Software Product Description

PRODUCT NAME: RSTS/E, Version 8.0 **SPD 13.01.22**

DESCRIPTION:

RSTS/E is a multiuser, general purpose timesharing system. Its uses include interactive timesharing, batch processing, program development, and special purpose applications. Up to 127 concurrent terminal users in both local and remote locations, through multiterminal services, can interact with application tasks. Without multiterminal services there can only be a maximum of 63 users. Tasks can share computational, storage, and input/output services provided by the RSTS/E system.

Programs can be written in any of several languages. The following languages are included on RSTS/E systems:

- BASIC-PLUS
- MACRO-11 assembly language

The following languages are optionally available for use on RSTS/E:

- BASIC-PLUS-2
- COBOL-81
- PDP-11 COBOL
- DIBOL-11/DECFORM
- FORTRAN IV
- FORTRAN-77

BASIC-PLUS-2, COBOL-81, and PDP-11 COBOL require the support of the Record Management Services (RMS) software that is included with all RSTS/E systems. The optional DATATRIEVE-11 data management software also uses RMS. The use of RMS is optional for DIBOL-11, FORTRAN-77, and MACRO-11 assembly language programs. BASIC-PLUS and FORTRAN-IV do not use RMS.

The RSTS/E system comprises the RSTS/E monitor, device drivers, Commonly Used System Programs (CUSPs) and standard software components. Some of the major features of RSTS/E include:

- Interactive timesharing
- Dynamic allocation of system resources
- User and job privileges
- Batch processing capabilities
- Extensive file processing including file sharing and protection mechanisms
- Magnetic tape processing
- Terminal handler designed for interactive environments
- Shared common code
- Software-maintained cache of frequently-accessed disk data
- Intertask communication
- Disk file and device backup and restore utilities
- System operations and access control utilities
- System reliability features
- System maintenance tools
- User Command Languages (DCL and CCL)
- System manager definition of user commands
- Line printer spooling
- Micro RSTS subset generation

Timesharing

Each user of a RSTS/E system is associated with some job on the system and normally interacts with that job by using a terminal. Jobs can also run detached (not using a terminal) or they can use pseudo keyboards, as in the case of batch jobs, which run under the control of other jobs. Although a RSTS/E system is limited to 63 jobs, some RSTS/E systems can support as many as 127 terminal users simultaneously. These limits (63 jobs and 127 multiple terminals) are not always achievable. The number of user jobs is also diminished by system processes and other detached jobs on the system, such as Error Logger, Operator Services, Queue Manager, line printer spoolers, batch processors, and batch jobs.

Dynamic Allocation of System Resources

RSTS/E schedules CPU time and memory residency among jobs based upon their priority and processing requirements. Jobs are rescheduled based upon time-slicing or as a result of waiting for system services. A round-robin algorithm is used to select among eligible jobs with the same priority. Job priorities can be altered by the system manager, any privileged user, or by a privileged program.

RSTS/E uses the memory management hardware capabilities to map a user's job area and any shared code into the user job's virtual address space. Jobs can be swapped out to disk storage when the memory is

needed for other jobs to run. A job's size can be expanded dynamically, subject to limits imposed by the system manager or other privileged users. The absolute limit for a job size is 64K bytes (32K words), but the usual limit is 56K bytes (28K words). BASIC-PLUS programs cannot be larger than 32K bytes (16K words).

Privilege

As a resource sharing system, RSTS/E gives every user access to all the system peripherals and resources, as well as a wide range of capabilities, unless otherwise restricted by the system manager or other privileged users. A privileged user has full access to all the capabilities allowed by the RSTS/E system, and may control the operations of the system such as starting up or shutting down the system. A privileged user can add or delete user accounts, including other privileged accounts. A privileged user can also designate certain programs as privileged, in order to grant program-selected privileged capabilities to normally nonprivileged users. Privileged users also have access to tools for controlling the use of system features that make the system operate more efficiently.

Batch Processing

Users can submit batch jobs to perform tasks that require no terminal interaction, or to run programs at a later time, for example, outside normal working hours. For each batch job, the user can set a limit on the amount of CPU and/or elapsed time allowed and can request error level checking. The system manager starts up and controls batch processors. There can be a maximum of eight batch processors per system. Each batch processor requires a pseudo keyboard and two jobs (one for itself and one for the batch job).

File System

Disk files can be created, updated, extended, deleted, and renamed under program control, or they can be created, deleted, and renamed using terminal commands. Files can be created and extended dynamically with the RSTS/E file system automatically allocating disk space wherever available. Alternatively, to enhance system performance, a file's location can be specified and/or a file can be preallocated to use physically contiguous space. A disk file's size is limited by the storage capacity of the volume on which it resides. One file cannot extend across multiple disk volumes.

Files can be accessed by multiple users simultaneously. When opened for shared update, multiple users can update the same file while it remains open. The file system's block interlock mechanism prevents different users from updating the same part of the file at the same time.

The RSTS/E disk structure consists of a hierarchy, that has a Master File Directory (MFD), Group File Directory (GFD), User File Directory (UFD), and files. Because you can create accounts for 254 groups and each group can have 255 user accounts the MFD on each disk can contain up to 64,771 accounts. Since each accounts directory requires disk space, the practical maximum number of accounts is limited by the disk size and usage. The number of files that a UFD can contain varies, depending on parameters such as the size of the files. Each file is distinguished from other files in that UFD by its unique file name and type.

