT) prior to the use of /A.

Issue a MOUNT/FOREIGN command to the host system command interpreter.

### ?JOAT-F-Directive error code n. \*error text\*

JOAT could not interpret an error received from a call to the host operating system.

The system manager should take corrective action using the I/O error codes listed in the RSX-11M/M-PLUS I/O Drivers Reference Manual.

### ?JOAT-F-Directory input error dev:

A hard error occurred while the directory of the specified device was being read.

Make sure the device is on-line and write-enabled. Check the device for bad blocks.

### ?JOAT-F-Directory not found dev:[DIRECTORY]

The directory specified in the file specification could not be located.

Check the device name and directory in your command line and try again.

### ?JOAT-F-Directory output error dev:

An error occurred while JOAT was writing to the device.

Make sure the device is on-line and write-enabled. Check the device for bad blocks.

### ?JOAT-F-Failed to attach dev:

The device specified with the /A option is attached to another task. The device was not attached to your terminal.

Retype the request to attach the device, or type CTRL/C to return to the RTE-11 keyboard monitor.

### ?JOAT-F-Failed to detach TT:

JOAT could not detach your terminal after /M was issued. This is an internal JOAT error or a system error.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

Exit from RTEM-11 and try the operation again. Try to invoke JOAT using a copy of JOAT from your distribution kit. If the error persists, submit an SPR to DIGITAL. Include with the SPR a description of the host system hardware configuration, the version number of the host system you are using, and the version number of RTEM-11 and JOAT.

### ?JOAT-F-FCS error code n. \*error text\*

JOAT received an error from a call to RSX-11 FCS that could not be interpreted.

The system manager should take corrective action using the I/O error codes listed in the RSX-11M/M-PLUS I/O Drivers Reference Manual.

### ?JOAT-F-Fetch error dev:

The copy of JOAT.SAV, the monitor file, or the specified device handler may be corrupted on disk.

Exit from RTEM-11 using JOAT /E. Invoke RTEM-11 again. If the error persists, obtain a new copy of JOAT.SAV, the specified device handler, and resubmit the disk.

### ?JOAT-F-File not found dev: SWAP.SYS

The SWAP.SYS file was not found on the device specified in a /S command line.

SWAP.SYS must reside on the shared area of the virtual system device.

### ?JOAT-F-File not found filespec

The specified file could not be found.

Check for a typing error in the command line. Retry the operation.

### ?JOAT-F-Insufficient memory

There was not enough memory space to complete the requested operation.

The system manager should increase the address space on the host system, then install RTEM-11 again.

### ?JOAT-F-Invalid command

An invalid command was used.

Check for a typing error and retype the command.

### ?JOAT-F-Invalid device dev:

The specified device is not a valid device for this operation. The device is not installed in the RTEM-11 monitor device tables, the volume is not loaded in the device, the device is not a valid device for the option used, or you specified an invalid unit number.

Check the appropriate section in this chapter for a list of valid devices for the option you are using. Make sure the device is installed and the volume loaded. Valid unit numbers fall in the range 0 to 7. The device must have a corresponding host system device handler to be accessed by JOAT.

## **JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)**

### **?JOAT-F-Invalid directory dev:**

The volume in the specified device does not contain a valid RT-11 directory structure.

With a virtual device, /S can be used only on a private area. With a foreign volume, initialize the volume before you use it with RTEM-11.

### **?JOAT-F-Invalid option**

An invalid option or option combination was specified in the command line.

Check for a typing error in the command line. Use only those options that are valid for the JOAT program.

### **?JOAT-F-Invalid option value**

A value outside the valid range was specified.

Check for a typing error in the command line. Refer to the list of valid JOAT options and the range of valid values for each option.

### **?JOAT-F-No LUN available**

For each foreign or virtual device to be attached to RTEM-11, one host system logical unit number (LUN) is used. The /A, /V, /C, and /S options each use one LUN to attach a device.

Use the JOAT /D option to detach a device and free a LUN. The task is installed with a certain number of LUNs, and RTEM-11 uses five in addition to those you might use.

### **?JOAT-F-No VS unit available**

The virtual device could not be attached because virtual device units 0 through 7 are already attached to RTEM-11.

Use JOAT /D to detach a virtual device and free a unit.

### **?JOAT-F-Output error dev:**

A hard error occurred while JOAT was writing to a volume.

Make sure the device is on-line and write-enabled. Check for bad blocks on the volume.

### **?JOAT-F-Privilege violation**

The specified file does not reside in the current directory. The file cannot be opened for read or write.

Copy the file to the current directory to access it.

### **?JOAT-F-RT-11 device already attached Dev:**

You attempted to attach a foreign device using the /A command, but the RT-11 device was already attached by a previous command.

Detach the RT-11 device using the /D command. Then reissue this command.

## **JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)**

### **?JOAT-F-Too many mark zone files**

This error occurs when the /S/O options are used and you attempt to insert more than 32 files into the read/write mark zone of a shared file. No more than 32 files are allowed in the mark zone of a shared virtual device file.

### **?JOAT-F-Wrong version of RTEM-11**

The RTEM-11 monitor is corrupted, or you tried to run JOAT under an RT-11 monitor or an outdated RTEM-11 monitor.

Exit from RTEM-11 and retry the operation. Do not attempt to run JOAT under monitors not distributed in the RTEM-11 kit.

### **?JOAT-I-Attached to V:VS<sub>n</sub>:**

The device specified with /C, /S, or /VS<sub>n</sub> is attached to the device specified in this message.

This is an informational message.

### **?JOAT-I-dev:/Attach supersedes existing assignment; Are you sure?**

The specified virtual device unit is already attached to a file.

Detach the device or respond Y to proceed.

### **?JOAT-I-dev:/Detach; Are you sure?**

You must confirm your intention to detach the device. Respond Y or Yes if you want to detach the specified device from RTEM-11.

