

# digital

## Software Product Description

PRODUCT NAME: VAX-11 PL/I, Version 1.0

SPD 25.30.1

### DESCRIPTION:

VAX-11 PL/I is an extended implementation of the proposed ANSI X3.74, American National Standard PL/I General Purpose Subset. VAX-11 PL/I extensions to the subset language are either selective, full language PL/I features or system-specific features. VAX-11 PL/I consists of a set of run-time support routines, a HELP facility, INCLUDE files for system services, and a shareable compiler. The compiler runs under the VAX/VMS Operating System and generates optimized, position-independent machine code.

Compiler generated code is in-line, with the exception of some built-in function calls and I/O operations. The VAX-11 Run-Time Library performs all out-of-line operations. VAX-11 hardware instructions directly implement many high-level language operations.

All VAX/VMS system services are available to programs written in PL/I via the CALL statement; furthermore, VAX-11 PL/I supports RMS, the VAX/VMS Record Management System. A set of ENVIRONMENT options provides access to a large subset of RMS features. All RMS file organizations are supported: sequential, relative, and indexed.

VAX-11 PL/I supports the VAX-11 interlanguage calling standard. Routines written in any other native mode language can call PL/I and vice versa. In addition, all VAX/VMS system services and system utilities (run-time library, SORT, etc.) are available via the PL/I CALL statement. A library of predefined ENTRY declarations minimizes the coding required to utilize VAX/VMS system services.

VAX-11 PL/I is a comprehensive and powerful language that supports scientific computation, commercial data handling and data organization, and extensive string manipulation capabilities. Block-structuring provides for easier to understand programs, which are in turn less error prone.

### Features

- A full complement of VAX-11 datatypes: binary integer (FIXED BINARY), floating point (FLOAT BINARY, FLOAT DECIMAL), decimal (FIXED DECIMAL), character strings — fixed or varying length (CHARACTER [VARYING]), fixed length bit strings (BIT), edited numeric data in character format (PICTURE), address manipulation (AREA, OFFSET and POINTER), entry point (ENTRY) and label, which can be subscripted (LABEL).
- An assignment operator (=) that operates on equivalent arrays of data as well as scalar variables. A scalar can be assigned to an entire array.
- Three storage classes
  - AUTOMATIC: variables are allocated upon block entry
  - STATIC: variables are allocated at compile time. Static data can be EXTERNAL, or globally shared. The special attribute, GLOBALDEF, provides program section (PSECT) control of data
  - BASED: variable allocation is dynamically controlled by the programmer
  - INITIAL values can be specified for AUTOMATIC and STATIC variables
- Storage control
  - ALLOCATE statement with SET option for explicit dynamic storage allocation
  - FREE space previously ALLOCATED
  - POINTER AND OFFSET datatypes for address manipulation of scalar and aggregate data
  - AREA as an address base for variables of OFFSET type (user controlled allocation only)
- A powerful set of structured program control statements
  - DO statement with TO, BY, WHILE, and REPEAT options

October 1980

AE-J971B-TE

IF...THEN...ELSE conditional statement  
CALL statement and function reference  
(RETURN)

GOTO statement for transfer of control

- Condition handling

ON statement to establish ON-units (for ENDFILE, ENDPAGE, KEY, UNDEFINEDFILE, FIXEDOVERFLOW, OVERFLOW, ZERODIVIDE, ERROR, FINISH, ANYCONDITION and VAXCONDITION conditions)

REVERT statement to cancel ON-units

RESIGNAL statement that allows conditions to be passed to other ON-units

- Input/Output control

OPEN and CLOSE file control statements

READ, WRITE, DELETE and REWRITE record-oriented I/O statements

GET and PUT stream-oriented I/O statements (with FILE, STRING, EDIT, LIST, PAGE and SKIP options)

ENVIRONMENT and OPTIONS clauses provide access to RMS features

- Program structuring statements

PROCEDURE blocks: Internal (nested) and EXTERNAL

BEGIN...END blocks, allowing local variable declaration

DO groups that provide compound statement capabilities

ENTRY statement that allows a routine to have multiple entry points

- Built-in functions

A full set of arithmetic functions: ABS, CEIL, DIVIDE, FLOOR, MAX, MIN, MOD, ROUND, SIGN, TRUNC

A full set of mathematical (transcendental) functions: ACOS, ASIN, ATAN, ATAND, ATANH, COS, COSD, COSH, EXP, LOG, LOG10, LOG2, SIN, SIND, SINH, SQRT, TAN, TAND, TANH

String functions: BOOL, COLLATE, COPY, INDEX, LENGTH, STRING, SUBSTR, TRANSLATE, VERIFY

Conversion functions: BINARY, BIT, CHARACTER, DECIMAL, FIXED, FLOAT, UNSPEC, RANK, BYTE

Condition-handling functions: ONARGLIST, ONCODE, ONFILE, ONKEY

Array-handling functions: DIMENSION, HBOUND, LBOUND

Storage functions: ADDR, NULL, OFFSET, POINTER

Timekeeping functions: DATE, TIME

File control functions: LINENO, PAGENO

Pseudovariables (functions allowed on left-hand side of an assignment): PAGENO, STRING, SUBSTR, UNSPEC