RSTS/E disk volumes, when used as file-structured devices, are either public or private. A public volume is the system disk or any volume initialized as a public volume. Other file-structured volumes are private. The system disk and any other mounted public volumes together constitute the public structure, which is a logical extension of the system disk, and to which all users access. However, files cannot span volumes within have the public structure. Users have access to mounted private volumes only if their UFD's exist on the private volumes, or if the protection codes of the files in other UFD's on those volumes permit access. Access to a disk file is governed by its protection code, which specifies read and write access for the file's owner, for other users within the owner's group, and for all other users. For executable files, the protection code specifies execute and read/write access for owner, group, and all other users. In addition, disks can be owned by one user on the system, so no other user can access files on that disk, regardless of the files protection code.

A special utility (FIT) provides file transfer capabilities to and from volumes (including RX01/RX02 floppy diskettes, for which FIT is the only file access method) using RT-11 file structure. This is limited to disks up to 33.5 million bytes in storage capacity. A separate utility handles interchange of files on flexible diskettes using the IBM 3741 single density format (Format 1). With this utility EBCDIC to ASCII translation is a user-specifiable option.

Magnetic Tape Processing

The user can process 9-track 800 or 1600 BPI magnetic tape by using one of the two labelling formats DOS-11 or ANSI.

DOS-11 format is used for interchange between PDP-11 systems: RSTS/E, RT-11, RSX-11M, RSX-11M-PLUS, IAS, and VAX/VMS.

ANSI format is used for interchange with the above systems as well as other computer systems. RSTS/E implements a subset of the ANSI format, defined by American National Standard Institute Specification X3.27 1978, which is used for interchange between systems that support the standard. When using ANSI labelling format, RSTS/E processes only volume-header, file-header, and end-of-file labels. RSTS/E does not perform access checking. A tape volume is considered private to the job which has access to that volume. RMS uses ANSI tape labelling format exclusively. Files may be processed using F (fixed-length) or D (variable-length) record formats.

RSTS/E utilities process single-volume file sets, except when PIP (Peripheral Interchange Program) is used. PIP can process volume sets consisting of more than one tape reel. Tapes conforming to a subset of ANSI X3.27-1978 can be read and written by the RMS utilities and PIP.

Terminal Handling

The RSTS/E terminal handler is designed for interactive environments and features:

- Full-duplex communications
- Modem control

- Type-ahead with immediate echo
- Programmable echo control
- Multiterminal I/O for individual jobs
- Pseudo keyboard capability

The echo control feature allows programs to handle terminal input one field at a time and to retain control of the screen display. This feature gives application programs the capability to use nonblock mode transfer terminals to simulate block mode input. RSTS/E does not support block mode transfer terminals.

Each RSTS/E system includes at least one terminal, the system console terminal, and potentially as many as 126 additional terminals. On systems purchased as DIGITAL supported, the console terminal must be either a:

- Hard copy device
- VT100 series with the VT1XX-AC printer port and printer.

On systems purchased as license only, the console terminal can be a VT100 series.

The multiterminal service feature allows any job to control multiple terminals, up to the maximum number configured for the system, on one logical channel. This feature allows one program to control a number of terminals that are all performing the same function.

Pseudo keyboards are logical devices that have the logical characteristics of real, physical terminals but have no terminals associated with them. Pseudo keyboards have input and output buffers to which a program can send output, and from which it can receive input. Using a pseudo keyboard as a communications device, a user can write a program to control other jobs. Each RSTS/E system includes at least one pseudo keyboard. The maximum total number of terminals and pseudo keyboards is 128.

Shared Common Code

RSTS/E allows the sharing of code that is common to multiple jobs. For example, the BASIC-PLUS Run Time System is shared by all users of that language. Another example of shared code is resident libraries of software routines, for example, RMS. The RMS resident library capability can be used by programs written in the languages that use RMS. EDT can also be used as a resident library.

The code that resides in the resident library must be written in the MACRO assembler language.

It is possible to create cluster libraries; that is, resident libraries that share the same address window in the user task's virtual address space. For example, the FMS-11/RSTS, COBOL-81 and RMS-11 resident libraries can be clustered so that they use 16K bytes (8K words) of the user's virtual address space, rather than up to 40K bytes (20K words) if they were not clustered.

It is recommended that resident libraries be used on systems with greater than 248K bytes (124K words) of memory.

Disk Data Cache

RSTS/E can minimize accesses to disk for frequently used data by keeping data in a software-maintained cache, a specially designated area of system memory space. The data retained in this cache can be restricted to disk directory blocks only, or it can include data from disk files. In the latter case, a privileged user has the option to allow all disk files to be cached or to allow only certain eligible files to be put in cache.

It is recommended that data from disk files be stored in the software maintained cache only on systems with greater than 512K bytes (256K words) of memory.

Intertask Communication

RSTS/E jobs can communicate with each other by sending and/or receiving intertask messages under program control. Jobs can send messages to valid message receivers. A job must have privileges to declare itself as a message receiver.