### **?JOAT-I-dev:[directory]filename.ext;ver/Cannot open for write - Opening read-only; Are you sure?**

JOAT has been unable to gain write access to the Files-11 file attached with the /V option. If you answer Y to the prompt "Are you sure?," you will be unable to write to the virtual device attached. If you do not answer Y, JOAT will not attach the virtual device. You can override this prompt by specifying the /Y option along with the /V option.

### **?JOAT-I-/Exit RTEM-11; Are you sure?**

You must confirm your intention to exit from RTEM-11.

Type a Y or Yes to exit from RTEM-11.

### **?JOAT-I-Foreground job loaded**

If you are running a foreground job, JOAT prints this message before executing the options /A, /D, and /E.

This is an informational message. Respond NO to the Are you sure? queries printed with /A, /D and /E if you want to unload the foreground job before execution.



## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

**?JOAT-I-Host device Dev: attached as RT-11 device Dev:**

This message is provided because some host device names and unit numbers may require JOAT to convert the host device name into an RT-11 device name. It informs you that, after the /A command, further references to the device attached must be made using the RT-11 device name given in this message. See JOAT /A for more information.

This is an informational message.

**?JOAT-I-Returning to host system**

**?JOAT-I-Type "DCL>START taskname" or "MCR>UNSTOP taskname" to continue**

After you suspend RTEM-11 with /M, this message tells you how to restart RTEM-11.

You can direct terminal input to any RSX-11 task or command interpreter at this point. Taskname is either RTETn (where n is your terminal number) or ...RTE. If your terminal is set to DCL, type START taskname. If your terminal is set to MCR, type UNSTOP taskname.

**?JOAT-I-Virtual device should be squeezed  
dev:[directory]filename.ext;ver**

The /T option to extend a virtual device has been used. This message reminds you to use the SQUEEZE command with the virtual device, so the RT-11 directory can be updated correctly with the new file size.

**?JOAT-U-Failed to attach TT:**

JOAT cannot reattach your terminal to RTEM-11 after you type UNSTOP taskname or START taskname.

RTEM-11 exits. You must invoke RTEM-11 again.

**?JOAT-U-System error**

An attempt was made to use a device not in the system, or a serious system error has occurred.

Make sure the device you want to use is loaded or installed. Check the directory of the system device to ensure that the necessary system programs are intact. Exit from RTEM-11 and invoke it, retrying the operation. Try to invoke JOAT using a copy of JOAT from your distribution kit. If the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration and version number, and the version numbers of RTEM-11 and JOAT.

**?JOAT-U-Unknown error code**

This error is usually combined with:

**?JOAT-F-FCS error code n. \*error text\***

or

**?JOAT-F-Directive error code n. \*error text\***

If the message appears alone, it indicates an error in JOAT. Try to invoke JOAT again, using your distribution kit. If the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration and version number, and the version numbers of RTEM-11 and JOAT.

## JACK-OF-ALL-TRADES UTILITY PROGRAM (JOAT)

?JOAT-W-Cannot open for write; opening read-only  
dev:[directory]filename.ext;ver

JOAT has been unable to gain write access to the Files-11 file attached with the /V option. This message informs you that you will be unable to write to the virtual device attached.

Specify a virtual device that may be opened for write using the /O option.

?JOAT-W-Device not attached dev:

The specified device is not attached to RTEM-11.

Use JOAT /V to attach a virtual device. Use JOAT /A to attach a physical device.

## CHAPTER 5

### FILE INTERCHANGE PROGRAM (FIP)

You can use the file interchange program (FIP) to transfer files in Files-11 format between RTEM-11 and host operating system devices. FIP does not support RT-11 to RT-11 file transfers or RT-11 magtapes. Use the RT-11 PIP.SAV program (RT-11 COPY command) for these functions. The RSX-11M/M-PLUS MCR Operations Manual lists devices supported by RSX-11. The VAX/VMS Command Language User's Guide lists devices supported by VAX/VMS.

#### 5.1 CALLING AND TERMINATING FIP

To call FIP, type:

```
.R FIP
```

FIP prints an asterisk at the left margin of the terminal and waits for you to type a command string.

To halt FIP and return control to the RTEM-11 monitor, type CTRL/C when FIP is waiting for input from the console terminal. You can type two CTRL/C commands to abort FIP at any other time. To restart FIP, type R FIP.

##### 5.1.1 HELP Command

To display information about FIP command syntax, type HELP FIP when you see the keyboard monitor prompt. Note that the RT-11 HELP.SAV program must reside on the current RTEM-11 system device for the HELP command to work.

```
.HELP FIP
```

FIP Transfers files between RT-11 volumes and Files-11 volumes

SYNTAX

```
filespec[/options]=filespec[/options][,filespec[/options]...]
```

```
.  
.  
.
```

## FILE INTERCHANGE PROGRAM (FIP)

### 5.1.2 FIP Command String

Chapter 3 describes the general syntax of a FIP command line.

All variations of the wildcard construction are valid for input file specifications.

Output file specifications cannot contain embedded wildcards. If you use any wildcard character in an input file specification, the corresponding output file name or file type must be an asterisk, or the output file specification must contain no wildcards. In the latter case, FIP creates the output file as a concatenation of all the input files. The following example shows wildcard usage:

```
*.B=A%B.MAC
```

In this example, the embedded percent character (%) represents any single valid file-name character. In the output file specification, the asterisk tells the system to use files with names that are the same as the corresponding input file.

FIP ignores all files with the file type .BAD unless you explicitly specify both the file name and file type in the command string. No message is printed if FIP does not include .BAD files in the transfer.

FIP transfers files between RTEM-11, which accepts up to six characters in a file name, and the host operating system, which accepts up to nine characters in a file name. When you copy a Files-11 file to RTEM-11, FIP truncates the file name to six characters if necessary. For example, the host system file EMPLOYEES.BAS is copied to RTEM-11 as EMPLOY.BAS.

