VMS Software

VSI OpenVMS

VSI OpenVMS RTL General Purpose (OTS$) Manual

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VSI OpenVMS RTL General Purpose (OTS$) Manual

VMS Software

Preface

1. About VSI

VMS Software, Inc. (VSI) is an independent software company licensed by Hewlett Packard Enterprise to develop and support the OpenVMS operating system.

2. Intended Audience

This manual is intended for system and application programmers who write programs that call OTS$ Run-Time Library routines.

3. Document Structure

This manual is organized into two parts as follows:

- Chapter 1 contains a brief overview of the OTS$ routines.
- Chapter 2 provides detailed reference information on each routine contained in the OTS$ facility of the Run-Time Library. This information is presented using the documentation format described in *VSI OpenVMS Programming Concepts Manual*. Routine descriptions appear in alphabetical order by routine name.

4. Related Documents

The Run-Time Library routines are documented in a series of reference manuals. A description of how the Run-Time Library routines are accessed and of OpenVMS features and functionality available through calls to the OTS$ Run-Time Library appears in the *VSI OpenVMS Programming Concepts Manual*. Descriptions of other RTL facilities and their corresponding routines and usages are discussed in the following books:

- *Compaq Portable Mathematics Library*
- *VSI OpenVMS RTL Library (LIB$) Manual*
- *VSI OpenVMS RTL Screen Management (SMG$) Manual*
- *VSI OpenVMS RTL String Manipulation (STR$) Manual*

The *Guide to POSIX Threads Library* contains guidelines and reference information for POSIX Threads, the Multithreading Run-Time Library.

Application programmers using any programming language can refer to the *Guide to Creating OpenVMS Modular Procedures* for writing modular and reentrant code.

High-level language programmers will find additional information on calling Run-Time Library routines in their language reference manual. Additional information may also be found in the language user's guide provided with your OpenVMS language software.

For additional information about OpenVMS products and services, access the VSI website at the following location:

5. VSI Encourages Your Comments

You may send comments or suggestions regarding this manual or any VSI document by sending electronic mail to the following Internet address: <docinfo@vmssoftware.com>. Users who have VSI OpenVMS support contracts through VSI can contact <support@vmssoftware.com> for help with this product.

6. OpenVMS Documentation

The full VSI OpenVMS documentation set can be found on the VMS Software Documentation webpage at https://docs.vmssoftware.com.

7. Typographical Conventions

The following conventions are used in this manual:

Convention	**Meaning**
Ctrl/*x*	A sequence such as Ctrl/*x* indicates that you must hold down the key labeled Ctrl while you press another key or a pointing device button.
PF1 *x*	A sequence such as PF1 *x* indicates that you must first press and release the key labeled PF1 and then press and release another key (*x*) or a pointing device button.
. . .	A horizontal ellipsis in examples indicates one of the following possibilities: • Additional optional arguments in a statement have been omitted. • The preceding item or items can be repeated one or more times. • Additional parameters, values, or other information can be entered.
. . .	A vertical ellipsis indicates the omission of items from a code example or command format; the items are omitted because they are not important to the topic being discussed.
( )	In command format descriptions, parentheses indicate that you must enclose choices in parentheses if you specify more than one.
[ ]	In command format descriptions, brackets indicate optional choices. You can choose one or more items or no items. Do not type the brackets on the command line. However, you must include the brackets in the syntax for directory specifications and for a substring specification in an assignment statement.
|	In command format descriptions, vertical bars separate choices within brackets or braces. Within brackets, the choices are optional; within braces, at least one choice is required. Do not type the vertical bars on the command line.
{ }	In command format descriptions, braces indicate required choices; you must choose at least one of the items listed. Do not type the braces on the command line.
bold type	Bold type represents the name of an argument, an attribute, or a reason. Bold type also represents the introduction of a new term.

Convention	Meaning
italic type	Italic type indicates important information, complete titles of manuals, or variables. Variables include information that varies in system output (Internal error *number*), in command lines (/PRODUCER=*name*), and in command parameters in text (where *dd* represents the predefined code for the device type).
UPPERCASE TYPE	Uppercase type indicates a command, the name of a routine, the name of a file, or the abbreviation for a system privilege.
`Example`	This typeface indicates code examples, command examples, and interactive screen displays. In text, this type also identifies website addresses, UNIX commands and pathnames, PC-based commands and folders, and certain elements of the C programming language.
`-`	A hyphen at the end of a command format description, command line, or code line indicates that the command or statement continues on the following line.
numbers	All numbers in text are assumed to be decimal unless otherwise noted. Nondecimal radixes—binary, octal, or hexadecimal—are explicitly indicated.

Chapter 1. Run-Time Library General Purpose (OTS$) Facility

This chapter describes the OpenVMS Run-Time Library General Purpose (OTS$) Facility. See the Chapter 2 for a detailed description of each routine within the OTS$ facility.

