Software Product Description

PRODUCT NAME: OpenVMS AXP Operating System, Version 1.5 **SPD 41.87.01**

DESCRIPTION*

OpenVMS AXP is a general-purpose multiuser operating system that supports Digital Equipment Corporation's Alpha AXP series computers in both production and development environments. OpenVMS AXP software supports industry standards, facilitating application portability and interoperability. OpenVMS AXP provides symmetric multiprocessing (SMP) support for multiprocessing Alpha AXP systems.

OpenVMS AXP can be tuned to perform well in a wide variety of applications, including compute-intensive, I/O-intensive, real-time, and combinations of those and other environments. Actual performance depends on the type of computer, available physical memory, and the number and type of disk and tape drives on the system.

OpenVMS AXP software has integrated networking and distributed computing capabilities. OpenVMS AXP contains extensive features that promote ease-of-use, improve productivity, and facilitate system management.

OpenVMS AXP Version 1.5 is the second release of the OpenVMS operating system for Digital's 64-bit Alpha AXP architecture. This release contains most of the features of the OpenVMS VAX operating system. OpenVMS AXP compilers and applications take advantage of 64 bits by using 64-bit data-types. Consult the Software Product Descriptions of OpenVMS AXP compilers for further details. Note that application virtual address space is a 32-bit implementation for compatibility and migration purposes.

User Environment

Users can access OpenVMS AXP software by using the English-like Digital Command Language (DCL), the command language for OpenVMS AXP that is supplied with the system. DCL commands take the form of a command name followed by parameters and qualifiers. DCL commands provide information about the system, initiate system utilities, and initiate user programs. OpenVMS AXP prompts users to enter required DCL parameters, making it easy for novice users to use.

Users can enter DCL commands at a terminal or include them in command procedures; command procedures can be run interactively or submitted to a batch queue for deferred execution.

Information on DCL and OpenVMS AXP utilities is available through the online OpenVMS AXP Help system. Online Help includes summary information on all aspects of system operation.

A number of tools and utilities are integrated into the OpenVMS AXP operating system. These tools and utilities include the following.

Text Processing

The Extensible Versatile Editor (EVE), one of several text editors supplied by Digital, allows users to insert, change, and delete text quickly. Written in the DEC Text Processing Utility (DECTPU) language, EVE is a full-screen editor that allows users to manipulate text on a terminal screen. EVE also provides an EDT-style keypad, allowing users of the EDT text editor to easily transition to EVE.

Mail Utility

The Mail utility allows users to send messages to any other user on the system. Multinode operation is available if DECnet for OpenVMS AXP is installed and licensed on each participating node on the configured network.

* "Licensee agrees to only execute Display PostScript on those Digital workstations identified as licensed systems in this Software Product Description, and that in any event licensee agrees not to make use of the software directly or indirectly, to print bitmap images with print resolutions greater than 150 DPI, or to generate fonts or typefaces for use other than with the Digital licensed system." (Terms and Conditions for Display PostScript can be found in *Appendix B* of this Software Product Description, on Third-Party Licensing.)

Command-Level Programming

Command-level programming allows users to create special files called command procedures that contain a series of DCL commands. When users start a command procedure, the system consecutively processes the commands in the command procedure. Users can also use DCL commands to assign symbolic names, evaluate numerical and logical expressions, accept parameters, perform conditional (IF-THEN-ELSE) and branching (GOTO) logic, and handle error conditions.

User Environment Tailoring

Users can customize the computing environment with user login command procedures, shorthand commands, binding of commands to function keys, and command recall and editing.

Terminal Fallback Facility (TFF)

This facility allows Digital 7-bit terminals to input and output the Digital Multinational Character Set (MCS). Specific tables allow conversion to MCS for a number of different 7-bit National Replacement Character sets, such as French, German, Spanish, and Swedish. The TFF also allows character composition on terminals that do not have the compose key.

Program Development Environment

OpenVMS AXP includes a comprehensive set of tools for developing programs, including run-time libraries (RTLs), a linker, a librarian, and a symbolic debugger. Tools available to the OpenVMS AXP programmer include the following.

Language and Run-Time Library Support

OpenVMS AXP includes several run-time libraries which provide string manipulation, parallel processing support, I/O routines, I/O conversion, terminal independent screen handling, date and time formatting routines, highly accurate mathematical functions, signaling and condition handling, and other general purpose functions. These routines can be called from programs written in such languages as MACRO-64, Ada, C, Fortran, and Pascal.

Also included in OpenVMS AXP are language support libraries. While each language is different, all provide support for sequential file I/O and most support direct and indexed file I/O as well. Language RTLs also provide support for I/O formatting, error handling, and, in DEC Fortran, the ability to read unformatted files containing data from other vendors.

Translated OpenVMS VAX RTLs are provided to preserve customer investment by ensuring that existing OpenVMS VAX software can run on an OpenVMS AXP system and by ensuring compatible results. A translated OpenVMS VAX RTL is an RTL image which has undergone binary translation because no compiler exists for the programming language to produce an OpenVMS AXP RTL image at this point in time. Translated RTLs interoperate with their native counterparts where possible.

Major OpenVMS AXP languages (including those listed above) adhere to the common calling standard, meaning that routines written in any of these languages can directly call routines written in any other language. Development of applications using multiple languages is simple and straightforward.

At a lower level, programs can call system services directly for security, event flag, asynchronous system trap, logical name, record and file I/O, process control, timer, time conversion, condition handling, lock management, and memory management services. Again, system services use the Alpha AXP calling standard and condition handling conventions.

Macro-32 Compiler

The Macro-32 compiler for OpenVMS AXP is supplied with OpenVMS AXP software for migration purposes.

DECthreads

OpenVMS AXP includes a user-mode multi-threading capability referred to as DECthreads. DECthreads provides an implementation of draft 4 of the proposed POSIX 1003.4a standard. DECthreads is a library of run-time routines callable from a C program that allows the user to create multiple threads of execution within a single address space. Multi-threading capability allows computation activity to be overlapped with I/O activity. Synchronization elements, such as mutexes and condition variables, are provided to help ensure that shared resources are accessed correctly. DECthreads also provides multiple scheduling policies for scheduling and prioritizing threads.

Librarian Utility

The Librarian utility permits storage of object modules, image files, macros, help text, or any general record-oriented information in central, easily accessible files. Object module and image file libraries are searched by the linker when the linker finds a reference it cannot resolve in one of its input files. Macro-32 libraries are searched by the Macro-32 compiler when the compiler finds a macro that is not defined in the input file.

Debugger

The OpenVMS AXP debugger allows users to trace program execution as well as display and modify register contents using the same symbols that are present in the source code.

RMS File Utilities

RMS file utilities allow users to analyze the internal structure of an RMS file and to determine the most appropriate set of parameters for an RMS file. They can also be used to create, load, and reclaim space in an RMS file. Refer to the *Operating System Environment* section of this Software Product Description for more information on RMS.

File Differences Utility

The File Differences utility compares the contents of two files and lists those records that do not match.

Translated Image Environment

OpenVMS AXP provides an array of services to allow the operation of programs that have undergone binary translation from OpenVMS VAX images. These programs can perform virtually all user-mode functions on OpenVMS AXP, and can operate in combination with other programs (images) that have been translated from OpenVMS VAX or have been built using native compilers on OpenVMS AXP. Without requiring special source code, the Translated Image Environment automatically resolves differences between the VAX and Alpha AXP architectures, including floating point registers, condition codes, exception handling, ASTs, and others.

