digital

Software Product Description

PRODUCT NAME: RSX-11M, Version 3.1, Real Time Operating System **SPD 14.35.10**

DESCRIPTION:

RSX-11M is a disk-based real-time operating system which runs on any UNIBUS PDP-11 processor. It provides an environment for the execution of multiple real-time tasks (program images) using a priority structured event-driven scheduling mechanism. System generation allows the user to configure the software for systems ranging in size from small 16K-word systems to large 1920K-word systems.

RSX-11M can be generated as either a mapped or unmapped system, depending on whether the hardware configuration includes a KT11 Memory Management Unit. If the configuration does not include hardware memory management, the system can support between 16K and 28K words of memory. If the configuration includes hardware memory management, the system can support between 24K and 124K words of memory on processors other than the PDP-11/70, or between 64K words and 1920K words on the PDP-11/70. RSX-11M provides the same primary services in mapped and unmapped systems; however, some supplied optional features and separately licensed options require hardware configurations larger than the minimum supported systems.

Memory is logically divided into partitions in which tasks are loaded and executed. Activity in a partition can be either user-controlled or system-controlled: the user determines the placement of tasks in the former, and the system controls the placement of tasks in the latter. Automatic memory compaction minimizes any fragmentation of a system-controlled partition. Unmapped systems support only user-controlled partitions. Mapped systems support both user-controlled and system-controlled partitions.

Real-time interrupt response is provided by the system's task scheduling mechanism, which recognizes 250 software priority levels. The user-specified task priority determines the task's eligibility to execute. A task can be fixed in a partition to ensure immediate execution when it is activated, or it can reside on disk while it is dormant to make memory available to other tasks. Task checkpointing enables tasks to be displaced from a partition to enable a higher-priority non-resident task to execute.

RSX-11M offers complete program development facilities as well as a real-time response run-time system. Program development and real-time tasks can execute concurrently in systems with at least 24K words of memory. The system's software priority levels enable the user to compile/assemble, debug, and install tasks without affecting real-time task response.

A multi-user program development facility is available for systems with a recommended 32K words or more of memory. Passwords and LOGIN/LOGOUT, device access protection, a round- robin scheduler (running under the real-time executive), and concurrent execution of equal priority tasks via executive level swapping are provided.

Tasks can be written in MACRO-11 assembly language and optionally FORTRAN IV, FORTRAN IV-PLUS, PDP-11 COBOL, BASIC-11, and BASIC-PLUS-2. Sharable libraries and system support for user-created libraries are provided. The EDI text editor, the EDT DEC editor, utilities, symbol cross-reference, and task memory dump facility are provided to assist task development and check-out.

The RSX-11M file system provides automatic space allocation and file structures for all block-structured devices. Features include:

- sequential, random, and relative (RMS-11) file organizations
- file protection
- device independence and logical device assignment

During system generation, the user can select a minimum 2K-word version of the resident file system to conserve space. On systems with other than the minimum 2K-word version of the file system, multi-header file support is provided. It enables file size to be limited only by the capacity of the volume on which it resides.

In addition to the resident file system, the use of the file control services (FCS) will increase the user task size by approximately 1K to 4K words, depending on the number of open files and the services desired. The record management system (RMS) requires at least 4K words per task.

Indirect command file support provides extremely powerful batch-like facilities. A terminal user can create a file containing system commands. The system can then be instructed to execute the commands in the file without operator intervention. The indirect file processor can be executing command files concurrent with real-time task execution.

