

# digital

## Software Product Description

**PRODUCT NAME: RSX-11M, Version 3.2**  
**Real Time Operating System**

**SPD 14.35.15**

### **DESCRIPTION:**

RSX-11M is a disk-based, real-time operating system that runs on any UNIBUS PDP-11 processor, the PDP-11/23, and the PDP-11/70. It provides an environment for the development and 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 32K byte systems to large 3840K byte systems.

Program development and real-time tasks can execute concurrently in systems with at least 48K bytes 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 multiuser, program development facility is available for systems with a recommended 64K bytes 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, CORAL 66, BASIC-11, and BASIC-PLUS-2. Shareable 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 4K byte version of the resident file system to conserve space. On systems with other than the minimum 4K byte version of the file system, multiheader 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 2K to 8K bytes, depending on the number of open files and the services desired. The Record Management System (RMS) requires at least 8K bytes 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.

Most PDP-11 processors have Memory Management available that provide logical to physical memory mapping. If the configuration does not include hardware memory management, the system can support between 32K and 56K bytes of memory. If the configuration includes hardware memory management, RSX-11M can support between 48K and 248K bytes of memory on processors other than the PDP-11/44 or 11/70, or between 148K bytes and 3840K bytes on the PDP-11/44 or 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 either be 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 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 that 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, nonresident task to execute.

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Software supported reliability features include

- Processor (PDP-11/44, 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, RK07, RP04/05/06, RPR02, RP03, and RS03/04)

Other optional RSX-11M features include

- Logical device assignments
- ANS Level 3 magnetic tape label support, except user labels
- Dynamic UMR allocation for PDP-11/44 and 11/70
- Line printer spooling
- Loadable device drivers
- Post-mortem and snapshot dump facility
- Crash dump analyzer facility
- Host for RSX-11S systems
- Optional full duplex terminal handler which supports DMA output (with DH11 interface) and DL11-E with modem control.
- RMS sequential and relative file access (not available on unmapped 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:

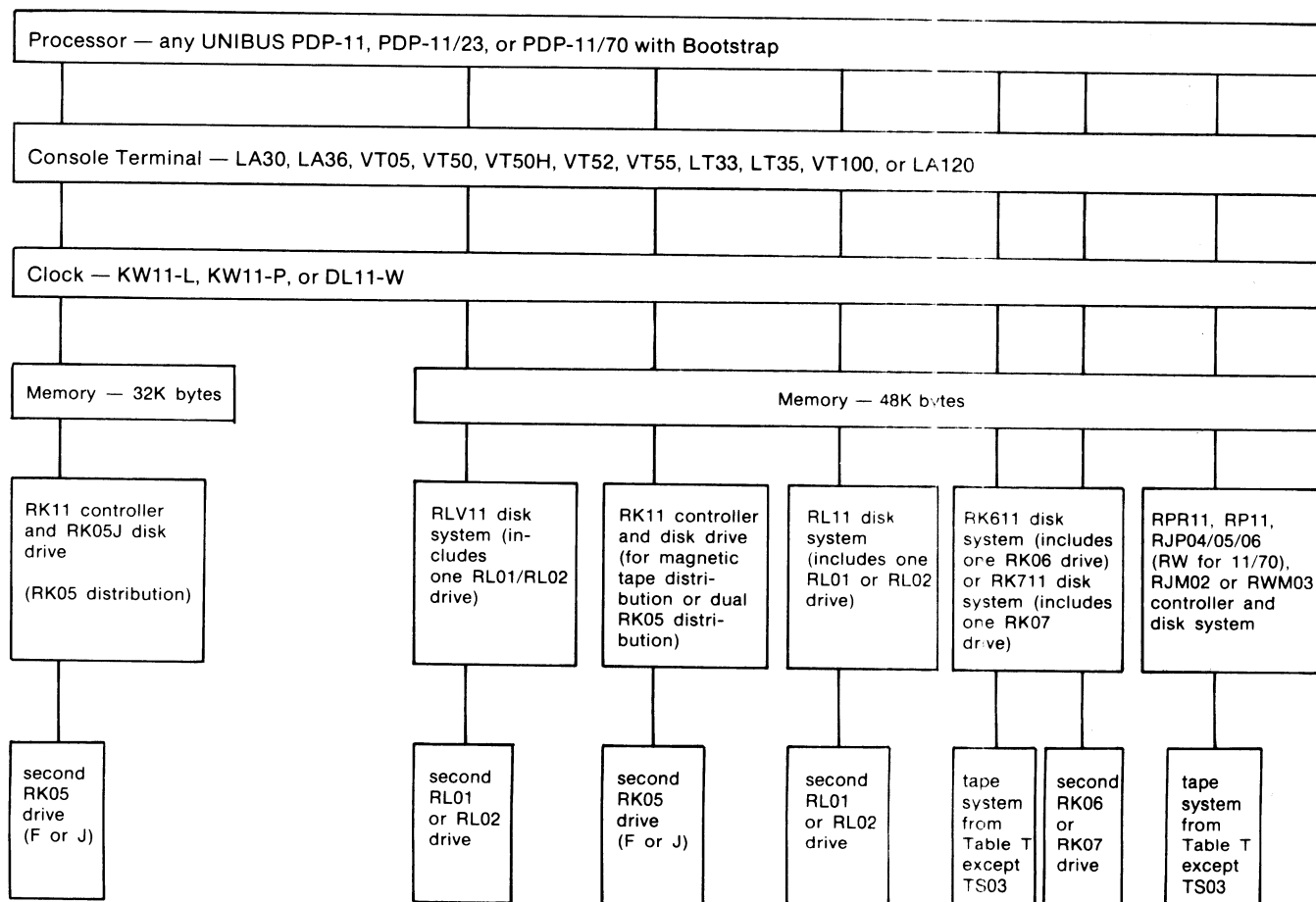
To define a minimum system, use Figure I, the RSX-11M configurator. Any system defined by connecting the boxes with one of the six vertical lines forms a required minimum system.

The basic 32K byte RSX-11M system provides approximately 16K bytes of memory for user tasks and 16K bytes 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 system memory space:

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

A minimum of 48K bytes is required for mapped systems or where it is desired to perform concurrent program development and application execution.

Figure I



<sup>1</sup>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 32K byte system, the recommended minimum memory for tape support is 48K bytes. If magnetic tape is the distribution media, 48K bytes is a requirement.

**Table T**  
**Tape System**

| PROCESSOR                       | TAPE<br>Controller | Transport         |
|---------------------------------|--------------------|-------------------|
| All UNIBUS<br>PDP-11 processors | TM11               | TU10              |
|                                 | TMA11              | TU10              |
|                                 |                    | TS03 <sup>2</sup> |
|                                 | TMB11              | TS03 <sup>2</sup> |
|                                 |                    | TU10W             |
|                                 | TME11              | TE10              |
|                                 | TJU16              | TU16              |
|                                 | TJE16              | TE16              |
|                                 | TJU45              | TU45              |
|                                 | TM03               | TU77              |
| PDP-11/70                       | TS11               | TS11              |
|                                 | TWE16              | TE16              |
|                                 | TWU45              | TU45              |
|                                 | TWU77              | TU77              |
|                                 | TS11               | TS11              |

<sup>2</sup>NOTE: TS03 software distribution for RK05 systems only.

#### **OPTIONAL HARDWARE:**

<sup>3</sup>NOTE: In some cases not all hardware features of the following options are supported. Hardware restriction can limit the number of devices which a given system can support.

- Additional memory to a system total of 56K bytes on systems that do not include the hardware memory management unit, 248K bytes on other than PDP-11/44 or 11/70 systems that include the hardware memory management unit or 3840K bytes on PDP-11/44 or 11/70 systems.
- KT11 Memory Management Unit (requires a minimum of 48K bytes of memory)
- KE11-A, B Extended Arithmetic Element (supported only on systems that 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 56K bytes of physical memory.