The Translated Image Environment included with OpenVMS AXP is sufficient to run such images which have been translated elsewhere. The DECmigrate for OpenVMS AXP layered product can be used to translate OpenVMS VAX images. For additional information on the precise characteristics of programs suitable for binary translation refer to the DECmigrate for OpenVMS AXP Systems Software Product Description (SPD 39.44.xx).

System Management Environment

OpenVMS AXP provides a variety of tools to aid the system manager in configuring and maintaining an optimal system. Tools available for the system manager include the following.

Batch and Print Queuing System

OpenVMS AXP provides an extensive batch/print capability that allows the creation of queues and the setup of spooled devices in order to process non-interactive workloads in parallel with timesharing or real-time jobs.

The OpenVMS AXP batch and print operations support two types of queues: generic queues and execution queues. A generic queue is an intermediate queue that holds a job until an appropriate execution queue becomes available to initiate the job. An execution queue is a queue through which the job (either print or batch) is actually processed or executed.

The system queues batch jobs for execution. The system manager can regulate the number of queues and the number of streams per queue (that is, the number of batch jobs in the queue that can execute concurrently).

Both generic and execution batch queues can have different attributes, such as the maximum CPU time permitted, working set size, and priority. Facilities are provided for starting and stopping queues, and for starting and stopping jobs in a queue.

Print queues, both generic and execution, together with queue management facilities, provide versatile print capabilities, including support of ANSI and PostScript® file printing.

Accounting Utility

For accounting purposes, OpenVMS AXP keeps records of the use of system resources. These statistics include processor and memory utilization, I/O counts, print symbiont line counts, image activation counts, and process termination records. The OpenVMS AXP Accounting utility allows various reports to be generated using this data.

Autoconfigure/AUTOGEN Utilities

OpenVMS AXP provides utilities to automatically configure the available devices into the system tables and to set system operational parameters based on the detected peripheral and memory configuration. There is no need for a traditional "system generation" process when the hardware configuration is expanded or otherwise modified.

The OpenVMS AXP AUTOGEN command procedure automatically sets a number of system parameters by detecting devices installed in a configuration. A feedback option can be used to generate a report of recommended parameter settings for system tuning.

Backup Utility

The Backup utility provides full volume and incremental file backup for file-structured and mounted volumes. Individual files, selected directory structures, or all files can be backed up and restored. Files can be selected by various dates (creation, modification, and so forth). Files can be backed up to magnetic tape or magnetic disk. With standalone backup, system managers can back up and restore system disks. Standalone backup

is used during the installation of the OpenVMS AXP operating system. The Backup utility can be used to restore a saveset or list the contents of a saveset.

Analyze Disk Structure Utility

The Analyze Disk Structure utility compares the structure information on a disk with the contents of the disk, prints the structure information, and permits changes to that information. It also can be used to repair errors that are detected in the file structure of disks.

Monitor Utility

The Monitor utility permits the system manager to monitor different classes of system-wide performance data, including process activity, I/O activity, and memory management activity, at specified intervals. The data may be displayed as it is gathered or saved in a file for later use.

License Management Facility (LMF)

The License Management Facility (LMF) allows the system manager to enable software licenses and to determine which software products are licensed on an OpenVMS AXP system.

SYSMAN Utility

The SYSMAN utility allows the system manager to define a system management environment so that operations performed from the local OpenVMS AXP system can be executed on all other OpenVMS AXP systems in the defined environment. The environment may include OpenVMS AXP systems networked via DECnet for OpenVMS AXP.

Operations

OpenVMS AXP enables varying levels of privilege to be assigned to different operators. In addition, system-generated messages can be routed to different terminals based on their interest to the console operators, tape librarians, security administrators, and system managers. Operators can use the OpenVMS AXP Help Message utility to get an online description of OpenVMS AXP error messages.

Security and Control

OpenVMS AXP provides privilege, protection, and quota mechanisms to control user access to system-controlled structures in physical memory, to system-structured files, and to certain devices.

User account information is maintained by the system manager in the user authorization file (UAF). When creating user accounts with the Authorize utility, the system manager assigns the privileges and quotas associated with each user account. The system manager also assigns a unique user name, password, and user identification code (UIC) to each account. Optionally, additional identifiers can be assigned to each account, permitting users to belong to multiple overlapping groups or projects. Account use may be limited by time of day, day of week, and type of access, such as local, remote, or batch.

To log in and gain access to the system, the user must supply a user name and password. The password is encoded and does not appear on terminal displays. Users can change their password voluntarily, or the system manager can selectively enforce how frequently passwords change, password length, and generation of random alphabetic passwords.

Additionally, OpenVMS AXP provides several password filters that screen all user password changes against a dictionary of common passwords. This prevents users from reusing passwords that they have used within the last year. In addition to these built-in filters, a site can install its own filter to screen passwords against a site-specific password policy.

The system password hash algorithm can also be replaced with a private algorithm for those sites that have contractual agreements to use specific password encryption algorithms. This feature can be enabled on a per-user, per-password basis.

Login security includes break-in detection, which allows terminals to be disabled when password guessing is detected. When a user logs in, the system displays a message stating when the last login for the account occurred and whether any failed attempts to log in have taken place since the last successful login.

A UIC consists of two fields: the unique user field and a group field. Every file, device, queue, or other system object is labeled with the UIC of its owner (normally the user who created the object).

Files, devices, queues, and other system objects are assigned a protection mask that allows read, execute, write, and delete access to be selectively granted to the object's owner and group, to privileged system users, and to all other users. In addition, files, devices, queues, and some other system objects can be protected with access control lists to allow selectively granted or denied access to a list of individual users, groups, or identifiers.

Scavenge protection can be enabled selectively in the form of file highwater marking, erase on allocate, and erase on delete, to ensure that file contents cannot be read after a file has been deleted.

Security alarms are provided to allow selective auditing of security-related events, including:

- Login and logout
- Login failures and break-in attempts
- Authorization changes
- File access, selectable by use of privilege, type of access, and by individual file

Note: No system can provide complete security and Digital cannot guarantee system security. However, Digital continually strives to enhance the security capabilities of its products. Customers are strongly advised to follow industry-recognized security practices.

Operating System Environment

Processes and Scheduling

The basic unit of execution in OpenVMS AXP is the process. A process consists of individual address space and registers known as "context," and code called an "executable image." The context identifies the process and describes its current state. Executable images consist of system programs and user programs that have been compiled and linked.

The maximum number of concurrent processes is 8 192 per OpenVMS AXP system.

Processes receive processor time to execute their images based on the priority of the process. Thirty-two priorities are recognized: priorities 0 to 15 are for time-sharing processes and applications that are not time critical (four is the typical default for time-sharing processes), and priorities 16 to 31 are for real-time processes.

Each time an event such as an I/O interrupt occurs, the system first services the event and then passes control to the highest priority process ready to execute. The system automatically adjusts the priorities of processes whose base priority is in the range of 0 to 15 to favor I/O-bound and interactive processes, but the system will not adjust the priority of a process in the range of 16 to 31.

Real-time processes can be assigned higher priorities to ensure that they receive processor time whenever they are ready to execute. Real-time processes are scheduled pre-emptively; that is, if a real-time process is ready to execute, it is given the processor immediately, unless a real-time process with a higher priority is ready to execute.

OpenVMS AXP uses paging and swapping mechanisms to provide sufficient virtual memory for multiple concurrently executing processes. Also, paging and swapping is provided for processes whose memory requirements exceed available physical memory. The maximum working set size is 400 MB of memory.

Programmers can exercise control over memory management from within an image. An image executing in a real-time process, for example, can inhibit paging or swapping of critical code and data.