Most of the OTS$ routines were originally designed to support language compilers. Because they perform general-purpose functions, the routines were moved into the language-independent facility, OTS$.

1.1. 1.1 Overview

The Run-Time Library General Purpose (OTS$) Facility provides routines to perform general-purpose functions. These functions include data type conversions as part of a compiler's generated code, and some mathematical functions.

The OTS$ facility contains routines to perform the following main tasks:

- Convert data types (see Table 1.1)
- Divide complex and packed decimal values (see Table 1.2)
- Move data to a specified destination address (see Table 1.3)
- Multiply complex values (see Table 1.4)
- Raise a base to an exponent (see Table 1.5)
- Copy a source string to a destination string (see Table 1.6)
- Return a string area to free storage (see Table 1.7)
- Use convenience routines related to the OpenVMS Calling Standard (see Table 1.8)

Some restrictions apply if you link certain OTS$ routines on an Alpha system or I64 system. See Section 1.2 for more information about these restrictions.

Table 1.1. OTS$ Conversion Routines

Routine Name	Function
OTS$CNVOUT	Convert a D-floating, G-floating, H-floating, IEEE S-floating or IEEE T-floating value to a character string.
OTS$CVT_L_TB	Convert an unsigned integer to binary text.
OTS$CVT_L_TI	Convert a signed integer to signed integer text.
OTS$CVT_L_TL	Convert an integer to logical text.
OTS$CVT_L_TO	Convert an unsigned integer to octal text.
OTS$CVT_L_TU	Convert an unsigned integer to decimal text.
OTS$CVT_L_TZ	Convert an integer to hexadecimal text.
OTS$CVT_TB_L	Convert binary text to an unsigned integer value.
OTS$CVT_TI_L	Convert signed integer text to an integer value.

Routine Name	Function
OTS$CVT_TL_L	Convert logical text to an integer value.
OTS$CVT_TO_L	Convert octal text to an unsigned integer value.
OTS$CVT_TU_L	Convert unsigned decimal text to an integer value.
OTS$CVT_T_*x*	Convert numeric text to a D-, F-, G-, H-, IEEE S-, or IEEE T-floating value.
OTS$CVT_TZ_L	Convert hexadecimal text to an unsigned integer value.

For more information on Run-Time Library conversion routines, see the CVT$ reference section in the *VSI OpenVMS RTL Library (LIB$) Manual*.

Table 1.2. OTS$ Division Routines

Routine Name	Function
OTS$DIVC*x*	Perform complex division.
OTS$DIV_PK_LONG	Perform packed decimal division with a long divisor.
OTS$DIV_PK_SHORT	Perform packed decimal division with a short divisor.

Table 1.3. OTS$ Move Data Routines

Routine Name	Function
OTS$MOVE3	Move data without fill.
OTS$MOVE5	Move data with fill.

Table 1.4. OTS$ Multiplication Routine

Routine Name	Function
OTS$MULC*x*	Perform complex multiplication.

Table 1.5. OTS$ Exponentiation Routines

Routine Name	Function
OTS$POWC*x*C*x*	Raise a complex base to a complex floating-point exponent.
OTS$POWC*x*J	Raise a complex base to a signed longword exponent.
OTS$POWDD	Raise a D-floating base to a D-floating exponent.
OTS$POWDR	Raise a D-floating base to an F-floating exponent.
OTS$POWDJ	Raise a D-floating base to a longword integer exponent.
OTS$POWGG	Raise a G-floating base to a G-floating or longword integer exponent.
OTS$POWGJ	Raise a G-floating base to a longword integer exponent.
OTS$POWHH_R3[1]	Raise an H-floating base to an H-floating exponent.
OTS$POWHJ_R3[1]	Raise an H-floating base to a longword integer exponent.
OTS$POWII	Raise a word integer base to a word integer exponent.
OTS$POWJJ	Raise a longword integer base to a longword integer exponent.
OTS$POWLULU	Raise an unsigned longword integer base to an unsigned longword integer exponent.
OTS$POW*x*LU	Raise a floating-point base to an unsigned longword integer exponent.

Routine Name	Function
OTS$POWRD	Raise an F-floating base to a D-floating exponent.
OTS$POWRJ	Raise an F-floating base to a longword integer exponent.
OTS$POWRR	Raise an F-floating base to an F-floating exponent.
OTS$POWSJ	Raise an IEEE S-floating base to a longword integer exponent.
OTS$POWSS	Raise an IEEE S-floating base to an S-floating or longword integer exponent.
OTS$POWTJ	Raise an IEEE T-floating base to a longword integer exponent.
OTS$POWTT	Raise an IEEE T-floating base to a T-floating or longword integer exponent.