Disk File and Device Backup

RSTS/E provides the ability for total or selective backup of accounts and files to disks or to magnetic tapes. Selective backup can be done online. Backing up entire disk volumes can be performed off-line for all volumes including the system disk, or it may be performed on-line for any volume that is not logically mounted. Since the system disk is always logically mounted, it can only be backed up off-line, or files on it can be backed up selectively on-line.

System Operation Control

The system manager has the ability at system start-up time to:

- Add run-time systems
- Set the default run-time system
- Enable and/or disable devices
- Set system default parameters
- Allocate memory usage
- Install a new RSTS/E executive with different system generation parameters
- Initialize disk packs
- Verify and correct the file structure of RSTS/E disks
- Save and restore disk packs

The system manager and other privileged users have access to many utilities for controlling system operations on-line. The functions they can perform include the following:

- Define normal system startup control files
- Define automatic system restart control files
- Set the default keyboard monitor
- Logically mount and dismount disk packs
- Add or remove swap files, run-time systems, and resident libraries
- Add or remove system-dependent commands
- Define terminal characteristics for any terminal
- Change job priorities and other job-related parameters

- Add or delete user accounts, change passwords
- Dump account statistics for all or selected accounts
- Control usage of disk data cache feature

System Reliability

The error logging mechanism in RSTS/E records certain classes of hardware errors in a disk file. These errors include memory parity and disk or magnetic tape errors. The mechanism records system traps that occur in the executive, as well as other events such as system startup and shutdown, and power-fail recovery restarts. The system manager can print the error log and analyze it online.

If the hardware detects power failure, RSTS/E automatically ceases system operations. When the hardware detects power restoration, RSTS/E automatically reloads the system from the system disk, and reinitializes system operation by doing a "cold restart." The system resumes operation without operator intervention, but any users previously logged in will have to log in again. On systems that have MOS memory, the power failure destroys the content of memory unless the hardware battery backup option is installed. Without battery backup, the system will have to be manually re-started.

Likewise, if nonrecoverable hardware or system software errors result in a system crash, RSTS/E will attempt to dump the read/write portion of the executive's address space to a disk file then attempt to reload the system and do a "cold restart." Note that the system manager can disable either the crash dump or the automatic restart capability.

The system manager can check the reliabity of most peripherals online by running a Device Test package. The package exercises the peripherals in an attempt to force errors and identify fault-prone devices. However, comprehensive error isolation requires that DIGITAL Field Service use standard diagnostic software.

System Maintenance

Software integrity is kept at a high level by using software maintenance tools that allow the system manager to correct software components that are found to be in error. Parts of the RSTS/E system are maintained by replacing the component in error (e.g. the RSX default runtime system CUSPs) and the rest of the system by patching.

Software module updates and patches are applied through an automatic, machine-readable maintenance update procedure, thus avoiding the effort and potential errors associated with keying in patches manually.

The RSTS/E Software Dispatch is a publication that contains articles describing known problems and work-arounds. Where applicable, it includes instructions for patching the affected software components.

Program Development Tools

Program development on a RSTS/E system is facilitated by a wide selection of system utilities. The DEC Editor (EDT) can edit all types of text files, including RMS fixed length record files, variable length record files, and stream files.

The RSX run-time system provides an environment somewhat similar to that found on the RSX-11M Operating System, by handling a subset of the RSX-11M system directives. The RSX run-time system is required by all software using RMS, and by FORTRAN-77.

The RT-11 run-time system provides an environment similar to that found on the single-job monitor of the RT-11 Operating System, and handles a subset of the RT-11 directives. The RT-11 run-time system is required by FORTRAN IV and is also used during system generation. In addition the RT-11 run-time system is required for running the peripheral interchange program (PIP) and is therefore always present (but not necessarily resident in memory) on each RSTS/E system.

MACRO-11 assembly language programs involving subroutines callable by a higher-level language program, use the run-time system required by that higher-level language. When programming in MACRO-11 exclusively, the RSX run-time system is the preferred environment. The RT-11 environment can also be used.

Both the RSX and RT-11 environments provide the MACRO-11 Assembler, a Linker or Task Builder, and a Librarian utility. The Linker or Task Builder converts relocatable object modules, produced by the Assembler or optional language compilers, into executable images. Overlays do not require any special instructions or function calls in the source program. The user designates an overlay structure to the Linker or Task Builder with the overlay description language or interacting with DCL, and an executable task image with the desired overlays will be produced. The Librarian utility creates and maintains libraries of commonly used object module subroutines and Assembly language macro definitions. The Linker or Task Builder uses object libraries to resolve undefined external symbols.

User Command Languages

User commands to the RSTS/E system are handled and interpreted by one of the run-time systems capable of acting as a keyboard monitor.

The four standard Keyboard Monitors are DCL, RSX, RT-11, and BASIC-PLUS. All of these interpret sets of system commands, that is, English-like words followed by optional command parameters. These system commands allow users to perform all the fundamental functions required to use the RSTS/E system, such as logging on and off, and running programs. BASIC-PLUS and RT-11 have additional commands to perform actions appropriate for those environments.