Peripheral devices can be managed by the system or allocated by individual processes. At least one disk must be a system disk. Other disks can be designated as data disks for the general use of all users logging into the system or for a specific group of users. The system controls interactive terminals and one or more printers.

Input/Output

The QIO system service provides a direct interface to the operating system's I/O routines. These services are available from within most OpenVMS AXP programming languages and can be used to perform low-level I/O operations efficiently with a minimal amount of system overhead for time-critical applications.

Device drivers execute I/O instructions to transfer data to and from a device and to communicate directly with an I/O device. Each type of I/O device requires its own driver. Digital supplies drivers for all devices supported by the OpenVMS AXP operating system and provides QIO system service routines to access the special device-dependent features available in many of these devices.

OpenVMS AXP supports a variety of disk and tape peripheral devices, as well as terminals, networks, and mailboxes (virtual devices for interprocess communication).

Record Management Services (RMS)

Record Management Services (RMS) is a set of I/O services that helps application programs to process and manage files and records. Although it is primarily intended to provide a comprehensive software interface to mass storage devices, RMS also supports device-independent access to unit-record devices.

RMS supports sequential, relative, and indexed file organizations in fixed-length and variable-length record formats. RMS also supports byte stream formats for sequential file organization.

RMS record access modes provide access to records in four ways: sequentially, directly by key value, directly

by relative record number, and directly by record file address. RMS also supports block I/O operations for various performance-critical applications that may require user-defined file organizations and record formats.

RMS promotes safe and efficient file sharing by providing multiple file access modes, automatic record locking where applicable, and optional buffer sharing by multiple processes.

RMS utilities aid file creation and record maintenance. These utilities convert files from one organization and format to another, restructure indexed files for storage and access efficiency, and reclaim data structures within indexed files. The utilities also generate appropriate reports.

For systems that have DECnet for OpenVMS AXP installed, RMS provides a subset of file and record management services to remote network nodes. Network remote file operations are generally transparent to user programs.

DCL commands such as EDIT, CREATE, COPY, TYPE, and PRINT allow manipulation of RMS files and records within RMS files at the DCL command level.

Reliability

The system handles hardware errors as transparently as possible while maintaining data integrity and providing sufficient information to diagnose the cause of an error. The system limits the effects of an error by first determining if the error is fatal. If the error is fatal then the process that encountered the error is aborted. If the error occurs in system context then the current OpenVMS AXP session is shut down. If the error is not fatal then recovery actions pertinent to the error are executed and the current operation is continued.

In all cases, information relevant to an error is collected and put in an error log file for later analysis. Hardware errors include the following categories:

- Processor errors

  These include processor soft errors, processor hard errors, processor machine checks, adapter errors.

- Memory errors

  These are hardware errors that are handled in a slightly different manner. The system examines memory at startup time and does not use any pages found to be bad. During system operation, the hardware transparently corrects all single-bit memory errors for those systems with Error Correction Code (ECC) memory.

Other failures include:

- Operating system errors (system-detected inconsistencies or architectural errors in system context)
- User errors
- I/O errors

The system logs all processor errors, all operating system errors detected through internal consistency checks, all double-bit memory errors (and a summary of corrected single-bit memory errors), and most I/O errors.

If the system is shut down because of an unrecoverable hardware or software error, a dump of physical memory is written. The dump includes the contents of the processor registers. The OpenVMS AXP System Dump Analyzer utility is provided for analyzing memory dumps.

Interprocess Communication

OpenVMS AXP provides a number of facilities for applications that consist of multiple cooperating processes.

- Mailboxes are virtual devices that allow processes to communicate with queued messages.
- Shared memory sections on a single processor permit multiple processes to access shared address space concurrently.
- Common event flags provide simple synchronization.
- The lock manager provides a more comprehensive enqueue/dequeue facility with multilevel locks, values, and ASTs (asynchronous system traps).

Networking Facilities

DECnet for OpenVMS AXP offers task-to-task communications, file management, downline system and task loading, network command terminals, and network resource sharing capabilities using the Digital Network Architecture (DNA) protocols.

OpenVMS AXP provides device drivers for all Digital LAN adapters listed in the *Network Options* section of *Appendix A* of this SPD. Application programmers can use the QIO system service to communicate with other systems connected via the Ethernet using either Ethernet or IEEE 802.3 packet format. Simultaneous use of Digital Ethernet and IEEE 802.3 protocols are supported on any Digital Ethernet adapter.

Not all devices are supported, and certain restrictions apply relative to line speed and line utilization. Refer to the *Hardware Charts* section and *Appendix A* of this SPD, as well as the DECnet for OpenVMS AXP Software Product Description (SPD 42.25.xx), for more information.

DECdtm Services

The DECdtm services embedded in the OpenVMS AXP operating system support fully distributed databases using a "two phase commit" protocol. The DECdtm services provide the technology and features for distributed processing, ensuring both transaction and database integrity across multiple resource managers. Updates to distributed databases occur as a single "all or nothing" unit of work, regardless of where the data physically resides. This ensures consistency of distributed data.

DECdtm services allow applications to define "global transactions" that may include calls to any of a number of Digital data management products. Regardless of the mix of data management products used, the global transaction will either commit or abort. OpenVMS is unique in providing transaction processing functionality as base operating system services.

DECdtm features include:

- Embedded OpenVMS AXP system services support the DECtp architecture, providing features and the technology for distributed transaction processing.
- DECdtm allows multiple disjoint resources to be updated atomically. These resources can be either physically-disjointed (for example, on different CPUs) or logically-disjointed (for example, in different databases on the same CPU).
- DECdtm encourages robust application development. Applications can be written to ensure that data is never in an inconsistent state, even in the event of system failures.
- As an OpenVMS AXP service, DECdtm can be called using any Digital TP monitor or database product. This is useful for applications using several database products.

Symmetric Multiprocessing

OpenVMS AXP provides symmetric multiprocessing (SMP) support for multiprocessing Alpha AXP systems. SMP is a form of tightly coupled multiprocessing in which all processors execute code streams simultaneously. The processors can perform operations in all OpenVMS AXP access modes (user, supervisor, executive, and kernel).

OpenVMS AXP SMP configurations consist of multiple central processing units executing code from a single shared memory address space. Users and processes share a single copy of OpenVMS AXP. SMP also provides simultaneous shared access to common data in global sections to all processors. OpenVMS AXP SMP dynamically balances the execution of all processes across all available processors based on process priority.

SMP support is an integral part of OpenVMS AXP and is provided transparently to the user. Because an SMP system is a single system entity, it is configured into a network and VMScluster systems as a single node.

Disk and Tape Volumes

Disk volumes can be organized into volume sets. Volume sets can contain a mix of disk device types and can be extended by adding volumes. Within a volume set, files of any organization type can span multiple volumes. Files can be allocated to the set as a whole (the default) or to specific volumes within the set. Optionally, portions of indexed files can be allocated to specific areas of a single disk volume or to specific volumes in a volume set.

Disk quotas can be placed to control the amount of space individual users can allocate. Quota assignment is made by User Identification Code and can be controlled for each individual volume.

Disk structure information can be cached in memory to reduce the I/O overhead required for file management services. Although not required to do so, users can preallocate space and control automatic allocation. For example, a file can be extended by a given number of blocks, contiguously or noncontiguously, for optimal file system performance in specific cases.

The system applies software validity checks and checksums to critical disk structure information. If a disk is improperly dismounted because of user error or system failure, the system automatically rebuilds the disk's structure information the next time the disk is mounted. The system detects bad blocks dynamically and prevents their reuse once the files to which the blocks were allocated have been deleted. On Digital Storage Architecture (DSA) disks, the disk controller dynamically detects and replaces bad blocks automatically.