If you omit the version number, FIP always copies the highest numbered version of the input file, or creates an output file with a version number that increments the highest existing version number (of the same name and type) by one.

### 5.2 FIP COMMAND OPTIONS

FIP command options, summarized below, let you specify how files are copied between RTEM-11 and the host operating system. You can put command options at the end of the command string or after any file name in the string. Operations involving Files-11 devices are an exception; you must specify the /F option on the same side of the command string (input or output) as the Files-11 device.

| Option | Function                                                                                                                                                                                    |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /A[:n] | Copies all files in ASCII mode regardless of file type. In transfers to Files-11 format, fixed-length records of length n are generated if you specify a value for n. (See Section 5.2.1.)  |
| /B[:n] | Copies all files in formatted binary mode regardless of file type. In transfers to Files-11 format, if n is specified, fixed-length records of length n are generated. (See Section 5.2.2.) |

(Continued on next page)

## FILE INTERCHANGE PROGRAM (FIP)

|        |                                                                                                                                                                                                                                                                      |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /C     | Specifies that Files-11 output files will be created as contiguous. (See Section 5.2.3.)                                                                                                                                                                             |
| /F     | Specifies that input volume, output volume, or both are in Files-11 format. (See Section 5.2.4.)                                                                                                                                                                     |
| /G     | Specifies that only files having current date as their creation date will be copied. (See Section 5.2.5.)                                                                                                                                                            |
| /I[:n] | Copies all files in image mode regardless of file type. In transfers to Files-11 format, if n is specified, fixed-length records of length n are generated. The default value is 512 blocks. (See Section 5.2.6.)                                                    |
| /N     | Specifies that a file will not be copied if a file of the same name (and version for Files-11) exists on output device. (See Section 5.2.7.)                                                                                                                         |
| /P     | Copies all files except those specified. (See Section 5.2.8.)                                                                                                                                                                                                        |
| /Q     | Prints file name of each file to be included in the copy. You must respond with a Y to copy the file. (See Section 5.2.9.)                                                                                                                                           |
| /T     | Copies Files-11 input files in STREAM mode regardless of file type. In transfers to Files-11, output files will have the FORTRAN IV carriage control file attribute. The FD.FTN bit is set in the file data block of the Files-11 output file. (See Section 5.2.10.) |
| /W     | Logs (displays) on the console terminal the names of all files copied. (See Section 5.2.11.)                                                                                                                                                                         |
| /Y     | Specifies that .SYS files may be included in the copy. (See Section 5.2.12.)                                                                                                                                                                                         |

### 5.2.1 Copying in ASCII Mode (/A[:n])

Use the /A option to transfer all files in the 7-bit ASCII mode. Rubouts, nulls, and vertical tabs are removed from records in the input file. When an RTEM-11 volume is the output volume, each record is terminated by a <CR><LF> pair. FIP treats CTRL/Z (32 octal) as the logical end-of-file in the input file.

In transfers to Files-11 volumes, the <CR><LF> pair is removed. If you specify a size value (n), fixed-length records of that size are generated, padded with nulls if required. If you omit the size value or if you specify it as zero, variable-length records are generated.

## FILE INTERCHANGE PROGRAM (FIP)

The following example transfers all .MAC files from the RTEM-11 default storage device (logical name DK) to DR0, a Files-11 volume:

```
*DR0:[200,200]*.* /F=*.MAC/A
```

The files are transferred in Files-11 format with variable length records.

### 5.2.2 Copying in Binary Mode (/B[:n])

Use the /B option to add formatted binary headers and checksums to files transferred to RTEM-11 volumes, and to remove formatted binary headers from files transferred to Files-11 volumes.

In transfers to Files-11 volumes, the size value (n) specifies that fixed-length records of that size will be generated. If the size value is omitted or 0 is specified, variable-length records are generated.

The following example transfers all .OBJ files from the Files-11 format RK05 in unit 0 to the RTEM-11 volume on DX1:.

```
*DX1:*.*=RK:*.OBJ/B/F
```

The /F option indicates that the input files are in Files-11 format. The /B option specifies that the files will be transferred in formatted binary mode.

If you need to copy a binary file from RTEM-11 to Files-11 for execution on RT-11, copy it in image mode (/I[:n]).

Do not use the /B option to copy OBJ libraries. Use the /QUERY or PIP /Q option to selectively copy files, and type NO for each OBJ library.

### 5.2.3 Creating Contiguous Output Files (/C)

Use the /C option to specify that the Files-11 output file will be a contiguous file.

The following example transfers the data file OLDFIL.DAT from the RTEM-11 default storage device DK:.. The file is renamed NEWFILE.DAT and copied to directory [10,20] on a Files-11 volume mounted on DB1:.

```
*DB1:[10,20]NEWFILE.DAT/F=OLDFIL.DAT/I/C
```

The Files-11 output file will be a contiguous file, as specified by the /C option, with fixed-length records of 512 bytes. The file is transferred in image mode as specified by the /I option, and the record length defaults to 512 because no value was specified.

If a file is transferred with /C and ASCII mode (explicitly or by default), the output file may not be contiguous because the difference in record formats precludes an exact determination of the output file size.

## FILE INTERCHANGE PROGRAM (FIP)

### 5.2.4 Specifying Files-11 Transfers (/F)

Use the /F option to specify that the input volume(s), output volume, or both are Files-11 volumes. This option applies only to the side of the command string (input or output) on which it appears.

The following command copies the highest numbered version of A.MAC from directory [230,72] to a file of the same name on the RTEM-11 default storage volume.

```
*A.MAC=[230,72]A.MAC/F
```

### 5.2.5 Copying New Files (/G)

The /G option copies all files with the current date as their creation date. Specify /G only once in the command line; it applies to all file specifications in the command.