[1]VAX specific

Table 1.6. OTS$ Copy Source String Routines

Routine Name	Function
OTS$SCOPY_DXDX	Copy a source string passed by descriptor to a destination string.
OTS$SCOPY_R_DX	Copy a source string passed by reference to a destination string.

Table 1.7. OTS$ Return String Area Routines

Routine Name	Function
OTS$SFREE1_DD	Free one dynamic string.
OTS$SFREEN_DD	Free *n* dynamic strings.
OTS$SGET1_DD	Get one dynamic string.

Table 1.8. OTS$ Convenience Routines

Routine Name	Function
OTS$CALL_PROC	Perform a call to a procedure that may be either in native code or in a translated image.
OTS$JUMP_TO_BPV	Transfer control to a bound procedure.

1.2. Linking OTS$ Routines on Alpha and I64 Systems

On Alpha and I64 systems, if you use the OTS$ entry points for certain mathematics routines, you must link against the DPML$SHR.EXE library. Alternately, you can use the equivalent math$ entry point for the routine and link against either STARLET.OLB or the DPML$SHR.EXE library. Math$ entry points are available only on Alpha and I64 systems.

Table 1.9 lists the affected OTS$ entry points with their equivalent math$ entry points. Refer to the *Compaq Portable Mathematics Library* for information about the math$ entry points.

Table 1.9. OTS$ and Equivalent Math$ Entry Points

OTS$ Entry Point	Math$ Entry Point
OTS$DIVC	math$cdiv_f
OTS$DIVCG_R3	math$cdiv_g

OTS$ Entry Point	Math$ Entry Point
OTS$DIVCS	math$cdiv_s
OTS$DIVCT_R3	math$cdiv_t
OTS$MULCS	math$cmul_s
OTS$MULCT_R3	math$cmul_t
OTS$MULCG_R3	math$cmul_g
OTS$POWCC	math$cpow_f
OTS$POWCGCG_R3	math$cpow_g
OTS$POWCJ	math$cpow_fq
OTS$POWCSCS	math$cpow_s
OTS$POWCSJ	math$cpow_sq
OTS$POWCTCT_R3	math$cpow_t
OTS$POWCTJ_R3	math$cpow_tq
OTS$POWGG	math$pow_gg
OTS$POWGJ	math$pow_gq
OTS$POWGLU	math$pow_gq
OTS$POWII	math$pow_qq
OTS$POWJJ	math$pow_qq
OTS$POWLULU	math$pow_qq
OTS$POWRJ	math$pow_fq
OTS$POWRLU	math$pow_fq
OTS$POWRR	math$pow_ff
OTS$POWSS	math$pow_ss
OTS$POWSJ	math$pow_sq
OTS$POWSLU	math$pow_sq
OTS$POWTJ	math$pow_tq
OTS$POWTLU	math$pow_tq
OTS$POWTT	math$pow_tt

1.2.1. 64-Bit Addressing Support (Alpha and I64 Only)

On Alpha and I64 systems, the General Purpose (OTS$) routines provide 64-bit virtual addressing capabilities as follows:

- All OTS$ RTL routines accept 64-bit addresses for arguments passed by reference.
- All OTS$ RTL routines also accept either 32-bit or 64-bit descriptors for arguments passed by descriptor.

Note

The OTS$ routines declared in ots$routines.h do not include prototypes for 64-bit data. You must provide your own generic prototypes for any OTS$ functions you use.

See the *VSI OpenVMS Programming Concepts Manual* for more information about 64-bit virtual addressing capabilities.

Chapter 2. General-Purpose (OTS$) Routines

This chapter provides detailed descriptions of the routines provided by the OpenVMS RTL General Purpose (OTS$) Facility.

OTS$CALL_PROC (Alpha and I64 Only)

OTS$CALL_PROC (Alpha and I64 Only) — The Call Special Procedure routine performs a call to a procedure that may be either in native code or in a translated image.

Format

```
OTS$CALL_PROC target-func-value ,target-sig-info ,standard-args ,...
```

Returns

None.

Arguments

target-func-value

OpenVMS usage:	**function value**
type:	**quadword address**
access:	**read only**
mechanism:	**by value in register R23 (Alpha); by value in register R17 (I64)**

Function value for the procedure to be called.

target-sig-info

OpenVMS usage:	**TIE signature information**
type:	**TIE signature block**
access:	**read only**
mechanism:	**by reference in register R24 (Alpha); by value in register R17 (I64)**

Signature information is used to transform the standard arguments into the form required by a translated image (if needed). The representation of signature information is described in the OpenVMS Calling Standard.

standard-args

Zero or more arguments to be passed to the called routine, passed using standard conventions (including the AI register).

Description

When translated code support is requested, the compiled code must call the special service routine, OTS$CALL_PROC. The actual parameters to the target function are passed to OTS$CALL_PROC as though the target routine is native code that is being invoked directly.