The system provides eight levels of named directories and subdirectories whose contents are alphabetically ordered. Device and file specifications follow Digital conventions. Logical names can be used to abbreviate the specifications and to make application programs device and file-name independent. A logical name can be assigned to an entire specification, to a portion of a specification, or to another logical name.

OpenVMS AXP supports multivolume magnetic tape files with transparent volume switching. Access positioning is done either by file name or by relative file position.

Associated Products

VMScluster Software

VMScluster Software is an OpenVMS AXP System Integrated Product that is separately licensed. It provides a highly integrated OpenVMS computing environment distributed over multiple Alpha AXP and VAX systems.

VMScluster systems communicate using any combination of the following interconnects; CI, DSSI, and Ethernet. VMScluster systems that include a CI may optionally be configured with HSC-series intelligent storage controllers.

Applications running on one or more nodes in a VMScluster system access shared resources in a coordinated manner. VMScluster Software components synchronize access to shared resources, preventing multiple processes on any node in the VMScluster from interfering with each other when updating data. This coordination ensures data integrity during multiple concurrent update transactions. Application programs can specify the level of VMScluster-wide file sharing that is required; access is then coordinated by the OpenVMS Extended QIO Processor (XQP) and Record Management Services (RMS).

The OpenVMS queue manager controls VMScluster-wide batch and print queues, which can be accessed by any VMScluster node. Batch jobs submitted to VMScluster-wide queues are routed to any available CPU so that the batch load is shared.

Two or more Alpha AXP and VAX computers connected to the same Computer Interconnect (CI) or Digital Storage Systems Interconnect (DSSI) must run VMScluster software and be part of the same VMScluster system.

Refer to the VMScluster Software Software Product Description (SPD 42.18.xx) for more information.

Networking Facilities

DECnet for OpenVMS AXP software is a System Integrated Product (SIP) that is separately licensed from OpenVMS AXP. Refer to the DECnet for OpenVMS AXP Software Product Description (SPD 42.25.xx) for further information on supported communications devices and software features.

Terminal Server Products

Digital's terminal server products can be used for terminal server access to OpenVMS AXP.

OpenVMS AXP can also establish a connection to other devices (such as printers) attached to such terminal servers.

DECwindows Motif® for OpenVMS AXP

Digital offers a separately orderable layered product called DECwindows Motif for OpenVMS AXP which provides support for both OSF/Motif®, a standards-based graphical user interface, and the X user interface (XUI) in a single run-time and development environment. By default, DECwindows Motif displays the OSF/Motif user interface. Because both Motif and XUI are based on MIT's X Window System applications written to either toolkit will run regardless of which environment the user selects. Refer to the DECwindows Motif for OpenVMS AXP Software Product Description (SPD 42.19.xx) for more information.

The OpenVMS AXP software installation procedure contains an optional step to allow installation of the DECwindows Motif for OpenVMS AXP device and font support, which is required to run the DECwindows Motif for OpenVMS AXP layered product. Please refer to the *OpenVMS Alpha Upgrade and Installation Manual* for details concerning the optional installation of the prerequisite DECwindows Motif for OpenVMS AXP device support.

Enhanced X Window Display PostScript®

The X Window System Display PostScript System provided with DECwindows Motif extends the native X graphical programming environment for DECwindows users displaying text or images on workstations that support the XDPS extension. The DECwindows Motif for OpenVMS AXP layered product must be installed and licensed in order to use Display PostScript.

X Display PostScript has two components:

- Display PostScript server extension, which is provided with the display server in the OpenVMS AXP and OpenVMS VAX operating systems. A workstation is required to use this server.
- Adobe® client libraries, which are used by applications to perform PostScript operations, such as rotating and scaling fonts, generating curves, and displaying PostScript documents. The Adobe client libraries are available in the DECwindows Motif for OpenVMS layered product, as well as on third-party platforms, including IBM®, Sun®, and Silicon Graphics.

X Display PostScript adds the following capabilities to the basic X11 Window System environment:

- All DECwindows fonts can be displayed at any size and rotation angle.
- Display PostScript graphics are specified in a user-defined coordinate system independent of monitor density.

- Color or gray-scale rendition is automatically modified to take advantage of the monitor type through either direct display, color dithering, or half-toning.
- Display PostScript display routines can be downloaded to the server and executed on command.
- Sophisticated graphics primitives, such as precisely controlled Bezier curves, can be displayed.
- Any display can be scaled and rotated arbitrarily.

The Display PostScript system also allows users to view PostScript files with such applications as DECwindows Mail and the CDA Viewer without generating hardcopy. (Terms and Conditions for Display PostScript can be found in *Appendix B* of this Software Product Description, on Third-Party Licensing).

DECram for OpenVMS AXP

Digital offers a separately orderable layered product called DECram for OpenVMS AXP. DECram for OpenVMS AXP is a disk device driver that allows an OpenVMS AXP system manager to create pseudo disks (RAMdisks) that reside in main memory for the purpose of improving I/O performance. Frequently accessed data can be accessed much faster from a DECram device than from a physical disk device. These RAMdisks can be accessed through the file system just as physical disks are accessed, requiring no change to application and/or system software.

Since main memory is allocated for the DECram device, an amount of extra memory is generally required. The amount of memory dedicated is selectable. The OpenVMS AXP system manager designates the amount of memory dedicated to the DECram device(s) and the files that will be stored on it. The maximum size of a DECram device is 524 280 blocks. Refer to the DECram for OpenVMS AXP Software Product Description (SPD 34.26.xx) for more information.

Standards

OpenVMS AXP is based on the public, national, and international standards listed below.

Support for POSIX Standards and XPG3 BASE Branding

POSIX (Portable Operating System Interface for Computing Environments) is a set of standards and draft standards that are being generated by the Institution of Electronic and Electronic Engineers (IEEE). Conformance to POSIX 1003.1-1988 and -1990 is demonstrated by passing the POSIX Conformance Test Suite (PCTS) which tests for conformance to NIST's Federal Information Standard 151-1 (FIPS 151-1) and results in a Certificate of Validation issued by NIST.

XPG3 BASE branding is awarded by X/Open™ Company Limited to systems which are compliant to the base specifications as defined in the X/Open Portability Guide Issue 3 (XPG3). The Branding certificate is obtained after successfully passing the X/Open Verification Test Suite for XPG3 (VSX4 in XPG3 mode) and declaring conformance to the specifications in the XPG3.

The OpenVMS AXP environment with POSIX for OpenVMS AXP is expected to obtain the NIST Certificate of Validation for FIPS 151-1 and XPG3 Base branding from X/Open. Refer to the POSIX for OpenVMS AXP Software Product Description (SPD 47.49.xx) for more information.

Support for OSF/Motif and X Window System Standards

DECwindows Motif provides support for both OSF/Motif, a standards-based graphical user interface, and the X Consortium's X Window System.