Software supported reliability features include:

- processor (PDP-11/45, 11/50, 11/55, 11/60, 11/70), disk and magnetic tape error logging
- power failure restart
- user-mode diagnostics, (terminals, line printers, TS03, TU10, TU16, TU45, RK05, RK06, RP04/05/06, RPR02, RP03, and RS03/04)

Other optional RSX-11M features include:

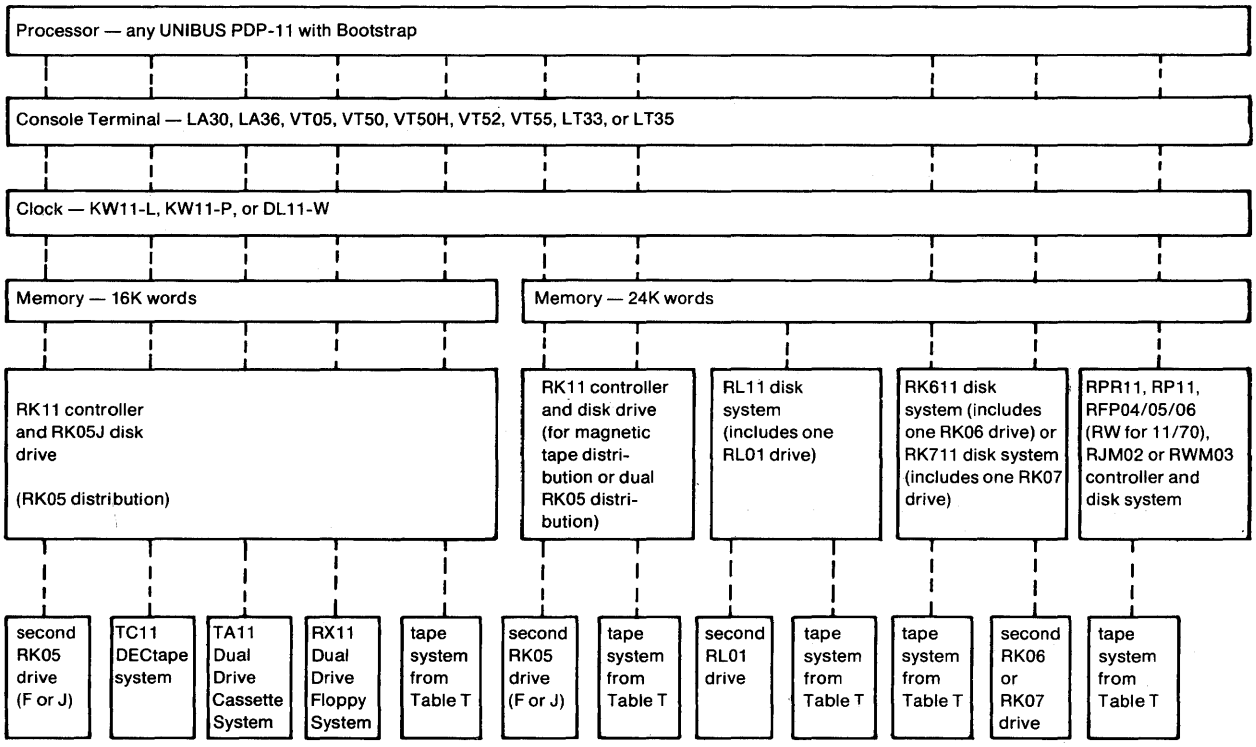
- Logical device assignments
- ANS format magnetic tape support
- Dynamic UMR allocation for PDP-11/70
- Line printer spooling
- Loadable device drivers
- Post-mortem and snapshot dump facility
- Crash dump analyzer facility
- Host for RSX-11S systems
- RMS sequential and relative file access (not available on unmapped systems or single RK05 systems), including "bucket" locking.
- Direct connect of user task to hardware interrupts
- PLOT55 subroutines for using the graphics features of the VT55 terminal

MINIMUM HARDWARE REQUIRED:

To define a minimum system, use Figure 1, the RSX-11M configurator. Any system defined by connecting the boxes with one of the eleven vertical lines forms a required minimum system.

The basic 16K-word RSX-11M system provides approximately 8K words of memory for user tasks and 8K words of memory for system space. Additional executive services and device drivers can be selectively incorporated into the system at increased memory space usage. The following is contained in the basic

Figure 1



system memory space:

- Executive
- File System Primitives (2K version)
- Operator Interface task (MCR)
- Task Loader
- Space for three device drivers:
  1. one system disk driver
  2. one DL11 driver supporting a single line
  3. one other driver (excluding ICS11/ICR11)

A minimum of 24K words is required for mapped systems or where it is desired to perform concurrent program development and application execution.