OTS$CALL_PROC first determines whether the target routine is part of a translated image.

If the target is in native code, then OTS$CALL_PROC completes the call in a way that makes its mediation transparent (that is, control need not pass back through it for the return). The native parameters are used without modification.

If the target is in translated code, then OTS$CALL_PROC passes control to the Translated Image Environment (TIE). For additional information, see the *VSI OpenVMS Calling Standard*.

Condition Values Returned

None.

OTS$CNVOUT

OTS$CNVOUT — The Convert Floating to Character String routines convert a D-floating, G-floating, H-floating, IEEE S-floating, or IEEE T-floating number to a character string in the Fortran E format.

Format

```
OTS$CNVOUT
   D-G-H-S-or-T-float-pt-input-val ,fixed-length-resultant-string
   ,digits-in-fraction

OTS$CNVOUT_G
   D-G-H-S-or-T-float-pt-input-val ,fixed-length-resultant-string
   ,digits-in-fraction

OTS$CNVOUT_H
   D-G-H-S-or-T-float-pt-input-val ,fixed-length-resultant-string
   ,digits-in-fraction (VAX only)

OTS$CNVOUT_S
   D-G-H-S-or-T-float-pt-input-val ,fixed-length-resultant-string
   ,digits-in-fraction (VAX only)

OTS$CNVOUT_T
   D-G-H-S-or-T-float-pt-input-val ,fixed-length-resultant-string
   ,digits-in-fraction (VAX only)
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

D-G-H-S-or-T-float-pt-input-val

OpenVMS usage:	**floating_point**
type:	**D_floating, G_floating, H_floating, IEEE S_floating, IEEE T_floating**
access:	**read only**
mechanism:	**by reference**

Value that OTS$CNVOUT converts to a character string. For OTS$CNVOUT, the **D-G-H-S-or-T-float-pt-input-val** argument is the address of a D-floating number containing the value. For OTS$CNVOUT_G, the **D-G-H-S-or-T-float-pt-input-val** argument is the address of a G-floating number containing the value. For OTS$CNVOUT_S, the **D-G-H-S-or-T-float-pt-input-val** argument is the address of an IEEE S-floating number containing the value. For OTS$CNVOUT_T, the **D-G-H-S-or-T-float-pt-input-val** argument is the address of an IEEE T-floating number containing the value.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor, fixed length**

Output string into which OTS$CNVOUT writes the character string result of the conversion. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to the output string.

digits-in-fraction

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Number of digits in the fractional portion of the result. The **digits-in-fraction** argument is an unsigned longword containing the number of digits to be written to the fractional portion of the result.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
SS$_ROPRAND	Floating reserved operand detected.
OTS$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

OTS$CVT_L_TB

OTS$CVT_L_TB — The Convert an Unsigned Integer to Binary Text routine converts an unsigned integer value of arbitrary length to binary representation in an ASCII text string. By default, a longword is converted.

Format

```
OTS$CVT_L_TB
   varying-input-value,fixed-length-resultant-string [,number-of-digits]
   [,input-value-size]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

varying-input-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**read only**
mechanism:	**by reference**

Unsigned byte, word, or longword that OTS$CVT_L_TB converts to an unsigned decimal representation in an ASCII text string. (The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, or longword.) The **varying-input-value** argument is the address of the unsigned integer.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor, fixed length**

ASCII text string that OTS$CVT_L_TB creates when it converts the integer value. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to this ASCII text string. The string is assumed to be of fixed length (CLASS_S descriptor).

number-of-digits

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Minimum number of digits in the binary representation to be generated. The **number-of-digits** argument is a signed longword containing this minimum number. If the minimum number of digits is omitted, the default is 1. If the actual number of significant digits is less than the minimum number of digits, leading zeros are produced. If the minimum number of digits is zero and the value of the integer to be converted is also zero, OTS$CVT_L_TB creates a blank string.

input-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the integer to be converted, in bytes. The **input-value-size** argument is a signed longword containing the byte size. This is an optional argument. If the size is omitted, the default is 4 (longword).

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

OTS$CVT_L_TI

OTS$CVT_L_TI — The Convert Signed Integer to Decimal Text routine converts a signed integer to its decimal representation in an ASCII text string. This routine supports Fortran Iw and Iw.m output and BASIC output conversion.