Standards Listing

These standards are American National Standards Institute (ANSI), U.S. Federal Information Processing (FIPS), and International Standards Organization (ISO) standards. The following information may be useful in determining responsiveness to stated conformance requirements as enabled in particular commercial or government procurement solicitation documents:

- ANSI X3.4-1986: American Standard Code for Information Interchange
- ANSI X3.22-1973: Recorded Magnetic Tape (800 BPI, NRZI)
- ANSI X3.27-1987: File Structure and Labeling of Magnetic Tapes for Information Interchange
- ANSI X3.39-1986: Recorded Magnetic Tape (1600 BPI, PE)
- ANSI X3.40-1983: Unrecorded Magnetic Tape
- ANSI X3.41-1974: Code Extension Techniques for Use with 7-bit ASCII
- ANSI X3.42-1975: Representation of Numeric Values in Character Strings
- ANSI X3.54-1986: Recorded Magnetic Tape (6250 BPI, GCR)
- ANSI X3.131-1986 (SCSI I): Small Computer System Interface
- ANSI/IEEE 802.2-1985: Logical Link Control
- ANSI/IEEE 802.3-1985: Carrier Sense Multiple Access with Collision Detection

- FIPS 1-2: Code for Information Interchange, its Representations, Subsets, and Extensions

  Note: FIPS 1-2 includes ANSI X3.4-1977(86)/FIPS 15; ANSI X3.32-1973/FIPS 36; ANSI X3.41-1974 /FIPS 35; and FIPS 7.

- FIPS 3-1/ANSI X3.22-1973: Recorded Magnetic Tape Information Interchange (800 CPI, NRZI)
- FIPS 16-1/ANSI X3.15-1976: Bit Sequencing of the Code for Information Interchange in Serial-by-bit Data Transmission

  Note: FED STD 1010 adopts FIPS 16-1.

- FIPS 25/ANSI X3.39-1986: Recorded Magnetic Tape for Information Interchange (1600 CPI, Phase Encoded)
- FIPS 37/ANSI X3.36-1975: High Speed Data Signaling Rates Between Data Terminal Equipment and Data Communication Equipment

  Note: FED STD 1001 adopts FIPS 37.

- FIPS 50/ANSI X3.54-1986: Recorded Magnetic Tape for Information Interchange, 6250 CPI (246 CPMM), Group Coded Recording
- FIPS 79/ANSI X3.27-1987: Magnetic Tape Labels and File Structure for Information Interchange
- FIPS 86/ANSI X3.64-1979: Additional Controls for Use with American National Standard Code for Information Interchange

  Note: Other FIPS not applicable.

  Note: Information regarding interchangeability of ANSI and FED standards with FIPS is contained in "ADP Telecommunications Standards Index," July 1988, published and maintained by the General Services Administration.

- ISO 646: ISO 7-bit Coded Character Set for Information Exchange
- ISO 1001: File Structure and Labeling of Magnetic Tapes for Information Interchange
- ISO 1863: Information Processing — 9-track, 12, 7 mm (0.5 in) wide magnetic tape for information interchange recorded at 32 rpmm (800 rpi)
- ISO 1864: Information Processing — Unrecorded 12, 7 mm (0.5 in) wide magnetic tape for information interchange — 35 ftpmm (800 ftpi) NRZI, 126 ftpmm (3,200 ftpi) phase encoded, and 356 ftmm (9,042 ftpi) NRZI
- ISO 2022: Code Extension Techniques for Use with ISO 646
- ISO 3307: Representations of Time of the Day
- ISO 3788: Information Processing — 9-track, 12, 7 mm (0.5 in) wide magnetic tape for information interchange recorded at 63 rpmm (1 600 rpt) phase encoded
- ISO 4873: 8-bit Code for Information Interchange — Structure and Rules for Implementation
- ISO 5652: Recorded Magtape (6250)
- ISO 6429: Control Functions for Coded Character Sets
- ISO 9660: Information processing — Volume and file structure of CD-ROM for information interchange.
- ISO 9945-1: POSIX IEEE 1003.1-1990.

INSTALLATION

OpenVMS AXP is distributed as a binary kit on CD-ROM. Procedures for setting up the system disk from media and for preparing the system for day-to-day operations are provided. The procedures are described in the *OpenVMS Alpha Upgrade and Installation Manual* and cover letter.

Test Package and Diagnostics

OpenVMS AXP includes a user environment test package (UETP) which verifies that the OpenVMS AXP operating system is properly installed and ready for use on the customer's systems.

Diagnostics can be run on individual devices during normal system operation. Certain critical components can operate in degraded mode.

OpenVMS AXP DISK SPACE REQUIREMENTS

OpenVMS AXP Operating System

The disk space requirement for OpenVMS AXP files after installation is approximately 180 MB. This figure does not include space for the page, swap, and dump files. Running the AUTOGEN procedure on a 32-MB-memory system creates the page file, swap file, and dump file. An additional 67 MB of disk space is needed as AUTOGEN creates files of the following size:

Page File	Swap File	Dump File
37 MB (required)	6 MB (suggested)	24 MB (optional)

Most systems will require larger page and swap files depending upon the system workload.

This figure also includes Help library files in data-compressed format. Most system managers choose to expand these files for faster access. The expansion requires approximately an additional 8 MB.

To support full OpenVMS AXP, a system disk of at least 225 MB is required. This includes:

Page File	Swap File	Dump File
37 MB	6 MB	No Dump File

A system disk of at least 400 MB is recommended to handle temporary disk space usage during an operating system upgrade to its next release. This includes:

Page File	Swap File	Dump File
37 MB	6 MB	24 MB

Refer to the *OpenVMS Alpha Upgrade and Installation Manual* for information on system disk requirements.

OpenVMS AXP Operating System and DECwindows Motif for OpenVMS AXP

To support full OpenVMS AXP and full DECwindows Motif for OpenVMS AXP, a system disk of at least 280 MB is required. This includes:

Page File	Swap File	Dump File
37 MB	6 MB	No Dump File

A system disk of at least 485 MB is recommended to handle temporary disk space usage during an operating system upgrade to its next release. This includes:

Page File	Swap File	Dump File
37 MB	6 MB	24 MB

Refer to the *OpenVMS Alpha Upgrade and Installation Manual* for information on system disk requirements.

Additional disk space will be required for layered product installation on the system disk. Due to space constraints, there is no guarantee that layered products can be installed if user files reside on the system disk. Refer to layered product installation guides for layered product disk space requirements.

Memory Requirements

The minimum amount of memory required for a system user to install, boot, and log in to an OpenVMS AXP system is 32 MB. To ensure satisfactory performance of some applications, additional memory may be required. Please refer to specific layered product Software Product Descriptions for their memory requirements.

Please refer to the OpenVMS AXP documentation for more information on performance.

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

CD-ROM

DOCUMENTATION

Digital offers OpenVMS AXP documentation in a variety of formats:

- Printed books (hardcopy)
- Online viewable books (using the DECwindows Motif for OpenVMS AXP Bookreader)
- Printable files

OpenVMS AXP customers automatically receive the entire OpenVMS AXP documentation offering in online viewable format on their OpenVMS AXP CD-ROM. Viewing online documentation requires that DECwindows Motif for OpenVMS AXP be installed on the system and that a valid DECwindows Motif for OpenVMS AXP license is registered and loaded. See the DECwindows Motif for OpenVMS AXP Software Product Description (SPD 42.19.xx) for ordering and licensing information.

In addition, OpenVMS AXP documentation is organized to offer a choice of three sets of hardcopy documentation: the Base Documentation Set, the Standard Documentation Set, and the Standard + Optional Documentation Set.

- Base Documentation Set—a desktop set for users of small standalone systems or users connected to large OpenVMS AXP systems. The Base Documentation Set contains information on the activities that you are most likely to perform as a user or a system manager of a small standalone system. It also includes system security information. It contains no programming information.
- Standard Documentation Set—a full documentation set for users who need extensive explanatory information on all major OpenVMS AXP resources, complete reference information on system routines and utilities, detailed examples, master indexes, a glossary, and information on the Help Message facility. The Standard Documentation Set meets the needs of system managers and of system and application programmers. It includes the Base Documentation Set as well as four other kits:
  - — Master Reference
  - — Advanced System Management

— Networking

— Programming

- Standard + Optional Documentation Set—for customers who need all available OpenVMS documentation. This set includes the Standard Documentation Set and all optional documentation.

