COMPAQ

# Software Product Description

**PRODUCT NAME: DECnet–11M, Version 4.8** **SPD 10.75.18**

## DESCRIPTION

DECnet–11M is a product of Mentec, Inc. and is licensed under Compaq Computer Corporation's Standard Terms and Conditions.

DECnet–11M allows a suitably configured RSX–11M system to participate as a routing or nonrouting (end) node in DECnet computer networks. DECnet–11M is a Phase IV network product and is warranted for use only with supported Phase III and Phase IV products supplied by Compaq Computer Corporation.

DECnet Phase IV networks can contain up to 1,023 nodes per network area given proper planning. Phase III nodes participating in Phase III/IV networks are limited to the Phase III routing capability of 255 nodes. Phase II nodes are not supported.

DECnet–11M offers task-to-task communications, utilities for network file operations, homogeneous network command terminal support, and network resource-sharing capabilities using the Digital Network Architecture (DNA) protocols. DECnet–11M communicates with adjacent nodes over synchronous and asynchronous communication lines, Ethernet Local Area Networks (LANs), and parallel interfaces. Access to DECnet–11M is supported for RSX–11M user programs written in MACRO–11, FORTRAN–77, BASIC-PLUS-2, and PDP–11C.

The functions available to an RSX–11M user depend, in part, on the configuration of the rest of the network. Each DECnet product offers its own level of functionality and its own set of features to the user. Networks consisting entirely of DECnet–11M nodes can have the full functionality described in this Software Product Description (SPD). Networks that mix DECnet–11M nodes with other DECnet products can limit the functions available to the DECnet–11M user because some DECnet–11M features are not supported by all DECnet products. Some supplied optional features require hardware configurations larger than the minimum supported systems.

The DECnet products and functions available to users on mixed networks can be determined by comparison of the SPDs for the component products.

*Adaptive Routing*

Adaptive routing is the mechanism by which one or more nodes in a network can route or forward messages between another pair of nodes in the same network. This routing capability will forward such messages even if no direct physical link exists between the pair of nodes apart from the sequence of physical links that includes the routing node(s).

A DECnet–11M node must function as a routing node whenever multiple lines are used simultaneously by that node. DECnet–11M end nodes provide all the capabilities of DECnet–11M routing nodes except that end nodes cannot route messages on behalf of other nodes in the network. Since end nodes do not route messages, they do not need to store or update routing databases. Consequently, end nodes use less system resource and generate less network traffic than routing nodes.

For this same reason, end node operation consumes less processing power than routing node operation. The Full Function DECnet–11M software must be installed on a node in order for that node to operate as a routing node. For a node to operate as an end node, either the Full Function or the End Node DECnet–11M software must be installed on that node. Full Function DECnet–11M software allows a node to be set up as either a routing node or as an end node.

Although two adjacent routing nodes can be connected by more than a single physical link, messages will be sent over only one of the links. All other lines will serve as "hot standbys," such that the least cost path available between two nodes is the one that will be used for message traffic. A line cost parameter set by the system manager determines the line over which all messages will be sent from node to adjacent node.

In addition to adaptive routing, which all DECnet Phase IV implementations use, DECnet–11M supports Area Routing. Area Routing is a method by which DECnet can send and route messages between the nodes in the same or different areas of the network. If the network manager chooses to separate the network into areas, up to 63 (Area 1 through Area 63), with up to 1,023 nodes per area, may be defined. For single area networks, Area 1 is the default. Area-based DECnet networks are hierarchical networks and some restrictions apply to communications from nodes in one area to nodes in another. For example, Phase III nodes in area-based networks can communicate only with nodes within their own areas. Proper network planning is essential when using Area Routing or configuring large networks.

*Task-to-Task Communication*

Using DECnet–11M, an RSX–11M user program written in MACRO–11 or one of the supported high level languages can exchange messages with other network user programs. These two user programs can be on the same node or on any other Phase IV node in the network or Phase III node in the same area. The messages sent and received by the two user programs can be in any data format.

The DECnet–11M software will optionally verify the access control privileges of a task requesting communication with a DECnet–11M task. The RSX–11M System Account File is used to determine access privileges. The results can either be passed on to the receiving task or used to reject the request by the network software.

**Network Resource Access:**

*File Transfer Utilities*

Using DECnet–11M utilities, a user can transfer sequential ASCII files between DECnet nodes. Files can be transferred in both directions between the locally supported RSX–11M File Control System (FCS) devices and the file system of other DECnet nodes. Wild cards can be used for the user identification code, file name, file type, and version number for local to remote file transfers. Transfer of other file types is supported, provided the source and destination DECnet systems support the same file type. Directory listings are also a supported DECnet–11M feature. File transfer integrity is now supported by verifying the transfer via a cyclic redundancy check (DAPCRC).