NOTE:

Dual RK05 systems using RK05 disk cartridges as the distribution media must have at least one removable unit and a second unit (either removable or fixed) within unit numbers 0 through 3 on the same controller.

Although magnetic tape drives are supported in a 16K word system, the recommended minimum memory for tape support is 24K words. If magnetic tape is the distribution media, 24K words is a requirement.

Table T
Tape System

PROCESSOR	TAPE Controller	Transport
All UNIBUS	TM11	TU10
PDP-11 processors	TMA11	TU10 TS03
	TMB11	TS03 TU10W
	TME11	TE10
	TJU16	TU16
	TJE16	TE16
	TJU45	TU45
PDP-11/70	TWE16	TE16
	TWU45	TU45

OPTIONAL HARDWARE:

Note: In some cases not all hardware features of the following options are supported.

- Additional memory to a system total of 28K words on systems that do not include the hardware memory management unit, 124K words on other than PDP-11/70 systems which include the hardware memory management unit, or 1920K words on PDP-11/70 systems.
- KT11 Memory Management Unit (requires a minimum of 24K words of memory)
- KE11-A, B Extended Arithmetic Element (supported only on systems which do not include a memory management unit)
- KE11-E Extended Instruction Set
- KE11-F Floating Instruction Set
- FP11 Floating Point Processor
- KW11-Y Watch-dog Timer Clock

I/O Peripherals:

- PR11 paper tape reader or PC11 paper tape reader/punch
- CR11 or CM11 card reader
- VT11/VS60 Graphics Display processor and scope except on PDP-11/70 when 22-bit addressing is enabled. VT11 data buffers must reside in first 28K words of physical memory.
- LA35, LA180, LS11, LP11, or LV11 line printer (no plotter support)

Magnetic tape devices:

- TA11 dual drive cassette tape system
- TC11 DECtape controller and dual transport
- Tape systems from Table T

Disk devices:

- RX11 floppy disk system
- RF11 fixed-head disk system
- RK11 disk cartridge controller with RK05J or RK05F disk drives
- RL11 disk cartridge controller with RL01 drives
- RK611 disk cartridge controller with RK06 or RK07 disk drives
- RK711 disk cartridge controller with RK06 or RK07 drives
- RPR02 disk pack drives (with appropriate controller)
- RP03 disk pack drives (with appropriate controller)
- RP04, RP05, or RP06 disk pack drives (with appropriate controller)
- RS03 or RS04 fixed-head disks (with appropriate controller)
- RM02 or RM03 disk pack drives (with appropriate controller)

Terminals:

- LA30, LA36, LA180S, LT33, LT35, VT05, VT50, VT52 terminals and VT55 graphics display terminals. (MCR provides no escape sequence support on VT50, VT52, VT55.) These terminals are supported when connected to DH11 (with or without DM11-BB), DZ11, DJ11, or DL11-A, B, C, D, or W.
- RT02 Alphanumeric Display
- RT02-C Alphanumeric Display and Badge Reader

Communications:

- DL11-E single line interface
- DP11 synchronous line interface
- DU11 synchronous line interface
- DUP11 synchronous line interface
- DQ11 DMA synchronous line interface
- DA11-B DMA UNIBUS link
- DMC11 interprocessor link

Laboratory/Industrial Control:

- AD01-D A/D converter
- AFC11 A/D converter

- DRS/DSS11 industrial control system modules
- UDC11 Universal Digital Controller

  IDA11-AA Contact sense module
  IDA11-AB Contact sense module
  IDA11-BA Contact interrupt module
  IDA11-BB Contact interrupt module
  IDA11-CA I/O converter
  IDA11-DA Solid state AC/DC driver
  IDA11-EA Flip-flop DC driver
  IDA11-FA Single shot driver
  IDA11-GA Latching output relay
  IDA11-HA Flip-flop output relay
  IDA11-JA Single shot output relay
  IAA11-AA Multi-range A/D converter
  IAA11-BA D/A converter
  IAA11-BB D/A converter
  IAA11-BC D/A converter
  IAA11-BD D/A converter
- ICS11/ICR11 Industrial Control subsystem