Digital Command Language (DCL)

The DCL feature is based upon the DCL available on most DIGITAL operating systems. In particular, it is a subset of the DCL implemented on VAX/VMS. DCL is implemented as a keyboard monitor, and may be used either as the default keyboard monitor or an additional keyboard monitor. The command set gives the user access to most RSTS/E system features.

Concise Command Language (CCL)

The CCL feature allows each installation's system manager to define additional commands to run system

utilities as well as other user programs. Each CCL command definition specifies the full form of the command and its abbreviation, the program that processes the command, and the entry parameters for the program.

Line Printer Spooling

There are two printer spooling packages. The larger of the two, which has been available on earlier versions of RSTS/E has the following characteristics:

- Users submit files for printing by command or program
- Multiple copies
- Multiple form types
- Spooling controlled by the system manager
- Up to eight spoolers per system
- Each spooler and the queue manager require a job slot
- Each spooler can be dedicated to a printer or handle general printing
- Spooled files must be of sequential organization and be less than 32767 blocks in length
- Spooled files cannot contain variable length records such as VAX/VMS "print format" files

The smaller spooling package, aimed primarily for use on small RSTS systems, e.g. Micro RSTS, has the following characteristics:

- Users submit files for printing by command or program
- Multiple copies
- Multiple forms types
- Spooling controlled by the system manager
- One spooler per system
- Spooler can control up to two printers
- Spooler and queue manager share the same job slot
- Any RMS file organization can be printed

Both spooling packages may be used on the same system, however, only one package may be directly addressed from DCL. The system manager determines which is used. Both may be accessed by the CCL command interface.

Both line printer spooling packages support keyboard spooling to hardcopy terminals, such as receive-only printers (serial LA180 and the LA120-RA). Note however, that data integrity is not checked on the serial line. The LA180 must remain on-line while keyboard spooling is in operation.

Micro RSTS Subset Generation

Micro RSTS is a proper subset of RSTS/E, generated from a RSTS/E distribution kit using the BUILD utility. The BUILD utility transfers the Micro RSTS file to a removable disk media common to both the RSTS/E system and the target Micro RSTS system. The RSTS/E supplied components are: command procedures and a presysgened RSTS monitor configured for the MICRO/PDP-11, including an installation certification procedure to verify installation completion. It is the user's responsibility to transport the resulting Micro RSTS software from the RSTS/E system to the target Micro RSTS system.

Layered products listed in the RSTS/E Cross Reference Table (SPD 20.97.xx) are capable of being run on a properly configured Micro RSTS system if there are sufficient system resources for that combination of products. Refer to the SPD for each product.

A single-use license-only option is required to use the Micro RSTS subset on each target system.

Standard RSTS/E Software Components

The following software components are supplied as integral parts of the RSTS/E Operating System:

- RMS-11
- RMS Utility Programs
- EDT
- SORT-11
- BASIC-PLUS
- MACRO-11

Record Management Services (RMS-11)

RMS-11 includes a set of run-time service routines and utility programs that provide a data management subsystem. This allows a user to create and manipulate files, and create, access, and alter records within files.

RMS supports three file organizations:

- Sequential
- Relative
- Indexed

The indexed file organization allows each indexed file to have one primary key and up to 254 alternate keys. In addition to random access based on key values, programs can access records in an indexed file sequentially in ascending order by key values. Records are stored physically only in primary key order.

RMS supports four record formats:

- Fixed length records
- Variable length records
- Variable length records with fixed control field
- Stream records

Indexed files are restricted to either of two record formats: fixed or variable. The stream record format is restricted to sequential disk files only. Languages that do not use RMS (for example FORTRAN IV) cannot process RMS files unless the record format is stream.

User programs are provided with logical data record access to RMS files through extended language syntax statements. The form of the statement is dependent upon the application language interface. The functional facilities provided are:

- OPEN
- CLOSE
- READ/GET
- WRITE/PUT
- REWRITE/UPDATE
- DELETE

RMS-11 supports cluster libraries for sharing application virtual address space between a resident library and resident libraries of other software systems that support cluster libraries.

RMS-11 supports Digital Network Architecture (DNA) Data Access Protocol (DAP). This support allows access by RMS from a RSTS/E system with DECnet/E to RMS files on remote DECnet nodes. The remote DECnet nodes may be RSTS/E, VAX/VMS, RSX-11M or RSX-11M-PLUS systems. In general, remote file access, to the programmer, appears the same as local file access.

RMS Utility Programs

The following set of utility programs supports RMS file-structured operations:

FILE DESIGN (DES) - An interactive utility to assist the user in designing files for optimum performance. This utility supersedes the RMS DEFINE utility provided with earlier versions of RSTS/E. The DEFINE utility is still provided with RSTS/E, Version 8.0, but may not be provided with later versions.

BACKUP - Creates a backup copy of one or more RMS files from a direct access device to another logical device or physical medium (typically, magnetic tape).

RESTORE - recreates from a backup copy the original RMS file on a direct access device or physical medium.

CONVERT - Initially loads or adds records to an output file from input data recorded on a sequential relative or indexed file; creates, supersedes, or extends a sequential output file from an input file.

DISPLAY - Lists attributes of RMS files and records.

INDEXED FILE LOAD (IFL) - Initial load utility for indexed files, optimized for performance and space.