The DECnet–11M file transfer utilities support file transfers for both FCS and RMS files where formats are compatible between the DECnet nodes.

Additional facilities allow system command files to be submitted to a remote node where the list of commands is in a format acceptable to the node responsible for the execution. DECnet–11M also allows RSX–11M command files to be received from other systems and executed.

A utility is also provided with DECnet–11M that allows the user to queue file operation requests for execution at a specified time. The user has the ability to monitor, list, and delete entries from this queue.

Network users must specify the appropriate user identification and password in order to access the files on a DECnet–11M node. Access to local files using the DECnet software can be controlled through the RSX–11M System Account File.

*File Access*

File access is supported to and from remote DECnet systems by explicit subroutine calls in the supported high level languages. READ, WRITE, OPEN, CLOSE, and DELETE operations can be initiated by local tasks for sequential and random access files residing on the local system or at remote DECnet systems. Other nodes supporting File Access can exercise this capability for files located on the RSX–11M node. Fixed and variable length record formats are supported. Files accessed remotely can contain either ASCII or binary information.

Access to RMS file organizations from other DECnet products is supported by DECnet–11M.

*Network Command Terminal*

DECnet–11M supports Digital's Terminal Services Architecture Command Terminal protocol (CTERM) giving the terminal user the ability to establish a virtual connection to remote Phase IV DECnet systems that provide similar support. This is particularly useful for doing remote program development, and allows terminal users on small application-oriented systems to utilize the resources of larger development-oriented systems.

**Note:** Some functions using CTERM between OpenVMS VAX and non-OpenVMS VAX systems are not supported. Specifically, OpenVMS-style command line editing, VAX TDMS applications, and VAX FMS applications are not supported under DECnet-RSX products.

DECnet–11M also provides an unsupported utility (RMT) that allows a terminal user to establish a virtual connection to other Phase III or Phase IV DECnet-RSX nodes. This utility may not be included in future releases of DECnet–11M.

*Down-Line System Loading*

Initial memory images for RSX–11S nodes in the network can be stored on RSX–11M file system devices and loaded into nodes across point-to-point, multipoint (DMP/DMV), and Ethernet links. Load requests can come from the local RSX–11M operator or from the remote node. Generation of initial memory images of DECnet–11S systems for down-line loading is supported by RSX–11M.

*Upline Dumping*

Memory images of adjacent RSX–11S nodes connected by DECnet can be written onto a file on a DECnet–11M system. This facility helps a programmer understand what may have caused the RSX–11S system to crash.

*Down-Line Task Loading*

Programs to be executed on DECnet–11S nodes in the network can be stored on the DECnet–11M system and loaded on request into DECnet–11S nodes. In addition, programs already executing on DECnet–11S nodes can be checkpointed to the host file system and later restored to main memory of the DECnet–11S node. These features simplify the operation of network systems that do not have mass storage devices.

*Communications Servers*

Compaq offers several communications server products for the DECnet Phase IV network environment. These are standalone processor and/or software packages based upon the PDP–11/RSX architecture. Such servers include the DECnet Router Server and DECnet /SNA Gateways.

Network management, down-line system loading, and upline dumping of these servers is the same as that described for RSX–11S nodes in the preceding paragraphs. Consult the SPD of the server product in question for details regarding availability of support on RSX–11M.

*Network Management*

The Network Control Program (NCP) performs three primary functions: displaying statistical and error information, controlling network components, and testing network operation. These functions can be performed locally or executed at remote Phase III and Phase IV nodes that support this feature. In either case, the output resulting from a command can be directed to a local file or to the user's terminal.

An operator can display the status of DECnet activity at the local node and other Phase III or Phase IV nodes. The user can choose to display statistics related to both node and communication lines, including data on traffic and errors. The local console operator can also perform many network control functions such as loading and unloading DECnet components, starting and stopping lines, activating the local node, and down-line loading RSX–11S systems.

DECnet–11M also provides local network event logging to the console device, a file, or a user-written program. Logging of events to a remote node is also supported. The NCP utility can be used to enable and disable the logging of specific events as well as to enable and disable the event logging facility.

*Communications*

DECnet–11M supports the Digital Data Communications Message Protocol (DDCMP) for full- or half-duplex transmission in point-to-point and multipoint operation using serial synchronous or asynchronous facilities. DDCMP provides error detection/correction and physical link management facilities. In addition, an auto-answer capability is provided if supported by the modem in use.