The following example copies all files having the current date to RSX-11 directory [230,50]. This is an efficient way to back up all new files after a session at the computer.

```
*[230,50]*.* /F=.* /G
```

### 5.2.6 Copying in Image Mode (/I[:n])

Use the /I option to specify that all files will be copied with no record translations.

In transfers to Files-11 volumes, if the size value (n) is specified, fixed-length records of that size are generated. If no value or 0 is specified, fixed-length records of 512 bytes are generated.

```
*STATUS.SAV/F=STATUS.SAV/I
```

### 5.2.7 Copying Without Replacing (/N)

Use the /N option to prevent the transfer of a file if a file with the same name, type, and version number exists on the output volume. The following example uses /N to prevent replacement of an existing file:

```
**SAV/F=SAV/N  
?FIP-I-Output file not superseded [220,31]STATUS.SAV;1  
*
```

The file STATUS.SAV is not copied to the host system directory because a file of the same name resides there. All other files with the .SAV file type are copied.

### 5.2.8 Excluding Files (/P)

The /P option copies all files except those named.

```
**OBJ=OBJ/F/P
```

## FILE INTERCHANGE PROGRAM (FIP)

All host files in the current directory except those with the .OBJ extension are copied by this command.

### 5.2.9 Copying with Query (/Q)

Use the /Q option to list all files and request confirmation before copying individual files. Type Y<RET> to copy a listed file. Type N<RET> to prevent the file from being copied.

```
*[230,50]*.*/F=*.OBJ/Q
Files copied:
DK:SYSLIB.OBJ to SY:[230,50]SYSLIB.OBJ;1? Y
DK:VDT.OBJ to SY:[230,50]VDT.OBJ;0? Y
*
```

### 5.2.10 Copying STREAM Files, Creating FORTRAN IV Files (/T)

Use the /T option when the input Files-11 file(s) are in VFC, STREAM or PRINT FILE format. When /T is used on a Files-11 output file specification, the output file(s) will contain FORTRAN IV carriage control.

```
**.*=FORT.DAT/F/T
*
```

This command copies the FORTRAN VFC file FORT.DAT from the host system's current directory.

### 5.2.11 Logging While Copying (/W)

The /W option creates a log on the console terminal of the names of all files copied. This option is useful if you want to keep a record of all files copied.

The following example copies all Files-11 files with the file type .MAC to the default RTEM-11 storage volume. The log of files copied is printed on the terminal.

```
**.*MAC=*.MAC/F/W
Files copied:
SY:[230,50]HIYA.MAC;1           to DK:HIYA.MAC
SY:[230,50]NEWHI.MAC;2         to DK:NEWHI.MAC
SY:[230,50]EMPLOYEES.MAC;6     to DK:EMPLOY.MAC
*
```



## FILE INTERCHANGE PROGRAM (FIP)

### 5.2.12 Copying System Files (/Y)

Use the /Y option to implicitly include system files (.SYS) in a copy operation. Files with the file type .SYS are not copied with an implicit copy command unless you use the /Y option. FIP prints a message (?FIP-W-No .SYS action) if you omit the /Y option in a command that would implicitly operate on .SYS files. FIP copy commands that explicitly reference system files will work without the /Y switch.

```
**.*=.* /Y/F
*
```

This command copies all files from the current host directory including those files with the .SYS file type.

### 5.2.13 Default Values

If you do not specify a copy mode option in a command line, the copy mode options default to /A, /B, /I or /T, depending on the file type of each input file copied.

If a copy mode option is specified, all files are copied in that mode regardless of file type.

The following table shows the default copy mode that is used to transfer files of specific types when the copy mode option is omitted.

| Default Copy Mode | File Types           |      |      |      |      |
|-------------------|----------------------|------|------|------|------|
| /A:0              | .BAK                 | .COM | .DIR | .LST | .SLP |
|                   | .BAS                 | .COR | .DMP | .MAC | .SRC |
|                   | .BAT                 | .DAT | .DOC | .MAP | .TEC |
|                   | .B2S                 | .DBL | .FOR | .ODL | .TXT |
|                   | .CBL                 | .DDF | .FTN | .PAS |      |
|                   | .CMD                 | .DIF | .LOG | .RNO |      |
|                   |                      |      |      |      |      |
| /B:0              | .BIN                 | .LDA | .OBJ | .STB |      |
| /I:512            | All other file types |      |      |      |      |

## 5.3 FIP ERROR MESSAGES

### ?FIP-F-Channel in use

An error occurred in the FIP program.

Exit from RTEM-11 using JOAT /E. Invoke RTEM-11 again and try the FIP operation again, using a copy of your distribution kit. If the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration and software version number, and the version numbers of RTEM-11 and FIP.

## FILE INTERCHANGE PROGRAM (FIP)

### ?FIP-F-Channel not open

An error occurred in the FIP program.

Exit from RTEM-11 using JOAT /E. Invoke RTEM-11 and try the FIP operation again, using a copy of your distribution kit. If the error persists, submit an SPR to DIGITAL. Include a description of the host system hardware configuration and software version number, and the version numbers of RTEM-11 and FIP.

### ?FIP-F-Checksum error dev:filename.typ

A checksum error occurred during a formatted binary transfer from RTEM-11.

Check for a typing error in the command line. Make sure the correct file is being transferred. Data may have been lost from the input file.

### ?FIP-F-Device full dev:filnam.typ

The output device did not have enough room to contain the specified file, although preceding files were copied.

Squeeze the output device to increase storage space. Try the operation again.

### ?FIP-F-Device in use dev:

Another job is using the specified device.

Try the operation again when the other job is finished.

### ?FIP-F-Directive error code n. \*error text\*

FIP could not interpret an error received from a call to the host operating system.

The system manager should take corrective action using the I/O error codes listed in the RSX-11M/M-PLUS I/O Drivers Reference Manual.

### ?FIP-F-Directory input error

An error occurred while the directory of the input device was being read.