- LA35, LA180, LS11, LP11, or LV11 line printer (no plotter support)
- KMC11-A Auxiliary processor as a line printer DMA interface

#### *Magnetic Tape Devices*

- TA11 dual drive cassette tape system
- TU58 DECtape II Cartridge with DL-11 or DLV-11 controller<sup>4</sup>
- TC11 DECtape controller and dual transport
- Tape systems from Table T

<sup>4</sup>NOTE The TU58 is to be used only in a stand-alone, lightly loaded environment. If used as a file device on a heavily loaded system, it can degrade system performance.

#### *Disk Devices*

- RX11, RX211 and RXV21 floppy disk systems
- RF11 fixed-head disk system
- RK11 disk cartridge controller with RK05J or RK05F disk drives
- RLV11 or RL11 disk cartridge controller with RL01 or RL02 drives
- <sup>5</sup>RK611 disk cartridge controller with RK06 or RK07 disk drives
- <sup>5</sup>RK711 disk cartridge controller with RK06 or RK07 drives
- RPR02 disk pack drives (with appropriate controller)
- RP03 disk pack drives (with appropriate controller)
- <sup>5</sup>RP04, RP05, or RP06 disk pack drives (with appropriate controller)
- RS03 or RS04 fixed-head disks (with appropriate controller)
- <sup>5</sup>RM02 or RM03 disk pack drives (with appropriate controller)

<sup>5</sup>NOTE: With this software product serious data corruption and/or performance degradation can occur if, in disk drive with dual port options, the port select switch is placed in the programmable position.

#### *Terminals*

- LA30, LA36, LA120, LA180S, LT33, LT35, VT05, VT50, VT52, VT100 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, DL11-A, B, C, D, E, or W, DLV11, DLV11-J or DZV11.
- RT02 Alphanumeric Display
- RT02-C Alphanumeric Display and Badge Reader

#### *Communications*

- DL11-E and DLV11-E single line interfaces
- 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
- ICS11/ICR11 Industrial Control Subsystem

*Data Acquisition*

One or more of the following subsystems:

- LPS11 Laboratory Peripheral Systems
- 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:
  - ADK11-KT 12-bit A/D converter with 16-channel multiplexer and dual clock; one per subsystem
  - AD11-K 12-bit A/D converter with 16-channel multiplexer; 16 per subsystem (15 if ADK11-KT is part of same subsystem)
  - 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)
  - AM11-K 48-channel A/D multiplexer with gain ranging; one per AD11-K or ADK11-KT
  - DR11-K 16-bit digital I/O option; 16 per subsystem
  - AA11-K 4-channel 12-bit D/A converter with scope control; 16 per subsystem
  - AAV11-A, ADV11-A, KWV11-A, and DRV11 real-time options

**PREREQUISITE SOFTWARE:**

None

**OPTIONAL SOFTWARE:**

BASIC-11/IAS-RSX  
 BASIC-PLUS-2  
 CORAL 66  
 DATATRIEVE-11  
 DECnet-11M  
 DBMS-11  
 FMS-11/RXS  
 FORTRAN IV/IAS-RSX  
 FORTRAN IV-PLUS  
 PDP-11 COBOL  
 RMS-11K  
 SORT-11

**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.

**SUPPORT CATEGORY:**

DIGITAL SUPPORTED

RSX-11M is a DIGITAL Supported Software Product.

**SOFTWARE INSTALLATION:**

DIGITAL INSTALLED

DIGITAL installation is required for Software Product Support. There is no charge for installation if performed at the time of system installation. DIGITAL installed software products, except for operating systems, are subject to an add-on installation fee when purchased subsequent to system installation.

**SOFTWARE PRODUCT SUPPORT:**

RSX-11M includes standard warranty services as defined in the Software Support Categories Addendum of this SPD.