Multipoint and auto-answer function with EIA-type devices only. Parallel communication devices use special link protocols (not DDCMP) optimized for their characteristics.

The Ethernet bus interfaces, when used in conjunction with Digital Ethernet transceivers, or DELNI, allows DECnet–11M to utilize Ethernet as a data link transmission medium.

The maximum number of physical links that can be supported by a DECnet–11M node is sixteen, depending on CPU, type of communications interface, and speed of interfaces.

DECnet–11M multipoint will support up to a maximum of twelve tributaries on a single multipoint line. Aggregate bandwidth of tributaries is limited to that of the control station device. The communication path to each tributary counts as a link with respect to the limits on number of links specified above. Multipoint line configurations will be supported for the following devices:

**Table 1**
**Multipoint Line Configurations**

| Devices | Multipoint Devices: Multipoint Control Station (Master) | Multipoint Devices: Multipoint Tributary (Slave) |
|---|---|---|
| DL11/DLVE1 | Yes | Yes |
| DUP11 | Yes | Yes |
| DUV11 | Yes | Yes |
| DPV11 | Yes | Yes |
| DZ11/DZV11/DZQ11 | Yes | No |
| DHU11/DHV11/DHQ11 | Yes | No |
| KMC11 (DZ11) | Yes | No |
| KMC11 (DUP11) | Yes | Yes |
| DV11 | Yes | Yes |
| DMP11[1] | Yes | Yes |
| DMV11[1] | Yes | Yes |

[1] Multipoint communication hardware device

*Direct Line Access*

User-written MACRO–11 tasks will be provided with Direct Line Access (DLX) support to all supported devices (including Ethernet Controller). DLX will allow direct control of the communications lines, bypassing the logical link control and transport mechanism provided by the DECnet software. User programs are required on both ends of the link in order to use this interface. Direct Line Access supports both Ethernet and IEEE 802.3 frame formats in a LAN environment.

*DECnet–11M Configuration*

The process of configuring a DECnet–11M node is based primarily on tradeoffs of cost, performance, and functionality, within the realm of satisfying the user's application requirements. It can be expected that network applications will run the gamut from low-speed, low-cost situations to those of relatively high performance and functionality. The performance of a given DECnet node is a function not only of the expected network traffic and resultant processing ("global" conditions), but also of the amount of concurrent processing specific to that node (local conditions). Thus, node performance depends on many factors, including:

- CPU type and memory size
- Number of device interrupts per unit time
- Communication line characteristics
- Number and size of buffers
- Message size and frequency of transmission
- Local applications
- Size and frequency of route-through traffic

**Note:** The rate at which user data can be transmitted (throughput) over a communications line may sometimes approach, but will never equal or exceed, the actual line speed. The reason is that the actual throughput is a function of many factors, such as the network application(s), topology, protocol overhead, and line quality, as well as the factors previously cited.

**Note:** Careful analysis is required when configuring routing nodes with 124K words or less.

Six basic groups of communications interfaces are presented in the following tables. They differ in many respects, particularly in their effect upon CPU utilization.

- With character interrupt devices such as the DUP11, CPU cycles are required for not only the line protocol processing such as DDCMP or the optional X.25 protocol, but also for each character sent and received.
- Devices such as the DV11 are direct memory access (DMA) for both transmission and reception. Since the line protocol (DDCMP) is in the PDP–11 software, CPU cycles are required for its processing.
- Devices such as the DHQ11 are direct memory access (DMA) on transmit, and character interrupt on receive. While CPU cycles are consumed for line protocol processing, and for each character received, the load is reduced for messages transmitted.
- The DMR11, DMV11, and KMS11 are DMA devices with the line protocol (DDCMP or X.25) executed in microcode, thus off-loading the PDP–11 CPU. The only DECnet load the processor sees is completed incoming and outgoing messages.
- The PCL11-B is a high speed DMA device that uses local parallel communications lines. It has its own line protocol and does not use DDCMP. CPU cycles are only required for processing of incoming and outgoing data messages and to perform control functions.
- The DEUNA and DELUA, UNIBUS-to-Ethernet, and the DELQA and DEQNA[1] Q–bus-to-Ethernet controllers are high speed DMA controllers supporting CSMA/CD protocol. CPU cycles are only required for processing of incoming and outgoing messages.

[1] This product is no longer available from Compaq and may not be supported in future releases.

The following tables describe the physical hardware configurations supported by DECnet–11M in terms of CPU type and communication interface. The numbers given in the tables are "load costs." Maximum line speeds (the fastest clock rate at which the device can be driven under DECnet–11M relative to the load cost), expressed in kilobits per second, are shown in parentheses.