Most manuals contain information that is common to both OpenVMS VAX and OpenVMS AXP systems. Any functional differences between the two are clearly described in the text and marked with margin icons. In addition, a small number of books have been produced specifically for the OpenVMS AXP operating system or the OpenVMS VAX operating system. OpenVMS AXP hardcopy documentation customers receive OpenVMS common manuals and OpenVMS AXP-specific manuals.

An additional hardcopy documentation offering delivers all OpenVMS common manuals, OpenVMS VAX-specific manuals, and OpenVMS AXP-specific manuals. Users running OpenVMS on both VAX and Alpha AXP systems, can use one order number for all OpenVMS operating system documentation needs. A complete listing of all the documentation kits and their contents is in the *Overview of OpenVMS Documentation*.

Note: Each book in these sets is also separately orderable.

SOURCE LISTINGS

OpenVMS AXP Operating System Source Listings are available on compact disc. These discs contain all source listings files that make up the OpenVMS AXP operating system. Digital provides source listings for all key modules of the OpenVMS AXP operating system that are appropriate for end users or application developers. Certain source listings, however, are excluded from the compact disc.

The orderable compact disc kit includes the license required to view these files on a standalone system or a VMScluster system. If users want to make these files available to another system (possibly at a remote site), they will need to purchase another kit.

A source license agreement must be signed for all kits. Contact your local Digital representative for more information.

ORDERING INFORMATION

Licenses

QL-MT1A*-6*	OpenVMS AXP Operating System Base License
QL-MT1A9-6*	OpenVMS AXP Operating System Symmetric Multiprocessing (SMP) Base Extension License
QL-MT2A*-**	OpenVMS AXP Interactive User License

Media and Online Documentation

QA–MT1AA–H8	OpenVMS AXP software and online documentation compact disc
QA–MT3AA–H8	OpenVMS VAX/AXP software and online documentation compact discs

Digital Layered Product Media

QA–03XAA–H8	Digital CD-ROM Software Library for OpenVMS AXP

Hardcopy Documentation Sets

QA–MT1AB–GZ	OpenVMS AXP Base Documentation Set
QA–MT1AA–GZ	OpenVMS AXP Standard Documentation Set
QA–MT1AH–GZ	OpenVMS AXP Standard + Optional Documentation Set
QA–MT3AB–GZ	OpenVMS VAX/AXP Base Documentation Set
QA–MT3AA–GZ	OpenVMS VAX/AXP Standard Documentation Set
QA–MT3AH–GZ	OpenVMS VAX/AXP Standard + Optional Documentation Set

Source Listings Kits

QB–MT1AB–E8	OpenVMS AXP Listings CD-ROM Kit & License

Software Product Services

QT–MT1A*–**	Base System Software Support Service
QT–MT2A*–**	Interactive User Software Support Service

A variety of integrated and à la carte hardware and software product services are available. For additional information, please contact your local Digital office.

Media and Documentation Update Service

QT–MT1AA–E8	OpenVMS AXP software and online documentation compact disc
QT–MT3AA–E8	OpenVMS VAX/AXP software and online documentation compact discs

Digital Layered Product Media Service

QT–03XAA–C8	Digital CD-ROM Software Library for OpenVMS AXP

Hardcopy Documentation Only Update Service

QT–MT1AB–KZ	OpenVMS AXP Base Documentation Set
QT–MT1AA–KZ	OpenVMS AXP Standard Documentation Set
QT–MT1AH–KZ	OpenVMS AXP Standard + Optional Documentation Set
QT–MT3AB–KZ	OpenVMS VAX/AXP Base Documentation Set
QT–MT3AA–KZ	OpenVMS VAX/AXP Standard Documentation Set
QT–MT3AH–KZ	OpenVMS VAX/AXP Standard + Optional Documentation Set

Source Listings Service

QT–MT1AB–Q8	OpenVMS AXP Source Listings Service

* Denotes variant fields. For additional information on available licenses, services, and media, refer to the appropriate Digital price book.

SOFTWARE LICENSING

The OpenVMS AXP operating system software is furnished under the licensing provisions of Digital Equipment Corporation's Standard Terms and Conditions.

The OpenVMS AXP operating system license also includes the license for DECprint Supervisor for OpenVMS, Base. The DECprint Supervisor for OpenVMS has separate documentation, media kit, and service products. Refer to DECprint Supervisor for OpenVMS Software Product Description (SPD 44.15.xx) for more information.

The System Integrated Product DECnet for OpenVMS AXP is a separately licensed product. Refer to the DECnet for OpenVMS AXP Software Product Description (SPD 42.25.xx) for more information.

The System Integrated Product VMScluster Software is a separately licensed product. Refer to the VMScluster Software Product Description (SPD 42.18.xx) for more information.

DECwindows Motif for OpenVMS AXP is a separately licensed layered product. Refer to the DECwindows Motif for OpenVMS AXP Software Product Description (SPD 42.19.xx) for more information.

DECram for OpenVMS AXP is a separately licensed layered product. Refer to the DECram for OpenVMS AXP Software Product Description (SPD 34.26.xx) for more information.

DECmigrate for OpenVMS AXP Systems is a separately licensed layered product. Refer to the DECmigrate for OpenVMS AXP Systems Software Product Description (SPD 39.44.xx) for more information.

OpenVMS AXP License Information

There are three types of OpenVMS licenses available on Alpha AXP processors.

1. Operating System Base License (QL-MT1A*-6*)

This license grants the right to non-interactive use of the remote batch, print, application, and computing services of the OpenVMS AXP operating system on a single processor. This license authorizes one direct login for system management purposes only.

The Operating System Base License is a prerequisite for Interactive User Licenses and SMP Extension Licenses.

The Operating System Base License provides the right to use only the OpenVMS AXP features of the current version license.

2. Symmetric Multiprocessing (SMP) Base Extension License (QL-MT1A9-6*)

SMP Extensions extend the Operating System Base License to enable Symmetric Multiprocessing capability on those OpenVMS AXP systems supporting SMP. SMP Extensions are permanently tied to the Operating System Base License and may not be separated from the Operating System Base Licenses if an SMP board is removed from the system.

SMP Extensions grant the right to use the same version of the operating system software as permitted for the corresponding Operating System Base License at the time when the SMP Extension is installed.

3. Interactive User License (QL-MT2A*-**)

This license grants the right to interactive use of the OpenVMS AXP operating system, provided the appropriate Operating System Base License has been previously installed on the Alpha AXP system. These Interactive User licenses, which are concurrent use licenses, are available in any quantity desired or as an unlimited user license. A user is defined as an individual who is logged on to a processor and/or is interactively using the operating system software by means other than login.

When an Alpha AXP SMP System upgrade is performed, the SMP Extension to the OpenVMS AXP Operating System License permits the use of all existing Interactive User Licenses (including Unlimited Users) on the upgraded system.

This License grants the right to use the same version of the operating system software as permitted for the corresponding operating system when the Interactive User License is installed.

License Management Facility Support

The OpenVMS AXP operating system supports Digital's License Management Facility (LMF).

If an OpenVMS AXP license is not registered and activated using the License Management Facility, then only a single login is permitted for system management purposes through the system console (OPA0:).