EDT

EDT is a text editor that can be used to create a file, enter and manipulate text in the file, and save or delete work done during edit sessions. EDT works with any kind of text file.

EDT offers many features to make text editing easier and more efficient. These features include:

- On-line HELP that can be used any time during an edit session
- Protection of files with journaling
- Startup command files which specify editing characteristics
- Keypad, line, nokeypad editing, depending on the terminal type
- Two kinds of line numbering
- Use of several files or parts of files at a time
- Redefinition of function keys by the users for frequent jobs

File Sort Utility (SORT-11)

RSTS/E includes a file sort utility, SORT-11 that accepts as input one RMS file, and creates a second, reordered RMS file. The input file can contain data stored in binary or ASCII format. The file organization can be sequential, relative, or indexed and the record format can be fixed length, variable length, or stream.

Records can be sequenced by key fields in ascending or descending order. Sort keys can be:

- 1-word 2's complement
- Alphanumeric
- 2-word or 4-word floating point binary
- Packed decimal
- Numeric ASCII with the sign leading and separate
- Numeric ASCII with the sign trailing and separate
- Numeric ASCII with the sign leading and over-punched
- Numeric ASCII with the sign trailing and over-punched

SORT-11 has four possible sorting methods:

- Record Sort
- Tag Sort
- Address Routing Sort
- Indexed Sort

SORT-11 also includes a set of subroutines, callable from programs written in one of the languages that uses RMS. SORT-11 does not provide a file merge capability.

BASIC-PLUS

The BASIC-PLUS language processor comprises a compiler and run-time system. The BASIC-PLUS compiler produces a compact pseudo code that is interpreted by the run-time system. Being an incremental compiler, it checks each program line for syntax errors and returns an appropiate message if an error is found. The user can then correct the line (if necessary) by retyping it.

BASIC-PLUS programs can be saved in either source form or in compiled form (compact pseudo code).

The immediate mode feature of BASIC-PLUS allows single-line statements typed without a line number to be compiled and executed immediately. This is a particularly useful feature in interactive debugging of BASIC-PLUS programs.

BASIC-PLUS can serve as a powerful system programming language. The extensive file processing capabilities of BASIC-PLUS allow users to take full advantage of RSTS/E file processing features. Most system features of RSTS/E are accessible via the flexible SYS system function call mechanism.

In addition to the elementary BASIC statements, BASIC-PLUS also features:

- An incremental compiler
- Immediate mode statements
- Extensive file processing capabilities
- Access to most RSTS/E system features
- Virtual arrays
- Block I/O
- PRINT...USING formatting (optional)
- Extensive string support

- String arithmetic (optional)
- Matrix manipulation operations (optional)
- Long variable names (with EXTEND mode)
- IF...THEN...ELSE construct
- ON ERROR condition handlers
- Statement modifiers: IF, UNLESS, WHILE, UNTIL, FOR
- User-defined functions
- Multistatement lines
- Multiline statements
- Program chaining

NOTE: On some systems, it may not be possible to use all the optional features of BASIC-PLUS simultaneously, within 32K bytes (16K words).

MACRO-11

The MACRO-11 assembly language, which uses the PDP-11 instruction set, can be used for development of programs and/or subroutines. The MACRO-11 assembler is a two-pass assembler with the following features:

- Source and command string control of assembly functions
- Device and file name specifications for input and output files
- Error listing on command terminal and in listing files
- Alphabetized, formatted symbol table listing
- Optional cross-reference listing of symbols
- Relocatable object modules
- Global symbols for linking object modules
- Conditional assembly directives
- Program sectioning directives
- User-defined macros and macro libraries
- Comprehensive system macro library
- Extensive source and command string control of listing functions

SOURCE CODE INFORMATION:

Source code for the Terminal Driver and CUSPs is provided on all available distribution media and on microfiche. The source code modules are provided for system generation and user modification of the CUSPs.

This source code is provided on an "**AS IS**" basis without any warranty of any kind, either express or implied.

MINIMUM HARDWARE REQUIRED:

A RSTS/E configuration must include:

- Any PDP-11 CPU from the list below, with line clock
- Console terminal
- 248 K bytes (124K words) of memory
- 10M bytes of disk space
- Software distribution device/backup device of 10M bytes or greater

OPTIONAL HARDWARE:

Refer to Table I for a list of all hardware supported by RSTS/E.

Hardware limitations may limit the number of devices and/or memory that a particular system can support.

PREREQUISITE SOFTWARE:

None

OPTIONAL SOFTWARE:

The RSTS/E Optional Software Cross Reference Table (SPD 20.97.xx) lists the software which runs on RSTS/E. There may be several versions available of an optional software product. Refer to the RSTS/E Optional Software Cross Reference Table for the version of the product supported on RSTS/E, Version 8.0.

Optional software products may require system resources (e.g., physical memory, disk space) over and above the requirements for RSTS/E. If these extra resources are not available, severe system performance degradation can occur. Refer to SPD for specific resource requirements for each product.

TRAINING CREDITS:

THREE(3) - Training credits apply only to options that include support services. Consult the latest Educational Services Catalog at your local DIGITAL office for the available courses, course requirements and guidelines.