Device loading provides a method by which one can compute a maximum system configuration for a variety of communications devices. The load cost indicates the maximum load that a device can put on a particular type of CPU. The load cost limit for each CPU type is 16.

For communications devices that support half/full duplex, the load costs in the tables are for full duplex configurations. The load cost for a half duplex configuration can be calculated as one half of the load cost in the table except at very low speeds, in which case the load cost is the same as in the full duplex case.

**Table 2**
**DECnet–11M UNIBUS Device Load Table**

| | Processor Type | | | | |
|---|---|---|---|---|---|
| Device Type | 11/24 | 11/44 | 11/70 | 11/84 | 11/94 |
| DEUNA (10meg) | 16 | 16 | 16 | 16 | 16 |
| DELUA (10meg) | 16 | 16 | 16 | 16 | 16 |
| PCL (4meg) | 16 | 16 | 16 | 16 | 16 |
| DMP (to 19.2K) | 2 | 1 | 1 | 1 | 1 |
| DMP (56K) | 3 | 3 | 3 | 3 | 3 |
| DMP (1meg) | 16 | 16 | 16 | 16 | 16 |
| DMR (to 19.2K) | 2 | 1 | 1 | 1 | 1 |
| DMR (56K) | 3 | 3 | 3 | 3 | 3 |
| DMR (1meg) | 16 | 16 | 16 | 16 | 16 |
| DV (to 9.6K) | 4 | 3 | 3 | 3 | 3 |
| DHU (to 9.6K) | 2 | 2 | 2 | 2 | 2 |
| DL (to 9.6K) | 2 | 2 | 2 | 2 | 2 |
| DU (to 9.6K) | 2 | 2 | 2 | 2 | 2 |
| DUP (to 9.6K)[1] | 2 | 2 | 2 | 2 | 2 |
| DZ (to 9.6K) | 2 | 2 | 2 | 2 | 2 |

[1] Maximum 4.8Kbps for 11/24 processor

**Note:** For processor types not shown, use the load costs associated with the PDP–11/24 to compute device loading.

**Table 3**
**DECnet–11M Q–bus Device Load Table**

| | Processor Type | | | | | |
|---|---|---|---|---|---|---|
| Device Type | 11/23 | 11/23-PLUS | 11/53 | 11/73 | 11/83 | 11/93 |
| DEQNA[1] (10meg) | 16 | 16 | 16 | 16 | 16 | 16 |
| DELQA (10meg) | 16 | 16 | 16 | 16 | 16 | 16 |
| DMV (to 19.2K) | 2 | 2 | 1 | 1 | 1 | 1 |
| DMV (56K) | 3 | 3 | 3 | 3 | 3 | 3 |
| DHQ (to 9.6K) | 2 | 2 | 2 | 2 | 2 | 2 |
| DHV (to 9.6K) | 2 | 2 | 2 | 2 | 2 | 2 |
| DLV (to 4.8K) | 2 | 2 | 2 | 2 | 2 | 2 |
| DPV (to 4.8K) | 2 | 2 | 2 | 2 | 2 | 2 |
| DUV (to 4.8K) | 2 | 2 | 2 | 2 | 2 | 2 |
| DZV (to 9.6K) | 2 | 2 | 2 | 2 | 2 | 2 |

[1] This product is no longer available from Compaq and may not be supported in future releases.

**Table 4**
**Maximum Line Configurations Guidelines (Multipoint)**

| | Maximum Line Speed (Kilobits per Second, half- or full-duplex) | | | | |
|---|---|---|---|---|---|
| Device Group | 19.2 | 56 | 250 | 500 | 1000 |
| DMV11 (All Options) | 2/8 | 2/8 | | | |
| DMP11 (RS232-C, V.35) | 4[1]/8 | 2/8 | | | |
| (Local) | | 2/8 | 1/12 | 1/12 | 1/12[2] |
| (RS422/449) | 4[1]/8 | 2/8 | 1/12 | 1/12 | 1/12[2] |

[1] half-duplex

[2] 11/24 is limited to 2 controllers

**Note:** Left side of slash (/) indicates number of controllers per node and right side indicates total number of tributaries per control node.

Total number of circuits not to exceed 16 per node.

Number of tributaries on lines should be carefully configured for performance considerations.

In order to achieve a viable configuration, the user and/or a Compaq Software Specialist must perform a level of application analysis that addresses the factors above.

## HARDWARE REQUIREMENTS

Any valid RSX–11M system configuration with:

- The following additional memory must be available.

  DECnet–11M end node — 20 KW
  DECnet–11M routing node — 22 KW

  Ethernet support will add 6 KW to the above memory requirements.