- Additionally, built-in subroutines are provided for File-handling: DISPLAY, EXTEND, FLUSH, NXTVOL, REWIND, SPACEBLOCK  
Condition-handling: RESIGNAL

- Preprocessor statements

%REPLACE statement for compile-time replacement of arithmetic, bit-, or character-string constants

%INCLUDE statement for compile-time source copying, with full library support for INCLUDE modules and default user-specified and system libraries

### Compiler Options

Compile time command qualifiers provide a variety of options

- /[NO]CHECK: Produce extra code to check array and string references
- /[NO]CROSSREFERENCE: Produce a symbol cross-reference
- /[NO]DEBUG: Causes DEBUG information to be included with the object code
- /[NO]GFLOAT: Specifies the default floating point representation
- /[NO]LIST: Controls the production of a listing file
- /ENABLE: Selects specific listing options if /LIST specified
- /[NO]MACHINECODE: Causes machine code to be listed with the source
- /[NO]OBJECT: Controls the production of an object file
- /[NO]OPTIMIZE: Controls optimizations performed by the compiler
- /[NO]WARNINGS: Controls the printing of compiler warning messages
- /LIBRARY: Indicates the associated file is a library of source text modules specified by %INCLUDE statements

### Optimizations

VAX-11 PL/I generates efficient object code. Optimizations include

- Subexpression elimination
- Allocation of local variables to registers
- Removal of invariant computations from loops
- Simplification of Boolean expressions
- Extensive special case code generation
- Pattern replacement in generated code

### Industry PL/I Compatibility

VAX-11 PL/I provides many of those PL/I features often used by mainframe PL/I programmers. Conversion effort depends upon the individual program and the set of PL/I features used by the programmer. Well-structured programs that do not rely on system-specific or implementation-specific features convert

with a minimum of effort (from no changes to a few percent of the lines in the program). Programs that use implementation-specific features such as ENVIRONMENT and OPTIONS can require a larger conversion effort.

DIGITAL does not provide any special programs or other conversion aids. The user is responsible for determining the extent of any conversion effort and for providing appropriate conversion tools to convert programs and data.

Unusual conversion requirements may be necessary if programs use the machine dependent representation of data. The VAX architecture organizes bytes within an integer differently than most other vendors' hardware. This can lead to different results when UNSPEC or DEFINED operations are used to convert between BIT and FIXED BINARY data.

#### **MINIMUM HARDWARE REQUIRED:**

Any valid VAX/VMS Operating System running on any VAX-11/780 or VAX-11/750 configuration that includes at least

- 512 kilobytes of physical memory
- Two megabytes of virtual page file quota
- 250 page minimum working set
- 1200 blocks of disk storage (compiler, run-time system, HELP files, and INCLUDE libraries)

#### **OPTIONAL HARDWARE:**

FP780 Floating Point Accelerator (for VAX-11/780 only)

#### **PREREQUISITE SOFTWARE:**

VAX/VMS Operating System, Version 2.1

#### **OPTIONAL SOFTWARE:**

None

#### **TRAINING CREDITS:**

None

#### **SUPPORT CATEGORY:**

DIGITAL SUPPORTED

VAX-11 PL/I is a DIGITAL Supported Software Product.

#### **SOFTWARE INSTALLATION:**

##### **CUSTOMER INSTALLED**

VAX-11 PL/I is a software product engineered to be installed by the customer and includes other Software Product Support services listed below.

##### **SOFTWARE PRODUCT SUPPORT:**

VAX-11 PL/I includes standard warranty services as defined in the Software Support Categories Addendum of this SPD.

##### **ORDERING INFORMATION:**

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

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

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

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

The following key (G, Y, Z) represents the distribution media for the product and must be specified at the end of the order number, e.g., QD114-AG = binaries on TU58 DECtape II Cartridge.

G = TU58 DECtape II Cartridge

Y = RX01 Floppy Diskette

Z = No hardware dependency

Refer to Table I for available options.

##### **ADDITIONAL SERVICES:**

Post-warranty Software Product Services for this software product are available with the prerequisite being the purchase of the VAX/VMS Software Product Service. Customers should contact their local DIGITAL office for additional information.

TABLE I		
OPTIONS AND ADDITIONAL SERVICES	SYSTEM	
All options (except for license-only kits) include binaries on indicated media and documentation.	VAX-11/750 System	VAX-11/780 System
<b>Options</b> including single-use license, binaries, documentation, support services.	QD114-AG	QE114-AY
<b>Single-Use License Only</b> , no binaries, no documentation, no support services.	QD114-DZ	QE114-DZ
<b>Update Options</b> — Users of VAX-11 PL/I whose specified Support Category warranty has expired may order under license the following software update at the prevailing rate for such update. The update is distributed in binary form on the appropriate medium and includes no installation or other services unless specifically stated.	QD114-HZ	QE114-HZ
<b>Miscellaneous Options</b> Documentation-only kits	QD114-GZ	QE114-GZ