SOFTWARE INSTALLATION:

DIGITAL INSTALLED

DIGITAL will install the Software Product upon customer's notification to the nearest DIGITAL office that the computer system, including all prerequisite hardware and software, is ready for the installation of the Software Product.

DIGITAL will provide these services only if the notification that the system is ready for installation is received by DIGITAL within thirty (30) days of delivery of the Software Product. Installation will consist of verifying that all components of the Software Product have been received by the customer and loading the Software Product.

SUPPORT CATEGORY:

DIGITAL SUPPORTED

During the ninety (90) day period following installation, DIGITAL will provide the following standard services if the customer encounters a problem with the Software Product:

(a) If DIGITAL also determines the problem to be a defect in the Software Product, DIGITAL will provide remedial service on site if necessary (1) to apply a temporary correction or make a reasonable attempt to develop an emergency bypass if the software is inoperable, and (2) assist the customer in preparing a Software Performance Report (SPR).

(b) If customer diagnosis indicates the problem is caused by a defect in the Software Product, it may submit an SPR to DIGITAL. DIGITAL will respond to problems reported in SPRs that are caused by defects in the current, unaltered release of the Software Product via a Newsletter. This Newsletter provides code corrections, temporary corrections, useful emergency bypasses and/or notice of the availability of corrected code.

Telephone support is available, at no additional charge, from the DIGITAL Telephone Support Center for a ninety (90) day period commencing either from the date of first use of this Software Product by the customer or thirty (30) days after delivery, whichever comes first.

Any Updates to the Software Product released by DIGITAL during this ninety (90) day period will be provided to the customer on DIGITAL standard distribution media as specified in this SPD.

These services will be provided in locations within the United States, except Alaska. Otherwise, service will be provided in the country of purchase. Service required because of customer use of other than the current, unaltered release of the Software Product operated in accordance with the SPD will be provided at DIGITAL's then current rates, terms and conditions.

ORDERING INFORMATION:

All binary licensed software, including any subsequent updates, is furnished under the licensing provisions of DIGITAL's Standard Terms and Conditions of Sale, which provide in part that the software and any part thereof may be used on only the single CPU on which the software is first installed, and may be copied, in whole or in part (with the proper inclusion of the copyright notice and any proprietary notices on the software) only for use on such CPU.

All source licensed software is furnished only under the terms and conditions of a separate Software Program Sources License Agreement between Purchaser and DIGITAL.

Options with no support services are only available after the purchase of one supported license.

A single-use, license-only option is a license to copy the software previously obtained under license.

Sources and/or listings options are only available after the purchase of at least one supported license and after a source license agreement is in effect.

The following key (D, E, H, M, Q, R, T, V, Z) represents the distribution media for the product and must be specified at the end of the order number, e.g. QR430-AH = binaries on RL02 disk cartridge.

D = 9-track 800 BPI Magtape (NRZI)
E = RK05 Disk Cartridge
H = RL02 Disk Cartridge
M = 9-track 1600 BPI Magtape (PE)
Q = RL01 Disk Cartridge
R = Microfiche
T = RK06 Disk Cartridge
V = RK07 Disk Cartridge
Z = No hardware dependency

QR430 -A— Single-use license, binaries, documentation, support services (media: H, M, V)

QR430 -D— Single-use license-only option, no binaries, no documentation, no support services (media: Z)

Update/Unsupported Options

Users of RSTS/E whose specified Support Category warranty has expired may order under license the following software option as an update to an earlier version. The option may also be purchased for use on a second or subsequent CPU, in conjunction with a single-use, license-only option. Options are distributed in binary form on the appropriate medium and include no installation or other services unless specifically stated.

QR430 -H— Binaries, documentation (media: D, E, H, M, Q, T, V)

QR430 -H— Right to copy for single-use, no binaries, no documentation (media: Z)

PDP-11 Operating System General License Options:

These options include a single-use license-only for each of the following PDP-11 operating systems for use on a single CPU: RT-11, CTS-300, RSX-11S, RSX-11M, RSX-11M-PLUS, RSTS/E, and DSM-11. Options are available according to the type of CPU:

QJB36-DZ DCT11 Microprocessor Chip
QJB39-DZ DCF11 Microprocessor Chip
QJB43-DZ DCJ11 Microprocessor Chip
QJB46-DZ KD11, KDF11 CPU Modules
QJB51-DZ 11C23 MICRO/PDP-11 Models and Systems
QJB56-DZ 11/03 through 11/23-PLUS Models and Systems
QJB66-DZ 11/24 through 11/40 Models and Systems
QJB76-DZ 11/44 through 11/70 Models and Systems

Installation and Warranty Period Service Option

Customers ordering a PDP-11 Operating System General License option and an Update option (QR430-H—) may also order an Installation and Warranty Period Service Option providing the system conforms to the Minimum Hardware Required.

QR430-AZ RSTS/E Support Services only, three training credits, no binaries, no documentation, no license.

The purchase of the applicable PDP-11 Operating System General License option plus an Update option and the Installation and Warranty Period Services option it the equivalent to the purchase of the Digital Supported software product license.