**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 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., QJ728-AD = binaries (for dual RK05 based systems) on 9-track 800 BPI Magtape (NRZI).

<sup>6</sup>NOTE: For RP and RM disk kits, the distribution medium is not the system residency device.

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

See Table O.

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*Upgrade Options*

See Table O.

*Update Options*

See Table O.

*Sources/Listings Options*

NOTE: The combination of Executive and Utilities sources do not necessarily comprise all the sources used by DIGITAL to build the binary kits.

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

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

QJ638 -F— Utilities listings (media: R)

*Sources/Listings Update Options*

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

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

QJ628 -N— Executive and I/O device driver listing (media: R)

*Miscellaneous Options*

QJ628 -G— Documentation-only kit (media: Z)

**ADDITIONAL SERVICES:**

Post-warranty Software Product Services are available for licensed customers. Customers should contact their local DIGITAL office for additional information.

TABLE O

## SYSTEM DISK TYPE

|                                                                                                                                                                                                                                                                                                                                                                 | Dual RK05 Based Systems with at least 24K of | RL01/RL02 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) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------|----------------------|----------------------|------------------------------|--------------------------|----------------------------|-----------------------------------------------------|
| <b>Options</b> including single-use license, binaries, documentation, support services.                                                                                                                                                                                                                                                                         | QJ728-AD<br>QJ728-AE                         | QJ738-AD<br>QJ738-AH<br>QJ738-AQ | QJ629-AD<br>QJ629-AT | QJ739-AD<br>QJ739-AV | QJ636-AD                     | QJ637-AD<br>QJ637-AM     | QJ737-AD<br>QJ737-AM       |                                                     |
| <b>Options</b> including single-use license (available only after the purchase of at least one supported license), binaries, documentation, no support services.                                                                                                                                                                                                | QJ728-CD<br>QJ728-CE                         | QJ738-CD<br>QJ738-CH<br>QJ738-CQ | QJ629-CD<br>QJ629-CT | QJ739-CD<br>QJ739-CV | QJ636-CD                     | QJ637-CD<br>QJ637-CM     | QJ737-CD<br>QJ737-CM       | QJ628-DZ                                            |
| <b>Upgrade Options</b> Customers who are currently licensed users of RT-11, RSX-11D, or IAS may obtain this new product by purchasing a license to an upgrade kit for use on the same CPU as their previous license. (Includes support services.)                                                                                                               | QJ741-AD<br>QJ741-AE                         | QJ745-AD<br>QJ745-AH<br>QJ745-AQ | QJ742-AD<br>QJ742-AT | QJ743-AD<br>QJ743-AV | QJ744-AD                     | QJ754-AD<br>QJ754-AM     | QJ755-AD<br>QJ755-AM       |                                                     |
| <b>Upgrade Options</b> Customers who are currently licensed users of RT-11, RSX-11D or IAS may obtain this new product by purchasing a license to an upgrade kit for use on the same CPU as their previous license. (Does not include support services.)                                                                                                        | QJ741-CD<br>QJ741-CE                         | QJ745-CD<br>QJ745-CH<br>QJ745-CQ | QJ742-CD<br>QJ742-CT | QJ743-CD<br>QJ743-CV | QJ744-CD                     | QJ754-CD<br>QJ754-CM     | QJ755-CD<br>QJ755-CM       | QJ740-DZ                                            |
| <b>Update Options</b> Users of RSX-11M whose specified Support Category warranty has expired may order under license the following software update at the then current charge for such update. The update is distributed in binary form on the appropriate medium with documentation and includes no installation or other services unless specifically stated. | QJ728-HD<br>QJ728-HE                         | QJ738-HD<br>QJ738-HH<br>QJ738-HQ | QJ629-HD<br>QJ629-HT | QJ739-HD<br>QJ739-HV | QJ636-HD                     | QJ637-HD<br>QJ637-HM     | QJ737-HD<br>QJ737-HM       | QJ628-HZ                                            |