Make sure the input device has a valid directory structure.

### ?FIP-F-FCS error code n. \*error text\*

FIP received an error from a call to RSX-11 FCS that could not be interpreted.

The system manager should take corrective action using the I/O error codes listed in the RSX-11M/M-PLUS I/O Drivers Reference Manual.

### ?FIP-F-Fetch error dev:

A serious system or FIP internal error occurred. The copy of FIP.SAV, the monitor file, or the specified device handler may be corrupted on disk.

## FILE INTERCHANGE PROGRAM (FIP)

Exit from RTEM-11 using JOAT /E. Invoke RTEM-11 again and retry the operation. If the error persists, obtain a new copy of FIP.SAV and the device handler specified in the error message. Retry the operation. If the error recurs, submit an SPR to DIGITAL. Include a description of the hardware configuration, the version number of your host operating system, and the version numbers of RTEM-11 and FIP.

### ?FIP-F-File not found dev:filename.typ

The input file specified was not found, or no input files with the expected name or type were found when a wildcard was defined.

Check for a typing error in the command line, verify that the file exists as entered in the command line, and try the operation again.

### ?FIP-F-Insufficient memory

Memory overflow occurred, caused by too many device and/or file specifications (usually in wildcard operations).

Try copying the files one at a time without using wildcards.

### ?FIP-F-Invalid command

The command line is incorrect. An option that is not compatible with the command may have been used.

Check for a typing error. Verify that the format and syntax are correct and try the operation again.

### ?FIP-F-Invalid device dev:

An invalid or nonexistent device was specified.

Check for a typing error in the command line. Verify that the device indicated is loaded in the device drive.

### ?FIP-F-Invalid directory

The specified device does not contain a valid directory.

Make sure the device is a valid input or output device and contains a valid directory. Try to transfer the files again.

### ?FIP-F-Invalid option

An invalid option was used in the command line.

Check for a typing error in the command line. Use only those options listed as valid for FIP.

### ?FIP-F-Invalid use of wildcards dev:filename.typ

The output file specification contained embedded wildcards (\* or %) as in A\*B.MAC and A%B.MAC.

Correct any errors in the use of wildcards. RT-11 rules apply in the use of wildcards.

## FILE INTERCHANGE PROGRAM (FIP)

### ?FIP-F-No LUN available

In a transfer to or from a Files-11 device, no logical unit number (LUN) was available.

To free a LUN for the current operation, use JOAT to detach a device that was previously attached with JOAT.

### ?FIP-F-Output error dev:filnam.typ

1. An unrecoverable error occurred while FIP was transferring a file.

Check the procedures for recovery from hard error conditions described in the RT-11 System Message Manual.

2. There was not enough room on the device to transfer the specified file. In a multiple file operation, execution was successful on files preceding the one interrupted by the error.

In a transfer to RTEM-11, squeeze the device. In a transfer to the host operating system, delete files to create more storage space.

### ?FIP-F-Output file full dev:filnam.typ

The output file was too small to receive the input file.

Make sure there is enough space on the output device to receive the file. Try to transfer the file again.

### ?FIP-F-Protected file already exists

FIP tried to create an RTEM-11 output file with a name already associated with an existing protected file. No new file is created.

Use the monitor RENAME/NOPROTECT command or the PIP /Z option to change the protection status of the existing file, or use a different name to create the new file.

### ?FIP-F-System error

An attempt was made to use a device not on the system, or a serious error occurred.

Make sure the device you want to use is loaded. Check the directory of the relevant device to ensure that the necessary system programs are intact. Exit from RTEM-11, invoke it again, and try the operation again.

### ?FIP-F-Too many output files

More than one output file was specified in the command line.

Limit the number of output files on the command line to one.

### ?FIP-F-Wrong version of RTEM-11

The RTEM-11 monitor is corrupted, or an attempt was made to run FIP under an RT-11 monitor or an outdated RTEM-11 monitor.

## FILE INTERCHANGE PROGRAM (FIP)

Exit from RTEM-11, invoke it again, and try the operation again. Do not attempt to run FIP under monitors not distributed in the RTEM-11 kit.

### ?FIP-I-Output file not superseded dev:filename.typ

A file of the same name as specified resides on the output volume. FIP /N was used to prevent copying files of the same name (and version for Files-11 output).

This is an informational message.

### ?FIP-W-File created: protected file already exists dev:filnam.typ

A protected RTEM-11 file exists along with a newly created unprotected file of the same name.

List the directory, unsorted. If the unprotected file appears before the protected file in the directory listing, delete or rename it. If the protected file appears first, rename it or change the protection code with the PIP /Z option or the monitor RENAME/NOPROTECT command.

### ?FIP-W-Library file not copied dev:filnam.typ

An OBJ library is an input file in a FIP /B transfer command. The file name is shown in the message. The transfer is not completed.

Do not use the /B option to copy OBJ libraries. Use the /QUERY or PIP /Q option to selectively copy files, and type NO for each OBJ library.

### ?FIP-W-No .SYS action

The /Y option was not included in a command aimed at implicitly copying files of type .SYS. A wildcard transfer will most likely cause this message. The command is executed for all files but those of the .SYS file type.

Use /Y to implicitly copy files of type .SYS.



## CHAPTER 6

### MODIFYING THE VIRTUAL SYSTEM DEVICE

This chapter tells host system managers how to add and delete files in the shared area of the virtual system device.

You can modify the virtual system device to include RT-11 utility programs and any other files RTEM-11 users may want to share. You can select specific files to copy from your RT-11 distribution kit to the shared area or create a shared area from the entire volume.

The directory for the shared area of the virtual system device is expandable to accommodate additional system programs. This chapter shows how to make additional utilities, libraries, and data files available to all RTEM-11 users by copying new files to the shared area and extending it if necessary.