Sources/Listings Options

QR431 -F— Run-time systems and utilities listings (media: R)

QR432 -F— Monitor, INIT, and SYSGEN listings (media: R)

QR433 -F— BASIC-PLUS utilities listings (media: R)

QR438 -E— RSTS/E Monitor, run-time systems and utilities sources (media: M)

QR438 -F— RSTS/E Monitor, run-time systems and utilities listings (media: R)

Sources/Listings Update Options

The following options are available to licensed users as updates to source/listing options. The update is distributed in source form on the appropriate medium and includes no installation or other support services.

QR438 -N— RSTS/E Monitor, run-time systems and utilities sources (media: M)

QR438 -N— RSTS/E Monitor, run-time systems and utilities listings (media: R)

Miscellaneous Options:

Documentation-Only Kits

QR430 -G— Complete Documentation Kit (media: Z)

QR432 -G— System Managers Documentation Kit (media: Z)

QR433 -G— System User's Documentation Kit (media: Z)

QR426 -G— System Programming Documentation Kit (media: Z)

QR439 -G— System Primer Documentation Kit (media: Z)

QR470 -G— RSTS/E and VAX/VMS System Compatibility Documentation Kit (media: Z)

QR421 -G— Micro RSTS Documentation Kit (media: Z)

ADDITIONAL SERVICES:

The following post-warranty Software Product Services for these software products are available to licensed customers:

- Self-Maintenance Service
- Basic Service
- DECsupport Service

The module update facility is standard for Self-Maintenance, Basic and Decsupport Services.

Customers should contact their local DIGITAL office for additional information on the availability of these services.

QR430 -1— Additional Dispatch Subscription (media: Z)

QR436 -3— RSTS/E Autopatch option (media: D, E, H, M, Q, T, V).

Software Product Description

RSTS/E OPTIONAL SOFTWARE CROSS REFERENCE TABLE

SPD 20.97.07

This table has been prepared to assist in determining which RSTS/E optional software products were supported by versions 7.1 and 7.2 of RSTS/E and which are supported by RSTS/E, Version 8.0. Refer to the appropriate SPD for all other details on a particular product.

Customers running the software products listed below whose Support Category Warranty has expired, may order under license the applicable Out-of-Warranty software update (H-kit) at the prevailing rate for such update in order to come up to the current version. Refer to the appropriate SPD for all other details on a particular product.

	RSTS/E			
Optional Software	**SPD No.**	**V7.1**	**V7.2**	**V8.0**
ADE, PDP-11	13.11.xx	2.0	2.1	2.1
BASIC-PLUS-2 for RSTS/E, PDP-11	14.54.xx	1.6	2.0	2.1
COBOL, PDP-11	12.40.xx	4.4	4.4	4.4
COBOL-81/RSTS/E	13.16.xx	1.0	1.2	1.2
DATATRIEVE-11	12.48.xx	2.4	2.4	2.4
DECAL	15.86.xx	2.0	2.0	2.0
DECmail/RSTS	13.19.xx	—	1.0	1.0
DECnet/E	10.73.xx	2.0	2.0	2.0
DECWORD/DP	13.14.xx	1.1	1.2	1.2
DIBOL-11/DECFORM	14.8.xx	4.5	4.5	4.5
DIBS/CTS-500	13.31.xx	1.0	1.0	1.0
DMS-500	13.5.xx	2.0	2.0	2.0
DX/RSTS	10.95.xx	3.1	3.1	3.1
FMS-11/RSTS	13.17.xx	1.5	1.5	1.5
FORTRAN IV/RSTS/E	12.41.xx	2.5	2.6	2.6
FORTRAN-77/RSTS/E, PDP-11	14.49.xx	4.0	4.1	4.1
GIGI CAI Primer	30.11.xx	1.0	1.0	1.0
GIGI Software	30.10.xx	1.0	1.0	1.0
INDENT	12.33.xx	1.1	1.2	1.2
MENU-11/RSTS	12.60.xx	1.0	1.0	1.0
PLXY-11/RSTS	14.16.xx	1.1	1.1	1.1
ReGIS CAI Primer	30.12.xx	1.0	1.0	1.0
RSTS/E-2780 (CTS-500/2780)*	10.50.xx	3.0	3.0	3.0
RSTS/E (CTS-500)/3271 PE*	10.83.xx	2.1	2.1	2.1
RSTS/E (CTS-500) High Performance 2780/3780 Emulator*	10.49.xx	1.1	1.1	1.1
SPM-RSTS/E	S0.15.xx	1.0	1.0	1.0

* Will not execute on the PDP-11/23-PLUS or MICRO/PDP-11.