Format

```
OTS$CVT_L_TI
   varying-input-value ,fixed-length-resultant-string [,number-of-digits]
   [,input-value-size] [,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

varying-input-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**read only**
mechanism:	**by reference, fixed length**

A signed integer that OTS$CVT_L_TI converts to a signed decimal representation in an ASCII text string. The **varying-input-value** argument is the address of the signed integer.

On VAX systems, the integer can be a signed byte, word, or longword. The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, or longword.

On Alpha and I64 systems, the integer can be a signed byte, word, longword, or quadword. The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, longword, or quadword.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor**

Decimal ASCII text string that OTS$CVT_L_TI creates when it converts the signed integer. The **fixed-length-resultant-string** argument is the address of a CLASS_S descriptor pointing to this text string. The string is assumed to be of fixed length.

number-of-digits

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Minimum number of digits to be generated when OTS$CVT_L_TI converts the signed integer to a decimal ASCII text string. The **number-of-digits** argument is a signed longword containing this number. If the minimum number of digits is omitted, the default value is 1. If the actual number of significant digits is smaller, OTS$CVT_L_TI inserts leading zeros into the output string. If **number-of-digits** is zero and **varying-input-value** is zero, OTS$CVT_L_TI writes a blank string to the output string.

input-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the integer to be converted, in bytes. The **input-value-size** argument is a signed longword containing this value size. If the size is omitted, the default is 4 (longword).

On VAX systems, the value size must be 1, 2, or 4. If value size is 1 or 2, the value is sign-extended to a longword before conversion.

On Alpha and I64 systems, the value size must be 1, 2, 4, or 8. If the value is 1, 2, or 4, the value is sign-extended to a quadword before conversion.

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Caller-supplied flags that you can use if you want OTS$CVT_L_TI to insert a plus sign before the converted number. The **flags-value** argument is an unsigned longword containing the flags.

The caller flags are described in the following table:

Bit	Action if Set	Action if Clear
0	Insert a plus sign (+) before the first nonblank character in the output string.	Omit the plus sign.

If **flags-value** is omitted, all bits are clear and the plus sign is not inserted.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. Either the result would have exceeded the fixed-length string or the **input-value-size** is not a valid value. The output string is filled with asterisks (*).

OTS$CVT_L_TL

OTS$CVT_L_TL — The Convert Integer to Logical Text routine converts an integer to an ASCII text string representation using Fortran L (logical) format.

Format

```
OTS$CVT_L_TL longword-integer-value ,fixed-length-resultant-string
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

longword-integer-value

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**

mechanism:	**by reference**

Value that OTS$CVT_L_TL converts to an ASCII text string. The **longword-integer-value** argument is the address of a signed longword containing this integer value.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor, fixed length**

Output string that OTS$CVT_L_TL creates when it converts the integer value to an ASCII text string. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to this ASCII text string.

The output string is assumed to be of fixed length (CLASS_S descriptor).

If bit 0 of **longword-integer-value** is set, OTS$CVT_L_TL stores the character T in the rightmost character of **fixed-length-resultant-string**. If bit 0 is clear, it stores the character F. In either case, it fills the remaining characters of **fixed-length-resultant-string** with blanks.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is of zero length (descriptor LENGTH field contains 0).

Example

```
5 !+
  ! This is an example program
  ! showing the use of OTS$CVT_L_TL.
  !-

  VALUE% = 10
  OUTSTR$ = ' '
  CALL OTS$CVT_L_TL(VALUE%, OUTSTR$)
  PRINT OUTSTR$
9 END
```

This BASIC example illustrates the use of OTS$CVT_L_TL. The output generated by this program is 'F'.

OTS$CVT_L_TO

OTS$CVT_L_TO — The Convert Unsigned Integer to Octal Text routine converts an unsigned integer to an octal ASCII text string. OTS$CVT_L_TO supports Fortran Ow and Ow.m output conversion formats.

Format

```
OTS$CVT_L_TO
   varying-input-value ,fixed-length-resultant-string [,number-of-digits]
   [,input-value-size]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

varying-input-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**read only**
mechanism:	**by reference**

Unsigned byte, word, or longword that OTS$CVT_L_TO converts to an unsigned decimal representation in an ASCII text string. (The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, or longword.) The **varying-input-value** argument is the address of the unsigned integer.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor, fixed length**

Output string that OTS$CVT_L_TO creates when it converts the integer value to an octal ASCII text string. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to the octal ASCII text string. The string is assumed to be of fixed length (CLASS_S descriptor).

number-of-digits

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Minimum number of digits that OTS$CVT_L_TO generates when it converts the integer value to an octal ASCII text string. The **number-of-digits** argument is a signed longword containing the minimum number of digits. If it is omitted, the default is 1. If the actual number of significant digits in the octal ASCII text string is less than the minimum number of digits, OTS$CVT_L_TO inserts leading zeros into the output string. If **number-of-digits** is 0 and **varying-input-value** is 0, OTS$CVT_L_TO writes a blank string to the output string.

input-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the integer to be converted, in bytes. The **input-value-size** argument is a signed longword containing the number of bytes in the integer to be converted by OTS$CVT_L_TO. If it is omitted, the default is 4 (longword).

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

OTS$CVT_L_TU

OTS$CVT_L_TU — The Convert Unsigned Integer to Decimal Text routine converts an unsigned integer value to its unsigned decimal representation in an ASCII text string.

Format

```
OTS$CVT_L_TU
   varying-input-value ,fixed-length-resultant-string [,number-of-digits]
   [,input-value-size]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

varying-input-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**read only**

mechanism:	**by reference**

An unsigned integer that OTS$CVT_L_TU converts to an unsigned decimal representation in an ASCII text string. The **varying-input-value** argument is the address of the unsigned integer.