  IDC-IA Isolated DC sense
  IDC-IB Isolated DC interrupt
  IDC-IC I/O counter
  IDC-ID Non-isolated DC sense
  IDC-IE Non-isolated DC interrupt
  IAC-IA Isolated AC sense
  IAC-IB Isolated AC interrupt
  IDC-OA DC flip-flop driver
  IDC-OB DC single shot driver
  IAC-OA AC flip-flop driver
  IAC-OB AC single shot driver
  IRL-OA Latching output relay
  IRL-OB Flip-flop output relay
  IDA-OB 4-channel D/A converter
  IAD-IA 8-channel A/D converter
  IMX-IA 16-channel multiplexer for IAD-IA

Data Acquisition:

One or more of the following subsystems:

- LPS11 Laboratory Peripheral Systems. Requires LPS11-S, LPSAD-12, and LPSKW. Options:
  1. LPSDR-A 16-bit digital I/O registers and relays (bit interrupt capability not supported)
  2. BA408/LPSAM-SG switch gain OR LPSAM/LPSAM-E multiplexer
  3. LPSVC 12-bit D/A converter
  4. LPSDA D/A expander
- AR11 Analog Real-time Systems. Options: DR11-K 16-bit digital I/O option, one per subsystem (bit interrupt capability not supported)
- LPA11-K Laboratory Peripheral Accelerator
- Laboratory I/O Subsystem configured using the following options:
  1. ADK11-KT 12-bit A/D converter with 16-channel multiplexer and dual clock; one per subsystem
  2. AD11-K 12-bit A/D converter with 16-channel multiplexer; 16 per subsystem (15 if ADK11-KT is part of same subsystem)
  3. KW11-K Dual real-time clock with Schmitt triggers; one per subsystem (clock already included in ADK11-KT, no KW11-K required if one is present)
  4. AM11-K 48-channel A/D multiplexer with gain ranging; one per AD11-K or ADK11-KT
  5. DR11-K 16-bit digital I/O option; 16 per subsystem
  6. AA11-K 4-channel 12-bit D/A converter with scope control, 16 per subsystem

PREREQUISITE SOFTWARE:

None

OPTIONAL SOFTWARE:

FORTRAN IV/IAS-RSX
FORTRAN IV-PLUS
BASIC-11/IAS-RSX
BASIC-PLUS-2
DECnet-11M
MUX200/RSX-IAS
UN1004/RSX-IAS
RMS-11K
DATATRIEVE-11
RJE/HASP
PDP-11 COBOL
DBMS-11
SORT-11
RPG II
RSX-11M/2780
DV11/3271
CORAL 66
PLXY-11M
IP11 Process Control subsystem and DPM Distributed Plant Management subsystem (hardware and software available from Industrial Products Group)
CTS11 card reader/punch and XY11 or XY311 plotter device drivers (Both software and associated hardware available from Computer Special Systems)

TRAINING CREDITS:

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

SUPPORT CATEGORY:

A — Software Support will be provided as stated in the Software Support Categories Addendum to this SPD.

UPDATE POLICY:

Software Updates, if any, released by DIGITAL during the one (1) year period following installation, will be provided to the customer for a media charge (includes no installation). After the first year, updates, if any, will be made available according to then prevailing DIGITAL policies.

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 DIGITAL copyright notice and any DIGITAL

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 Agreement between Purchaser and DIGITAL.

Standard options with no support services are only available after the purchase of one supported license. When a software license is ordered without support services, the category of support applicable to such software is Category C.

A single-use license only option is a license to copy the software previously obtained under license, and use such software in accordance with DIGITAL's Standard Terms and Conditions of Sale. The category of support applicable to such copied software is Category C.

Source and/or listing options are only available after the purchase of at least one binary license and after a source license agreement is in effect.

The following key (D, E, 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., QJ628-AD = binaries (for dual RK05 based systems) on 9-track magnetic tape. Note: Except for RK05 and RK06, the distribution medium is not the system residency device..