To reserve space for future expansion in the shared area of the virtual system device, the directory contains directory fillers. Directory fillers are unique to RTEM-11 and are removed to convert a shared area to a private area. The basic difference between a shared and private area is the presence of directory fillers in the former. For an overview of the virtual system device, see Section 2.2.

Section 6.1 summarizes the procedure for modifying the shared area of the virtual system device. Section 6.2 provides an example that illustrates this procedure.

#### 6.1 MODIFICATION PROCEDURE

This section summarizes the steps required to create a shared area or to add, delete, or modify files that reside in an existing shared area of the virtual system device.

To create or modify a shared area, work from a privileged account but not from the account in which the shared file will reside. The default location for the shared file is LB:[1,1]RT11SH.DSK on an RSX-11 system or SYS\$LIBRARY:RT11SH.DSK on a VAX/VMS system.

##### 6.1.1 Establish Shared Area as a Temporary File

First, copy the shared area to a temporary file. You can modify this copy while the original shared area serves as part of the virtual system device.

```
$ COPY LB:[1,1]RT11SH.DSK output-filename.TMP
```

## MODIFYING THE VIRTUAL SYSTEM DEVICE

Invoke RTEM-11 from the default virtual system device.

\$ RTEM/VS

Use JOAT /V to attach the temporary file as a virtual device. To extend the device, you must use /T:n at this time. The value (n) specifies the number of blocks (in octal) by which the file will be extended. This value should include the number of blocks in the files you will add to the shared area. If you do not plan to add files, you can omit /T:n. There is no default value.

\*filename.TMP/V:VS<sub>n</sub>/T:n

### 6.1.2 Update and Compress the Virtual Device (JOAT /U)

The /U option converts a shared area into a private area. Thereafter, you can modify the device. By removing directory fillers, /U transforms a shared area into a private one. Files may be added, deleted, moved or modified after the /U option is used. You can combine /U with /V and /T in the previous step or use /U separately. Either way, specify the shared area with the virtual device name and unit to which it was previously attached.

\*VS<sub>n</sub>:/U

You must compress the volume (with SQUEEZE) or initialize it (with INITIALIZE) after using the /U option.

.SQUEEZE VS<sub>n</sub>:

### 6.1.3 Add, Delete, or Modify Files on the Virtual Device

Perform all modifications to files that reside in the former shared area. At this time, you may copy files to the shared area from your RT-11 distribution kit or working volume. You may also delete old files from the shared area to be replaced with updated ones. Access the former shared area as the virtual device (VS<sub>n</sub>;) to which it was attached with the JOAT /V option.

If you need to delete, modify, or replace a file from the former shared area, you must first disable the file's protected status.

.UNPROTECT VS<sub>n</sub>:filespec

.DELETE VS<sub>n</sub>:filespec

### 6.1.4 Create a New Shared Area (JOAT /S)

The /S option creates a shared area from an existing virtual device or RT-11 foreign volume. After using /U to convert a shared area to a private area, use /S to return it to a shared area.



## MODIFYING THE VIRTUAL SYSTEM DEVICE

When you use /S to create a shared area, the position of files in the shared area is established. All files are moved to the read-only area leaving SWAP.SYS, BAM.SYS, IND.SAV, and all RTEM-11 device handlers including SET options (respectively) in the mark zone. You can use the /O option to order the files differently. Read about /O (Section 6.1.5) before you use /S.

\*output-filespec=input-device:/S

Specify the input device as the virtual device to which the shared area was attached with the JOAT /V option. If you did not update an existing shared area but are creating a shared area from a foreign volume, specify the foreign volume with an RTEM-11 device mnemonic. If you intend to use the new shared area as a virtual system device, certain files must reside on it. The files are RTEMFB.SYS, VSM.SYS, and SWAP.SYS.

Use a host system file specification for the output file name. If you omit the file type, .SYS is assumed. The size of the output file is the total number of blocks in use on the input device.

The /S option automatically attaches the shared area as the first free virtual device unit. Automatic unit assignment cannot be overridden. JOAT displays the message:

?JOAT-I-Attached to VSn

This message tells you which virtual device unit was assigned.

### 6.1.5 Establish the Order of Files in Shared Area (JOAT /O[:XXX])

You can use the /O option with /S to establish the order of files in the shared area of a virtual system device.

When you use /S to convert a private area to a shared area, the position of files on the volume is established. All files are moved to the read-only area leaving SWAP.SYS, BAM.SYS, IND.SAV, and all RTEM-11 device handlers including SET options (respectively) in the mark zone. Use /O with /S to transfer files from the read-only area to the mark zone.

\*output-filespec=input-device:/S/O[:xxx]

The values for xxx are ADD, NEW, SAV, and UPD.

ADD causes files that reside in the mark zone (all blocks following SWAP.SYS) to remain unchanged, and prompts for additional files to be copied to this area. When you see the prompt File?, type the names of files you want to move from the read-only area of the volume to the mark zone. The files you specify must reside on the input device. The ADD option is the operational equivalent of the SAV and NEW options. Files added to the volume are positioned in the order in which they are specified.

NEW is the default for /O. This option adds files you specify to the mark zone. The files are added after SWAP.SYS, BAM.SYS, IND.SAV, and all RTEM-11 device handlers including SET options. The NEW option prompts File?. Type the names of the files you want to move from the read-only area to the mark zone. Files added to the volume are positioned in the order in which they are specified.

## MODIFYING THE VIRTUAL SYSTEM DEVICE

SAV causes the position of files that reside in blocks following SWAP.SYS to remain unchanged.

UPD lists every file in the mark zone following the SWAP.SYS file and prompts Include file filnam.typ? for each file. Type Y[ES] followed by a carriage return if you want the specified file to remain in the mark zone. Type N[O] followed by a carriage return if you want the file to be moved to the read-only area. NO is the default. After all files in the mark zone have been listed, the prompt File? is displayed. Type the names of files you want to move from the read-only area of the volume to the mark zone. Files added to the volume are added in the order in which they are specified.