OpenVMS AXP Interactive User Licenses define the number of concurrent users that are activity licenses as defined by the LMF. OpenVMS AXP defines activities, sometimes referred to as an OpenVMS AXP "user," as follows:

- Each remote terminal connection is considered an activity. This is true even if users set host to their local node (SET HOST 0).
- Each connection from a terminal server is considered an activity.
- A multiple-window session on a workstation is considered one activity, regardless of the number of windows.
- A batch job is not considered an activity.
- A remote network connection that is a connection other than a remote terminal connection, is not considered an activity.

For more information about Digital's licensing terms and policies, contact your

SOFTWARE PRODUCT SERVICES

A variety of service options are available from Digital. For more information, contact your local Digital office.

SOFTWARE WARRANTY

Warranty for this software product is provided by Digital with the purchase of a license for the product as defined in the Software Warranty Addendum of this SPD and the applicable Digital Standard Terms and Conditions.

SUPPORTED HARDWARE

The following tables list supported hardware for OpenVMS AXP, DECwindows Motif for OpenVMS AXP, DECnet for OpenVMS AXP, and VMSclusters. Combinations of hardware options are subject to limitations such as bandwidth, physical configuration constraints, and electrical load and power supply.

The content of this hardware configuration section is intended to specify the device limitations and provide a general guide. It does not describe all possible hardware configurations or circumstances. Any particular configuration should be discussed with Digital. Contact Digital for the most up-to-date information on possible hardware configurations.

Digital reserves the right to change the number and type of devices supported by OpenVMS AXP, DECwindows Motif for OpenVMS AXP, DECnet for OpenVMS AXP, and VMSclusters. The minimum hardware requirements for future versions and updates of OpenVMS AXP, DECwindows Motif for OpenVMS AXP, DECnet for OpenVMS AXP, and VMSclusters may be different from current hardware requirements. For configuration details about Alpha AXP systems, refer to the *Digital Systems and Options Catalog* and the *Networks and Communications Buyers Guide.*

A listing of Digital terminals, disks, tapes, controllers, communications options, and VMScluster options is in *Appendix A.* Some restrictions for specific devices are listed if applicable.

Refer to the individual SPDs for DECnet for OpenVMS AXP (SPD 42.25.xx) and VMScluster Software (SPD 42.18.xx) for detailed product information.

How to Read the Tables

The first column lists the Alpha AXP system, the media (CD-ROM) from which the OpenVMS AXP operating system can be loaded onto the system disk, and the type and maximum number of busses supported on the system.

The second column lists the disk controllers and drives that can be used on the system. A disk controller can be used with any disk drive listed next to it.

The third column lists the tape controllers and drives that can be used on the system. The tape controller can be used with any tape drive listed next to it.

The fourth column lists the communications options available for the systems. The listed Ethernet devices can also be used for network connections.

The fifth column lists other hardware that can be used and the maximum amount of memory allowed on the systems in each category.

System	Disks		Tapes		Options		Miscellaneous
	CTRL	DRIVE	CTRL	DRIVE		(LAN/CI)	
DEC 3000 Models 300, 300L (BUS) SCSI TURBOchannel	Integral SCSI	RRD42 RWZ01 RZ23L RZ24 RZ25 RZ26 RZ26B RZ55 RZ56 RX26 RZ58	Integral SCSI	TLZ04 TLZ06 TZ30 TZK10	Integral Ethernet		128 MB Max Mem PMAGB-BE PMTCE(1)

Note: Factory-loaded software on all configurations that include internal disks.
Supports Display PostScript.

System	Disks		Tapes		Options		Miscellaneous
	CTRL	DRIVE	CTRL	DRIVE		(LAN/CI)	
DEC 3000 Models 400, 400S, 500, 500S, 500X (BUS) SCSI TURBOchannel	Integral SCSI	RRD42 RWZ01 RZ23L RZ24 RZ25 RZ26 RZ26B RZ55 RZ56 RX26 RZ24L RZ58	Integral SCSI	TKZ09 TKZ60 TLZ04 TLZ06 TSZ05 TSZ07 TZK10 TZ30 TZ85 TZ857 TZ86 TZ867	Integral Ethernet	DEFZA (1) PMAD (1)	Model 400, 400S 128 MB Max Mem Model 500, 500S, 500X 256 MB Max Mem PMAGB-BE PMTCE (1)

Note: Factory-loaded software on all configurations that include internal disks.
Supports Display PostScript.

System	Disks		Tapes		Options		Miscellaneous
	CTRL	DRIVE	CTRL	DRIVE		(LAN/CI)	
DEC 4000 Model 600 Series (BUS) SCSI (5) DSSI (4)	Integral SCSI Integral DSSI	RRD42 RZ26 RZ73 RZ74 RF30 RF31 RF31T RF35 RF71 RF72 RF73	Integral SCSI Integral DSSI	TKZ09 TLZ06 TSZ07 TZ30 TZ85 TZ857 TZ86 TZ867 TF85 TF857	Integral Ethernet		512 MB Max Mem

Note: Factory loaded software on all configurations that include internal disks.

System	Disks		Tapes		Options	Miscellaneous
	CTRL	**DRIVE**	**CTRL**	**DRIVE**	**(LAN/CI)**	
DEC 7000	KDM70	ESE52	KDM70	TA78	CIXCD (2)	3.5 GB Max Mem
Model 600	HSC**	ESE56	HSC**	TA81	DEMFA	
Series	CIXCD	ESE58	CIXCD	TA90	DEMNA	
	(2)	RA72	(2)			
(BUSSES)		RA73				
SCSI		RA90	KZMSA	TKZ09		
XMI (4)		RA92		TKZ60		
				TLZ06		
	KZMSA	RRD42		TSZ07		
		RWZ01		TZ85		
		RZ26		TZ857		
		RZ73		TZ86		
		RZ74		TZ867		

Note: Maximum number of KDM70: 3 per XMI; 12 per system.
Maximum number of KZMSA: 4 per XMI; 6 per system.
Maximum number of DEMFA: 4 per XMI; 4 per system.
Maximum number of DEMNA: 4 per XMI; 6 per system.

System	Disks		Tapes		Options	Miscellaneous
	CTRL	**DRIVE**	**CTRL**	**DRIVE**	**(LAN/CI)**	
DEC 10000	KDM70	ESE52	KDM70	TA78	CIXCD (2)	3.5 GB Max Mem
Model 600	HSC**	ESE56	HSC**	TA81	DEMFA	
Series	CIXCD	ESE58	CIXCD	TA90	DEMNA	
	(2)	RA72	(2)			
(BUSSES)		RA73				
SCSI		RA90	KZMSA	TKZ09		
XMI (4)		RA92		TKZ60		
				TLZ06		
	KZMSA	RRD42		TSZ07		
		RWZ01		TZ85		
		RZ26		TZ857		
		RZ73		TZ86		
		RZ74		TZ867		

Note: Maximum number of KDM70: 3 per XMI; 12 per system.
Maximum number of KZMSA: 4 per XMI; 6 per system.
Maximum number of DEMFA: 2 per XMI; 2 per system.
Maximum number of DEMNA: 4 per XMI; 6 per system.

Appendix A

This appendix describes Digital terminals, disks, tapes, controllers, graphics, and network options. Some restrictions for specific devices are listed if applicable.

Terminals and Terminal Line Interfaces

The following table lists the terminals that are supported by OpenVMS AXP. To prevent input from overflowing a buffer, terminals use the ASCII control characters DC1 and DC3 for synchronization as defined by Digital's DEC STD 111, Revision A. VXT windowing terminals support standard ANSI applications and "X" windows using the LAT transport protocol.