D = 9-track Magnetic Tape
E = RK05 Disk Cartridge
Q = RL01 Disk Cartridge
R = Microfiche
T = RK06 Disk Cartridge
V = RK07 Disk Cartridge
Z = No hardware dependency

Standard Options:

See Table O.

Upgrade Options:

See Table O.

Update Options:

See Table O.

Source/Listing Options

QJ628 -F— Executive and I/O device driver listings (media: R)

QJ638 -E— Utilities sources (media: D, E, T)

QJ638 -F— Utilities listings (media: R)

QJ639 -F— All listings (media: R)

Source/Listing 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 services unless specifically stated otherwise.

The sources provided by DIGITAL on the standard binary kits plus the utilities source kit do not necessarily make up all the sources and command files which DIGITAL used to build the binary kit.

QJ638 -N— Utilities Sources Update (media: D, E, T)

Miscellaneous Options

QJ628 -G— Pre-delivery documentation kit (media: Z)

ADDITIONAL SERVICES:

See Table O.

Note:

Autopatch Option (for users whose specified support category warranty or Standard Binary Program Update service has not expired): Digital reserves the right to add to or delete from the list of available Autopatch media. However a current subscriber would be entitled to complete a one year subscription with the media originally ordered.

TABLE O

OPTIONS AND ADDITIONAL SERVICES	SYSTEM DISK TYPE								
All options (except for license-only kits QJ628-DZ and QJ740-DZ) include binaries on indicated media and documentation.	Single RK05 Based Systems (No RMS-11 Support)	Dual RK05 Based Systems With At Least 24K of Memory	RL01 based systems	RK06 Based Systems	RK07 based systems	RPR02 and RP03 Based Systems	RP04/05/06 Based Systems	RM02 or RM03 Based Systems	Single-use License Only (No Media or Documentation)
Standard Options including support services and Single-use license.	QJ628-AD QJ628-AE	QJ728-AD QJ728-AE	QJ738-AD QJ738-AQ	QJ629-AD QJ629-AT	QJ739-AD QJ739-AV	QJ636-AD	QJ637-AD	QJ737-AD	
Standard Options including single-use license (available only after the purchase of at least one supported license), no support services.	QJ628-CD QJ628-CE	QJ728-CD QJ728-CE	QJ738-CD QJ738-CQ	QJ629-CD QJ629-CT	QJ739-CD QJ739-CV	QJ636-CD	QJ637-CD	QJ737-CD	QJ628-DZ
Upgrade Options available as an upgrade kit from RSX-11B, RSX-11C, RSX-11D, or DOS/BATCH for use on the same single CPU on which the former system is licensed. The previous license shall be extended to cover this upgrade (includes support services).		QJ643-AD QJ643-AE				QJ645-AD	QJ646-AD		
Upgrade Options available as an upgrade kit from RSX-11B, RSX-11C, RSX-11D, or DOS/BATCH for use on the same single CPU on which the former system is licensed. The previous license shall be extended to cover this upgrade (does not include support services).		QJ643-CD QJ643-CE				QJ645-CD	QJ646-CD		
Upgrade Options available as an upgrade kit from RT-11 for use on the same single CPU on which the former system is licensed. The previous license shall be extended to cover this upgrade, (includes support services).	QJ740-AD QJ740-AE	QJ741-AD QJ741-AE	QJ745-AD QJ745-AQ	QJ742-AD QJ742-AT		QJ744-AD			
Upgrade Options available as an upgrade kit from RT-11 for use on the same single CPU on which the former system is licensed. The previous license shall be extended to cover this upgrade, (does not include support services).	QJ740-CD QJ740-CE	QJ741-CD QJ741-CE	QJ745-CD QJ745-CQ	QJ742-CD QJ742-CT		QJ744-CD			QJ740-DZ
Update Options Users of versions of RSX-11M whose warranty or Standard Program Update Service has expired may order under license these updates. No installation or other services are provided.	QJ628-HD QJ628-HE	QJ728-HD QJ728-HE		QJ629-HD QJ629-HT		QJ636-HD	QJ637-HD	QJ737-HD	QJ628-HZ
Update Options Users of Version 3 of RSX-11M whose specified Support Category warranty or Standard Program Update Service has not expired may order under license these updates. No installation or other services are provided.	QJ628-WD QJ628-WE	QJ728-WD QJ728-WE		QJ629-WD QJ629-WT		QJ636-WD	QJ637-WD	QJ737-WD	
Standard Binary Program Update Service for RSX-11M.	QJ628-3D QJ628-3E	QJ728-3D QJ728-3E		QJ629-3D QJ629-3T		QJ636-3D	QJ637-3D	QJ737-3D	
Binary Program Update Service for RSX-11M and FORTRAN IV.	QJ660-3D QJ660-3E	QJ665-3D QJ665-3E		QJ661-3D QJ661-3T		QJ662-3D	QJ663-3D	QJ664-3D	
Autopatch Option: for users whose Support Category warranty or Binary Program Update Service has expired.		QJ729-3D QJ729-3E	QJ729-3D QJ729-3Q	QJ729-3D QJ729-3T	QJ729-3D QJ729-3V	QJ729-3D	QJ729-3D	QJ729-3D	