### 6.1.6 Maintain the Host System

After you have performed all modifications to the shared area, exit from RTEM-11. Then copy the modified shared area to the library account (copy it to LB:[1,1]RT11SH.DSK on RSX-11 or SYSSLIBRARY:RT11SH.DSK on VAX/VMS). Protect the new shared area so all RTEM-11 users may access it. Delete all temporary files created during the modification process, test the new shared file, and then purge previous versions of the shared file from the library account. (See items [9] through [13] of Section 6.2.)

### 6.2 SAMPLE MODIFICATION

This section contains a sample modification procedure. The example shows how to copy files to the shared area from both an RT-11 format foreign volume (an RK05, unit 0) and from a file (RT11V5.DSK). The numbered steps are explained in the text following the example.

If you are copying from a foreign volume, place your volume in the device and issue the ALLOCATE and MOUNT /FOREIGN commands before you invoke RTEM-11.

#### Procedure

- [1] \$ COPY LB:[1,1]RT11SH.DSK RT11SH.TMP
- [2] \$ RTEM/VS  
?RTEM-I-Creating default private file DM1:[1,224]RT11PR.DSK;0  
RTEM-11 (host type) V02.nn  
  
RT11FB V05.xx  
?KMON-F-File not found DK:STARTM.COM
- [3] .R JOAT  
\*RT11SH.TMP/V:VS1/T:2000./U  
?JOAT-I-Virtual device should be squeezed DM1:[1,224]RT11SH.TMP;1

## MODIFYING THE VIRTUAL SYSTEM DEVICE

```
[4] *DK0:/A/W
    or
    *RT11V5/V:VS2/W
    *^C

[5] .SQUEEZE/NOQUERY VS1:

[6] .RENAME/NOPROTECT VS1:DEMOX1.OBJ VS1:*. *
    .DELETE VS1:DEMOX1.OBJ

[7] .COPY RK0:QUEMAN.SAV VS1:
    .
    .
    .COPY RK0:RESORC.SAV VS1:
    or
    .COPY VS2:QUEMAN.SAV VS1:
    .
    .
    .COPY VS2:RESORC.SAV VS1:

[8] .R JOAT
    *RT11SH=VS1:/S
    ?JOAT-I-Attached to VS3:

[9] */E/Y

[10] $ COPY RT11SH.DSK LB:[1,1]RT11SH.DSK

[11] VAX/VMS:
    $ SET PROTECTION=(GROUP:R,WORLD:R) LB:[1,1]RT11SH.DSK
    RSX-11:
    >SET PROTECTION LB:[1,1]RT11SH.DSK (GROUP:R,WORLD:R)

[12] $ DELETE RT11SH.TMP;0,RT11SH.DSK;0

[13] $ PURGE LB:[1,1]RT11SH.DSK
```

### Explanation

- [1] Copy the shared area to be modified to a temporary file (RT11SH.TMP).
- [2] Invoke RTEM-11 from the default virtual system device.
- [3] Attach the temporary file as a virtual device with JOAT /V:VS<sub>n</sub>. At the same time, extend the file by 20000 (decimal) blocks. Also, use /U to convert the shared area to a private area to allow for modification.

## MODIFYING THE VIRTUAL SYSTEM DEVICE

- [4] Attach the volume on which the files to be copied reside. This volume is either DK0: or VS2:.
- [5] Squeeze the virtual device attached in step 3 to reflect the extended space specified with /T:n.
- [6] If you need to delete, modify, or replace files from the former shared area, you must first unprotect the file or the operation will fail.
- [7] Modify the virtual device squeezed in step 5 with files from RK0: or VS2:.
- [8] Create a new shared area from the modified virtual device.
- [9] Exit from RTEM-11.
- [10] Copy the new shared area to the library account.
- [11] Protect the new shared area so all RTEM-11 users may access it.
- [12] Delete all temporary files.
- [13] Purge the library account.

## **GLOSSARY**

### **Command line interpreter**

See DCL and MCR.

### **Compatibility mode**

Provided by VAX/VMS to enable development and execution of RSX-11 programs.

### **Control characters**

Typed at the terminal to control terminal hardware and program execution; combine the CTRL key and another key. Referred to as special function keys in RT-11 terminology.

### **DCL**

DIGITAL command language; provides a means of communication between the user and the operating system. DCL is easier to use than MCR because the commands are English words and you are prompted for the information required to complete the command.

### **Despooling**

Passing output to a low-speed peripheral, such as a line printer, from a queue maintained on a volume. Compare with Spooling.

### **Device driver**

See Device handler.

### **Device handler**

Software that handles physical input and output to a device. Each device included in the system has a device handler. Device handlers (used in RT-11) are referred to as device drivers in RSX-11 or VAX/VMS. RTEM-11 device handlers don't handle physical I/O. They convert RTEM-11 I/O requests into equivalent host operating system QIO requests. The host system drivers then issue the QIO requests to the appropriate host system device.

### **Directory filler**

A special entry for reserving space in the shared portion of the RTEM-11 virtual system device's directory.

### **Directory-structured devices**

File-structured devices that have a series of directory segments at the beginning of the device. The device directory begins at block 6. File-structured devices store information in files under assigned names.

### **Executive**

The RSX-11 system program that directs program execution and maintains the integrity of the entire operating system. The executive monitors and coordinates all activities in the system including real-time and multiprogramming task execution, user communication, supervision of input and output (I/O), and resource allocation.

### **File**

An owner-named area on a volume.

**Files-11**

The on-disk structure used by RSX-11 and VAX/VMS.

**Foreign volume**

An RSX-11 or VAX/VMS volume that is not in Files-11 format; for example, an RT-11 directory-structured volume.

**Host system**

The system on which a program executes. RSX-11M, RSX-11M-PLUS, and VAX/VMS are host systems for RTE-11.