On VAX systems, the integer can be an unsigned byte, word, or longword. (The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, or longword.)

On Alpha and I64 systems, the integer can be an unsigned byte, word, longword, or quadword. (The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, longword, or quadword.)

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor, fixed length**

Output string that OTS$CVT_L_TU creates when it converts the integer value to unsigned decimal representation in an ASCII text string. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to this ASCII text string.

number-of-digits

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Minimum number of digits in the ASCII text string that OTS$CVT_L_TU creates. The **number-of-digits** argument is a signed longword containing the minimum number. If the minimum number of digits is omitted, the default is 1.

If the actual number of significant digits in the output string created is less than the minimum number, OTS$CVT_L_TU inserts leading zeros into the output string. If the minimum number of digits is zero and the integer value to be converted is also zero, OTS$CVT_L_TU writes a blank string to the output string.

input-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the integer to be converted, in bytes. The **input-value-size** argument is a signed longword containing this value size. If the size is omitted, the default is 4 (longword).

On VAX systems, the value size must be 1, 2, or 4.

On Alpha and I64 systems, the value size must be 1, 2, 4, or 8.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. Either the result would have exceeded the fixed-length string or the **input-value-size** is not a valid value. The output string is filled with asterisks (*).

OTS$CVT_L_TZ

OTS$CVT_L_TZ — The Convert Integer to Hexadecimal Text routine converts an unsigned integer to a hexadecimal ASCII text string. OTS$CVT_L_TZ supports Fortran Zw and Zw.m output conversion formats.

Format

```
OTS$CVT_L_TZ
   varying-input-value ,fixed-length-resultant-string [,number-of-digits]
   [,input-value-size]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

varying-input-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**read only**
mechanism:	**by reference**

Unsigned byte, word, or longword that OTS$CVT_L_TZ converts to an unsigned decimal representation in an ASCII text string. (The value of the **input-value-size** argument determines whether **varying-input-value** is a byte, word, or longword.) The **varying-input-value** argument is the address of the unsigned integer.

fixed-length-resultant-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**

mechanism:	**by descriptor, fixed length**

Output string that OTS$CVT_L_TZ creates when it converts the integer value to a hexadecimal ASCII text string. The **fixed-length-resultant-string** argument is the address of a descriptor pointing to this ASCII text string. The string is assumed to be of fixed length (CLASS_S descriptor).

number-of-digits

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Minimum number of digits in the ASCII text string that OTS$CVT_L_TZ creates when it converts the integer. The **number-of-digits** argument is a signed longword containing this minimum number. If it is omitted, the default is 1. If the actual number of significant digits in the text string that OTS$CVT_L_TZ creates is less than this minimum number, OTS$CVT_L_TZ inserts leading zeros in the output string. If the minimum number of digits is zero and the integer value to be converted is also zero, OTS$CVT_L_TZ writes a blank string to the output string.

input-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the integer that OTS$CVT_L_TZ converts, in bytes. The **input-value-size** argument is a signed longword containing the value size. If the size is omitted, the default is 4 (longword).

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

Example

```
with TEXT_IO; use TEXT_IO;
procedure SHOW_CONVERT is

   type INPUT_INT is new INTEGER range 0..INTEGER'LAST;

   INTVALUE : INPUT_INT := 256;
   HEXSTRING : STRING(1..11);

   procedure CONVERT_TO_HEX (I : in INPUT_INT; HS : out STRING);
   pragma INTERFACE (RTL, CONVERT_TO_HEX);
   pragma IMPORT_routine (INTERNAL => CONVERT_TO_HEX,
                          EXTERNAL => "OTS$CVT_L_TZ",
                          MECHANISM =>(REFERENCE,
```

```
                                                DESCRIPTOR (CLASS => S)));

begin
   CONVERT_TO_HEX (INTVALUE, HEXSTRING);
   PUT_LINE("This is the value of HEXSTRING");
   PUT_LINE(HEXSTRING);
end;
```

This Ada example uses OTS$CVT_L_TZ to convert a longword integer to hexadecimal text.

OTS$CVT_T_x

OTS$CVT_T_x — The Convert Numeric Text to D-, F-, G-, H-, IEEE S-, or IEEE T-Floating routines convert an ASCII text string representation of a numeric value to a D-floating, F-floating, G-floating, H-floating, IEEE S-floating, or IEEE T-floating value.

Format