ADDENDUM
SOFTWARE SUPPORT CATEGORIES

Each software product (hereinafter 'SOFTWARE') with a designated Support Category A or B in the applicable Software Product Description (SPD) existing at the time of order will be the current release at the time of delivery and will conform to the SPD. DIGITAL's sole obligation shall be to correct defects (nonconformance of the SOFTWARE to the SPD) as described below. Any SOFTWARE with a designated Support Category C will be furnished on an 'as is' basis.

For SOFTWARE with a designated Support Category A or B, DIGITAL will provide the services set forth below without additional charge.

CATEGORY A

1. Upon notification by customer to the nearest DIGITAL office that the computer system, including all required prerequisite hardware and software, is ready for the installation of the SOFTWARE, DIGITAL will install such SOFTWARE in any location within the contiguous forty-eight (48) United States, the District of Columbia, or a country in which DIGITAL or a subsidiary of DIGITAL has a software service facility. The notification must be received by DIGITAL and the system must be ready for installation within thirty (30) days after the delivery of the SOFTWARE to customer or DIGITAL will have no obligation to install. Installation will consist of: (1) verification that all components of the SOFTWARE have been received by customer, (2) loading the SOFTWARE, and (3) executing a DIGITAL sample procedure.
2. During the ninety (90) day period after installation, if the customer encounters a problem with the current unaltered release of the SOFTWARE which DIGITAL determines to be a defect in the SOFTWARE, DIGITAL will provide the following remedial service (on site where necessary): (1) if the SOFTWARE is inoperable, apply a temporary correction (TC) or make a reasonable attempt to develop an emergency by-pass, and (2) assist the customer to prepare a Software Performance Report (SPR) and submit it to DIGITAL.
3. During the one (1) year period following installation, if the customer encounters a problem with the SOFTWARE which his diagnosis indicates is caused by a SOFTWARE defect, the customer may submit an SPR to DIGITAL. DIGITAL will respond to problems reported in SPRs which are caused by defects in the current unaltered release of the SOFTWARE via the Maintenance Periodical for the SOFTWARE, which reports SPRs received, code corrections, temporary corrections, generally useful emergency by-passes and/or notice of the availability of corrected code. Software Updates, if any, released by DIGITAL during the one (1) year period, will be provided to the customer on DIGITAL's standard distribution media as specified in the applicable SPD. The customer will be charged only for the media on which such updates are provided, unless otherwise stated in the applicable SPD, at DIGITAL's then current media prices.

CATEGORY B

During the one (1) year period following delivery, the services provided to the customer will be the same as set forth in 3 above.

CATEGORY C

SOFTWARE is provided on an 'as is' basis. Any software services, if available, will be provided at the then current charges.

DIGITAL shall have the right to make additional charges for any additional effort required to provide services resulting from customer use of other than current unaltered release of the SOFTWARE operated in accordance with the SPD.