**Implicit prompt**

On an RSX-11 system, indicates that a program is ready to accept a command. The right angle bracket (>) is the implicit prompt displayed by the command line interpreter. Type a carriage return to display the implicit prompt or a CTRL/C to display the explicit prompt. The explicit prompt indicates which system program is currently waiting for input. For example, the explicit prompt MCR> indicates that MCR is waiting for input.

**Installation**

The site at which software and hardware components combine to form a computer system. Also, the process of installing software and hardware.

**Job**

An RT-11 executable program. Compare with Process and Task.

**Logical name**

A user-specified name for any portion or all of a file specification.

**Mapped system**

A system with memory management hardware that intercepts a 16-bit virtual address generated by the processor and converts it to an 18-bit physical address. This process -- associating a virtual address with a physical address -- is called mapping. RTE-11 runs on mapped systems only.

**Mark zone**

A section of the shared area of the virtual system device. Files that reside in the mark zone are read/write. Files in the remainder of the shared area are read-only.

**MCR**

Monitor console routine; on an RSX-11 system, provides a means of communication between the user and the system utilities and installed tasks. Most MCR commands use initials or abbreviations in strict syntax, rather than English words as in DCL.

**Node**

A computer system connected to other systems by hardware and software to form a computer network. A computer network consists of multiple nodes.

**Option**

An element of a command or command string that lets the user select from among several alternatives associated with the command. In RT-11, an option consists of a slash character (/) followed by the option name and, if necessary, a colon (:) and value. The RT-11 term option is equivalent to the RSX-11M/M-PLUS term switch.

**Password**

A protective keyword required in a log-in sequence to gain access to the operating system. The password is not displayed on the terminal when you type it.

**Private area**

A part of the virtual system device that holds user files.

**Process**

On a VAX/VMS system, the basic entity scheduled by system software for execution. A process consists of an address space and both hardware and software contexts. Compare with Job and Task.

**RTEM-11**

The set of programs that provide the RT-11 program development environment under RSX-11M/M-PLUS and VAX/VMS.

**Shared area**

A section of the virtual system device that holds files shared by RTEM-11 users. The shared area is read-only. See Mark Zone.

**Spooling**

Receiving input in a queue on a volume for output to a low-speed peripheral. Compare with Despooling.

**System prompt**

Indicates the system is ready for you to enter a command. The system prompts are:

|                 |                                                  |
|-----------------|--------------------------------------------------|
| RTEM-11:        | a period (.)                                     |
| RT-11:          | a period (.)                                     |
| RSX-11M/M-PLUS: | the letters MCR> or DCL> or an angle bracket (>) |
| VAX/VMS:        | a dollar sign (\$)                               |

**Task**

The fundamental executable unit of an RSX-11 program. The term task in RSX-11M/M-PLUS is equivalent to the term "job" in RT-11.

**Task builder**

An RSX-11M/M-PLUS utility program. Once a task is assembled or compiled into an object format, it is built into a task image by the task builder (TKB). The linker (LINK) is the RT-11 equivalent of the task builder.

**UIC**

User identification code; an account number that identifies an authorized system user. The UIC consists of a group number and a member number separated by a comma.

**Virtual device**

A Files-11 file that appears to be a volume to RTEM-11. The volume has a home block and directory segments defining its dimensions. The virtual system device is a pair of Files-11 files that are treated as a single system volume by RTEM-11. The Files-11 files that make up a virtual system device can be copied using the host system COPY command, but the RTEM-11 files within this device can be accessed only through RTEM-11.

**Virtual machine**

The environment provided by RTE-11. With the exception of the I/O page, a user program running under RTE-11 appears to be running on a stand-alone PDP-11 with RT-11.

**Volume**

The largest logical unit of the file structure. The term volume is often used as a synonym for the term device because you specify a device name to access a volume. However, the device name you supply in a file specification is the name of the device on which the volume resides.

In RT-11, a volume is a physical medium, such as a diskette or magtape, that you load into a device drive. A device or device drive is the unit that holds the volume and is attached to the peripheral housing.



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## HOW TO ORDER ADDITIONAL DOCUMENTATION

| From                                                                                                  | Call                                          | Write                                                                                                              |
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| Alaska, Hawaii                                                                                        | 603-884-6660<br>8:30 A.M. to 6:00 P.M. ET     |                                                                                                                    |
| or                                                                                                    | 408-734-4915<br>8:15 A.M. to 5:00 P.M. PT     |                                                                                                                    |
| New Hampshire                                                                                         | 603-884-6660<br>8:30 A.M. to 6:00 P.M. ET     | Digital Equipment Corporation<br>Accessories & Supplies Center<br>P.O. Box CS2008<br>Nashua, NH 03061              |
| Rest of U.S.A.,<br>Puerto Rico*                                                                       | 1-800-258-1710<br>8:30 A.M. to 6:00 P.M. ET   |                                                                                                                    |
| *Prepaid orders from Puerto Rico must be placed with the local DIGITAL subsidiary (call 809-754-7575) |                                               |                                                                                                                    |
| Canada                                                                                                |                                               |                                                                                                                    |
| British Columbia                                                                                      | 1-800-267-6146<br>8:00 A.M. to 5:00 P.M. ET   | Digital Equipment of Canada Ltd<br>940 Belfast Road<br>Ottawa, Ontario K1G 4C2<br>Attn: A&SG Business Manager      |
| Ottawa-Hull                                                                                           | 613-234-7726<br>8:00 A.M. to 5:00 P.M. ET     |                                                                                                                    |
| Elsewhere                                                                                             | 112-800-267-6146<br>8:00 A.M. to 5:00 P.M. ET |                                                                                                                    |
| Elsewhere                                                                                             |                                               | Digital Equipment Corporation<br>A&SG Business Manager*                                                            |
| *c/o DIGITAL's local subsidiary or approved distributor                                               |                                               |                                                                                                                    |