VT200-series	VT300-series
VT400-series	VXT 2000-series

Disks

The first column lists the device name. The second column is a description of the device. The third column lists the bus the device is supported on. The fourth column lists the device's protocol. The fifth column lists the minimum required version of OpenVMS AXP that supports these devices.

RA72	**1 GB fixed disk drive**	**SDI**	**MSCP**	**1.0**
RA73	**2 GB fixed disk drive**	**SDI**	**MSCP**	**1.0**
RA90	**1.2 GB fixed disk drive**	**SDI**	**MSCP**	**1.0**
RA92	**1.5 GB fixed disk drive**	**SDI**	**MSCP**	**1.0**
ESE-52	**120 MB solid state disk**	**SDI**	**MSCP**	**1.0**
ESE-56	**600 MB solid state disk**	**SDI**	**MSCP**	**1.5**
ESE-58	**960 MB solid state disk**	**SDI**	**MSCP**	**1.5**
RF30	**150 MB fixed disk drive**	**DSSI**	**MSCP**	**1.5**
RF31	**381 MB fixed disk drive**	**DSSI**	**MSCP**	**1.5**
RF31T	**381 MB fixed disk drive**	**DSSI**	**MSCP**	**1.5**
RF35	**800 MB fixed disk drive**	**DSSI**	**MSCP**	**1.0**
RF71	**400 MB fixed disk drive**	**DSSI**	**MSCP**	**1.5**
RF72	**1 GB fixed disk drive**	**DSSI**	**MSCP**	**1.5**
RF73	**2 GB fixed disk drive**	**DSSI**	**MSCP**	**1.0**
RRD42	**600 MB read-only optical disk drive**	**SCSI**	**SCSI**	**1.0**
RWZ01	**594 MB optical removable disk drive**	**SCSI**	**SCSI**	**1.0**
RX26	**2.8 MB diskette drive**	**SCSI**	**SCSI**	**1.0**
RZ24L	**245 MB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ25	**425 MB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ26	**1.05 GB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ26B	**1.05 GB fixed disk drive**	**SCSI**	**SCSI**	**1.5**
RZ55	**332 MB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ56	**665 MB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ58	**1.35 GB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ73	**2 GB fixed disk drive**	**SCSI**	**SCSI**	**1.0**
RZ74	**3.57 GB fixed disk drive**	**SCSI**	**SCSI**	**1.5**

Tapes

The first column lists the device name. The second column is a description of the device. The third column lists the device's protocol. The fourth column lists the bus the device is supported on. The fifth column lists the minimum required version of OpenVMS AXP that supports these devices.

TA78	**1600/6250 BPI, STI TU78**	**STI**	**TMSCP**	**1.0**
TA81	**145 MB tape drive**	**STI**	**TMSCP**	**1.0**
TA90	**1.2 GB tape cartridge subsystem. (5-inch 200 MB cartridge)**	**STI**	**TMSCP**	**1.0**
TKZ09	**5.0 GB, 8mm tape drive**	**SCSI**	**SCSI**	**1.5**
TKZ60	**200 MB, 3480 tape drive (no compression)**	**SCSI**	**SCSI**	**1.0**
TLZ04	**1.2 GB, 4mm, DAT tape drive**	**SCSI**	**SCSI**	**1.0**
TLZ06	**4 GB, 4mm, DAT tape drive**	**SCSI**	**SCSI**	**1.0**
TSZ05	**1600 BPI tape drive**	**SCSI**	**SCSI**	**1.5**
TSZ07	**1600/6250 BPI tape drive**	**SCSI**	**SCSI**	**1.0**
TZ30	**95 MB, 5-1/4-inch, half-height, tape drive**	**SCSI**	**SCSI**	**1.0**
TZ85	**2.6 GB tape drive**	**SCSI**	**SCSI**	**1.0**
TZ857	**18 GB tape loader**	**SCSI**	**SCSI**	**1.0**
TZ86	**6.0 GB tape drive**	**SCSI**	**SCSI**	**1.5**
TZ867	**42 GB tape loader**	**SCSI**	**SCSI**	**1.5**
TZK10	**320/525 MB, QIC (Quarter Inch Cartridge), tape drive**	**SCSI**	**SCSI**	**1.0**

Controllers

HSC40	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)
HSC50	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 4.1)
HSC60	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)
HSC65	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)

HSC70	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)
HSC90	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)
HSC95	Hierarchical Storage Controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1)
KDM70	An intelligent MSCP/TMSCP mass-storage controller for XMI systems with eight ports that support RA Series Disks and Storage Arrays, TA Series Tape, and Solid State Disks.
KZMSA	An intelligent mass-storage controller for XMI systems with two SCSI ports that support RZ Series Disks and Storage Arrays and TZ Series Tape.

Graphics Options

PMAGB	A multi-screen graphics adapter for TURBOchannel systems to connect multiple 8-plane color or grayscale monitors.

LAN Options

DEFZA	A high-performance network adapter that connects TURBOchannel systems to ANSI FDDI local area networks. (DMA receive only)
DEMFA	A high-performance network adapter that connects XMI systems to ANSI FDDI local area networks.
DEMNA	A high-performance network adapter that connects XMI systems to both the Ethernet and IEEE 802.3 local area networks.
PMAD	A network adapter that connects TURBOchannel systems to both the Ethernet and IEEE 802.3 local area networks.

CI Options

CIXCD-AC	Native CI adapter for DEC 7000 and 10000 AXP XMI systems. (minimum microcode version REV 1.0 is required)

Miscellaneous

InfoServer	An integrated hardware/software system which sits directly on the Ethernet to provide CD-ROM, hard disk, magneto optical, and tape access to OpenVMS clients in a local area network. It supports up to 14 SCSI devices and can be used for software distribution and initial system load (ISL). For more information refer to the InfoServer Software Product Description (SPD 33.20.xx.)

Acronyms

DSSI	Digital Storage Systems Interconnect
FDDI	Fiber Distributed Data Interconnect
IEEE	Institute for Electrical and Electronic Engineers
MSCP	Mass Storage Control Protocol
SCSI	Small Computer System Interconnect
SDI	Standard Drive Interface
STI	Standard Tape Interface
TMSCP	Tape Mass Storage Control Protocol
XMI	Extended Memory Interconnect

Appendix B

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Times	Italic	Linotype-Hell AG and /or its subsidiaries
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Helvetica		Linotype-Hell AG and /or its subsidiaries
Helvetica	Bold	Linotype-Hell AG and /or its subsidiaries
Helvetica	Oblique	Linotype-Hell AG and /or its subsidiaries
Helvetica	Bold Oblique	Linotype-Hell AG and /or its subsidiaries
Symbol		Public Domain
Courier		Public Domain
Courier	Bold	Public Domain
Courier	Oblique	Public Domain
Courier	Bold Oblique	Public Domain
ITC Souvenir	Light	International Typeface Corporation
ITC Souvenir	Light Italic	International Typeface Corporation
ITC Souvenir	Demi	International Typeface Corporation
ITC Souvenir	Demi Italic	International Typeface Corporation
ITC Avant Garde Gothic	Book	International Typeface Corporation
ITC Avant Garde Gothic	Book Oblique	International Typeface Corporation
ITC Avant Garde Gothic	Demi	International Typeface Corporation
ITC Avant Garde Gothic	Demi Oblique	International Typeface Corporation

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ITC Lubalin Graph	Book Oblique	International Typeface Corporation
ITC Lubalin Graph	Demi	International Typeface Corporation
ITC Lubalin Graph	Demi Oblique	International Typeface Corporation
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