```
OTS$CVT_T_D
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]

OTS$CVT_T_F
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]

OTS$CVT_T_G
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]

OTS$CVT_T_H
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]

OTS$CVT_T_S
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]

OTS$CVT_T_T
   fixed-or-dynamic-input-string ,floating-point-value
   [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

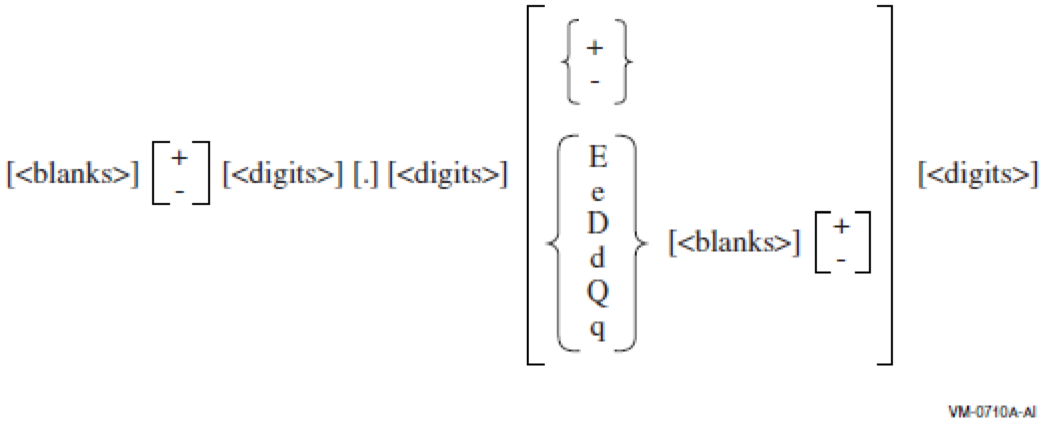
fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**

type:	**character string**
access:	**read only**
mechanism:	**by descriptor, fixed-length or dynamic string**

Input string containing an ASCII text string representation of a numeric value that OTS$CVT_T_*x*converts to a D-floating, F-floating, G-floating, H-floating, IEEE S-floating, or IEEE T-floating value. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string.

The syntax of a valid input string is as follows:



E, e, D, d, Q, and q are the possible exponent letters. They are semantically equivalent. Other elements in the preceding syntax are defined as follows:

Term	Description
blanks	One or more blanks
digits	One or more decimal digits

floating-point-value

OpenVMS usage:	**floating_point**
type:	**D_floating, F_floating, G_floating, H_floating, IEEE S_floating, IEEE T_floating**
access:	**write only**
mechanism:	**by reference**

Floating-point value that OTS$CVT_T_*x* creates when it converts the input string. The **floating-point-value** argument is the address of the floating-point value. The data type of **floating-point-value** depends on the called routine as shown in the following table:

Routine	Floating-Point-Value Data Type
OTS$CVT_T_D	D-floating
OTS$CVT_T_F	F-floating
OTS$CVT_T_G	G-floating
OTS$CVT_T_H	H-floating
OTS$CVT_T_S	IEEE S-floating

Routine	Floating-Point-Value Data Type
OTS$CVT_T_T	IEEE T-floating

digits-in-fraction

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Number of digits in the fraction if no decimal point is included in the input string. The **digits-in-fraction** argument contains the number of digits. If the number of digits is omitted, the default is zero.

scale-factor

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Scale factor. The **scale-factor** argument contains the value of the scale factor. If bit 6 of the **flags-value** argument is clear, the resultant value is divided by $10^{\textit{scale-factor}}$ unless the exponent is present. If bit 6 of **flags-value** is set, the scale factor is always applied. If the scale factor is omitted, the default is zero.

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flags. The **flags-value** argument contains the user-supplied flags described in the following table:

Bit	Action if Set	Action if Clear
0	Ignore blanks.	Interpret blanks as zeros.
1	Allow only E or e exponents. (This is consistent with Fortran semantics.)	Allow E, e, D, d, Q and q exponents. (This is consistent with BASIC semantics.)
2	Interpret an underflow as an error.	Do not interpret an underflow as an error.
3	Truncate the value.	Round the value.
4	Ignore tabs.	Interpret tabs as invalid characters.
5	An exponent must begin with a valid exponent letter.	The exponent letter can be omitted.
6	Always apply the scale factor.	Apply the scale factor only if there is no exponent present in the string.