- The following additional disk space must be available for DECnet–11M network software:

| | |
|---|---|
| DECnet–11M end node | 4,200 blocks (2,150 Kbytes) |
| DECnet–11M routing node | 4,700 blocks (2,406 Kbytes) |

- PDP–11/24, PDP–11/34, PDP–11/40, PDP–11/44, PDP–11/45, PDP–11/55, PDP–11/60, PDP–11/70, PDP–11/84, or PDP–11/94 central processor with one of the following communications devices:

| | |
|---|---|
| DUP11 | low-speed synchronous interface[4] |
| DMP11 | synchronous UNIBUS interface (RS232-C/RS423A, CCITT V.35/DDS, or RS449 /RS422)[4,5] |
| DMP11 | local synchronous UNIBUS interface[4,5] |
| DMR11 | synchronous UNIBUS interface (RS232-C/RS423A, CCITT V.35/DDS, or RS449 /RS422)[4] |
| DMR11 | local synchronous UNIBUS interface[4] |
| DL11 | asynchronous EIA interface with modem control[4] |
| DL11 | asynchronous 20mA current loop interface[1,4] |
| DZ11 | multiline asynchronous EIA interface[2,4] |
| DZ11 | multiline asynchronous 20mA current loop interface [1,2,4] |
| DHU11 | multiline asynchronous interface[2,4] |
| DV11 | multiline NPR synchronous interface[2,4] |
| PCL11-B | multiple CPU link |
| DELUA | UNIBUS-to-Ethernet controller |
| DEUNA | UNIBUS-to-Ethernet controller |

[1] Requires either the H319 option for optical isolation or one side of the 20mA line to be in passive mode.

[2] All lines on this interface must be dedicated as DECnet links.

[4] With appropriate FCC-compliant cabinet option.

[5] These products are no longer marketed by Compaq and may not be supported in future releases of DECnet–11M.

- PDP–11/23, 11/23-Plus or Micro/PDP–11 (11/23, 11/53, 11/73, 11/83, or 11/93) central processors with one of the following communications devices.

  **Note:** The KDJ11-A 11/73 option is only supported per the RSX–11M Operating System SPD (14.35.xx).

| | |
|---|---|
| DMV11 | synchronous Q–bus interface (RS232-C /RS423A or CCITT V.35/DDS)[4] |
| DMV11 | local synchronous Q–bus interface[4] |
| DUV11 | low-speed EIA synchronous interface[4] |
| DLVE1 | asynchronous EIA interface with full modem control for a single line[4] |
| DZV11 | multiline asynchronous Q–bus EIA interface[2,4] |
| DZQ11 | multiline asynchronous Q–bus EIA interface[2,4] |
| DHQ11 | multiline asynchronous Q–bus interface |
| DHV11 | multiline asynchronous Q–bus interface[2,4] |
| DPV11 | synchronous Q–bus interface[4] |
| DELQA | UNIBUS-to-Ethernet controller |
| DEQNA[6] | Q–bus-to-Ethernet controller |

[2] All lines on this interface must be dedicated as DECnet links.

[4] With appropriate FCC-compliant cabinet option.

[6] This product is no longer available from Compaq and may not be supported in future releases.

## OPTIONAL HARDWARE

- Additional lines and/or communication interfaces (from above) up to the maximum as defined in the *Device Load* tables for mapped systems.

- KG11-A Communications Arithmetic Element 5 (may be used in conjunction with DV11, DZ11, and DL11)
- KMC11-A (can be used in conjunction with up to eight DUP11s or one sixteen-line DZ11).

## SOFTWARE REQUIREMENTS

- RSX–11M Operating System

Refer to the RSX–11M Software Product Description (SPD 14.35.xx) for the required version.

## OPTIONAL SOFTWARE

- PDP–11 FORTRAN–77/RSX V5.4A
- PDP–11 BASIC-PLUS-2 for RSX–11M and RSX–11M–PLUS V2.7A

## GROWTH CONSIDERATIONS

The minimum hardware/software requirements for any future version of this product may be different from the requirements for the current version.

## DISTRIBUTION MEDIA

9-track 1600 BPI Magtape (PE), TK50 Streaming Tape

## ORDERING INFORMATION

*For DECnet–11M Full Function:*

Software License: QJ764-UZ
Software Update License: QJ764-HZ
Software Media and Documentation: QJ764-H*
Software Documentation: QJ766-GZ
Software Product Services: QJ764-**

*For DECnet–11M End Node:*

Software License: QJ765-UZ
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Software Media and Documentation: QJ765-H*
Software Documentation: QJ766-GZ
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