digital software

April 1983
AE-M777H-TC

TABLE I

Processor Type	MICRO/PDP-11	11/23-PLUS	11/24	11/34 11/34A	11/35 11/40 EIS Required	11/44	11/45-11/50 11/55-11/60	11/70
Optional Instruction sets.	CIS KEF11-AA	CIS KEF11-AA	CIS KEF11-AA	FPP	FIS	FPP CIS	FPP	FPP
Parity or ECC								
Minimum Memory Bytes	256KB	256KB	248KB	248KB	248KB	512KB	248KB	512KB
Maximum Memory Bytes	3.8MB	3.8MB	3.8MB	248KB	248KB	3.8MB	248KB	3.8MB
Cache Memory	None	None	None	2KB optional on 11/34A	None	8KB	2KB standard on 11/60	2KB
Peripheral Interface	Extended LSI-11 BUS	Extended LSI-11 BUS	UNIBUS	UNIBUS	UNIBUS	UNIBUS	UNIBUS	UNIBUS MASSBUS
Maximum Number of Disk Drives[1]								
RX01/2[2]	4[3]	4[3]	4	4	4	4	4	4
RX50	1	1	—	—	—	—	—	—
RK05[4]	—	—	8	8	8	8	8	8[5]
RL01/2[6]	4xRL02	4xRL02	4	4	4	4	4	4[5]
RD51	2	2	—	—	—	—	—	—
RK06/7	—	—	8	8	8	8	8	8[5]
RP02/3	—	—	8	8	8	8	8	—
RH11-RP04/5/6-RM02	—	—	8	8	8	8	8	—
RH70-RP04/5/6/7-RM03/5/80	—	—	—	—	—	—	—	16
UDA50/RA80/81/60[7]	—	—	8	8	—	8	—	8[5]
Tape Drives	Up to 4xTSV05[8]	Up to 4xTSV05[8]	Up to 8xTE16/ TU16/45 Up to 8xTE10/ TU10/TS03 or Up to 4x TS11/TU80[8] Up to 4xTU56 Up to 4xTU77	Same as 11/24 TU77	Same as 11/24	Same as 11/24	Same as 11/24	UNIBUS Tapes Up to 8xTE10/ TU10/TS03 or Up to 4x TS11/TU80[8] Up to 4xTU56 MASSBUS Tapes Up to 8xTE16/ TU16/45 Up to 4/TU77

TABLE I (cont.)

Processor Type	MICRO/PDP-11	11/23-PLUS	11/24	11/34 11/34A	11/35 11/40 EIS Required	11/44	11/45-11/50 11/55-11/60	11/70
Distribution Media	RL02	RL02	Either: 800BPI Tape 1600BPI Tape RK05/6/7 RL01/2	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
Backup Device	RL02 or RX50 or TSV05	RL02 or TSV05	Same media as distribution	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
Terminals[9] and Interfaces	Up to 14	Up to 14	Up to 127	Up to 127	Up to 127	Up to 127	Up to 127	Up to 127
	LA12, LA34 LA36, LA38 LA50, LA100 LA120 LA180, LQP02 VT52, VT55 VT100, VT101 VT102, VT125[10] VT131[11] PC 300[12]	LA12, LA34 LA36, LA38 LA50, LA100 LA120 LA180, LQP02 VT52, VT55 VT100, VT101 VT102, VT125[10] VT131[11] PC 300[12]	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS
	Up to 3 DZV11-C	Up to 3 DZV11-C	DL11, DJ11 DZ11,DH11[13]	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
	Same as 11/23-PLUS	Modems: DF01-A DF02-AA/AC or DF03-AA/AC or BELL 103A compatible	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS	Same as 11/23-PLUS

TABLE I (cont.)

Processor Type	MICRO/PDP-11	11/23-PLUS	11/24	11/34 11/34A	11/35 11/40 EIS Required	11/44	11/45-11/50 11/55-11/60	11/70
Other Peripherals	1 LPV11 plus Printer	1 LPV11 plus Printer	Up to 8 of the following in any combination LP11-A/B/C/D LP11-EA/EB/F LP11-G/H/J/K LP11-R/S/V/W LP11-X/Y/Z LA11-LA27	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
			CM11, CD11, CR11 card readers	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
			One PC11 paper tape reader/punch					
Hardware Supported Only on Systems Upgrading from RSTS/E, Version 7.2	NONE	NONE	RF11, RS03/4 Fixed disks	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24	Same as 11/24
			VT05, VT50 Video terminals					
			RK05 as System Disk					
			DP11					
			LT33					
			IBM 2741[14] Hard-copy terminals					
			TU58[15] DECtape II					

[1] Dual ported disks cannot be used by two systems simultaneously.
[2] RX01/2 is only supported as a non-RSTS file structured device.
[3] On the MICRO/PDP-11 and PDP-11/23-PLUS only RX01's are supported.
[4] The RK05 should only be used as a distribution disk or data disk. An RK05F counts as 2 RK05J's.
[5] On the PDP-11/70 the UDA50/RA80/RA81/RA60 combinations must be the only disks or the UNIBUS.
[6] A minimum of two RL01 drives plus a software distribution device is required.
[7] A RSTS/E system cannot support both the UDA-50 and the RSTS/E 2780 Communications Package.
[8] The TSV05 and TU80 are only supported as TS11 compatible devices, without streming at 25° per second.
[9] The console terminal must be a hard copy device or VT100 class terminal with printer port for supported systems.
[10] The VT125 is only supported by RSTS/E as a VT100 in ANSI mode. VT52 mode is not supported.
[11] The VT131 is only supported by RSTS/E as a VT100/VT102.
[12] The Professional 300 series Personal Computers are supported as subsets of the VT102.
[13] The DM11-BB is required for DH11 dial up.
[14] Either the IBM 2741 terminal emulation OR FMS/RSTS, Version 1.5 but NOT both can be included on a RSTS/E, Version 8.0 system.
[15] The same single user restrictions for the TU58 as RSTS/E, Version 7.0 still apply.