If you omit the **flags-value** argument, OTS$CVT_T_*x* defaults all flags to clear.

extension-bits (D-, F-floating, IEEE S-floating)

OpenVMS usage:	**byte_unsigned**
type:	**byte (unsigned)**
access:	**write only**
mechanism:	**by reference**

extension-bits (G-, H-floating, IEEE T-floating)

OpenVMS usage:	**word_unsigned**
type:	**word (unsigned)**
access:	**write only**
mechanism:	**by reference**

Extra precision bits. The **extension-bits** argument is the address of a word containing the extra precision bits. If**extension-bits** is present, **floating-point-value** is not rounded, and the first *n* bits after truncation are returned left-justified in this argument, as follows:

Routine	Number of Bits Returned	Data Type
OTS$CVT_T_D	8	Byte (unsigned)
OTS$CVT_T_F	8	Byte (unsigned)
OTS$CVT_T_G	11	Word (unsigned)
OTS$CVT_T_H	15	Word (unsigned)
OTS$CVT_T_S	8	Byte (unsigned)
OTS$CVT_T_T	11	Word (unsigned)

A value represented by extension bits is suitable for use as the extension operand in an EMOD instruction.

The extra precision bits returned for H-floating may not be precise because OTS$CVT_T_H carries its calculations to only 128 bits. However the error should be small.

Description

The OTSCVT_T_D, OTSCVT_T_F, OTSCVT_T_G, OTSCVT_T_H, OTS$CVT_T_S, and OTS$CVT_T_T routines support Fortran D, E, F, and G input type conversion as well as similar types for other languages.

These routines provide run-time support for BASIC and Fortran input statements.

Although Alpha and I64 systems do not generally support H-floating operations, you can use OTS$CVT_T_H to convert a text string to an H-floating value on an Alpha or I64 system.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error; an invalid character in the input string, or the value is outside the range that can be represented. The **floating-point-**

value and **extension-bits** arguments, if present, are set to +0.0 (not reserved operand –0.0).

Example

```
C+
C This is a Fortran program demonstrating the use of
C OTS$CVT_T_F.
C-

        REAL*4 A
        CHARACTER*10 T(5)
        DATA T/'1234567+23','8.786534+3','-983476E-3','-23.734532','45'/
        DO 2 I = 1, 5
        TYPE 1,I,T(I)
 1      FORMAT(' Input string ',I1,' is ',A10)

C+
C B is the return status.
C T(I) is the string to be converted to an
C F-floating point value.  A is the F-floating
C point conversion of T(I).  %VAL(5) means 5 digits
C are in the fraction if no decimal point is in
C the input string T(I).
C-
        B = OTS$CVT_T_F(T(I),A,%VAL(5),,)
        TYPE *,' Output of OTSCVT_T_F is     ',A
        TYPE *,'  '
 2      CONTINUE
        END
```

This Fortran example demonstrates the use of OTS$CVT_T_F. The output generated by this program is as follows:

```
Input string 1 is 1234567+23
 Output of OTSCVT_T_F is       1.2345669E+24
Input string 2 is 8.786534+3
 Output of OTSCVT_T_F is        8786.534
Input string 3 is -983476E-3
 Output of OTSCVT_T_F is      -9.8347599E-03
Input string 4 is -23.734532
 Output of OTSCVT_T_F is       -23.73453
Input string 5 is 45
 Output of OTSCVT_T_F is        45000.00
```

OTS$CVT_TB_L

OTS$CVT_TB_L — The Convert Binary Text to Unsigned Integer routine converts an ASCII text string representation of an unsigned binary value to an unsigned integer value. The integer value can be of arbitrary length but is typically a byte, word, longword, or quadword. The default size of the result is a longword.

Format

```
OTS$CVT_TB_L
```

```
fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
[,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by descriptor**

Input string containing the string representation of an unsigned binary value that OTS$CVT_TB_L converts to an unsigned integer value. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string. The valid input characters are blanks and the digits 0 and 1. No sign is permitted.

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Unsigned integer of specified size that OTS$CVT_TB_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the integer. The value of the **output-value-size** argument determines the size in bytes of the output value.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Arbitrary number of bytes to be occupied by the unsigned integer output value. The **output-value-size** argument contains a value that equals the size in bytes of the output value. If the value of**output-value-size** is zero or a negative number, OTS$CVT_TB_L returns an input conversion error. If you omit the **output-value-size** argument, the default is 4 (longword).

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flag that OTS$CVT_TB_L uses to determine how to interpret blanks within the input string. The **flags-value** argument contains this user-supplied flag.

OTS$CVT_TB_L defines the flag as follows:

Bit	Action if Set	Action if Clear
0	Ignore blanks.	Interpret blanks as zeros.

If you omit the **flags-value** argument, OTS$CVT_TB_L defaults all flags to clear.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TB_L encountered an invalid character in the **fixed-or-dynamic-input-string**, an overflow of **varying-output-value**, or an invalid **output-value-size**. In the case of an invalid character or of an overflow, **varying-output-value** is set to zero.

Example

```
OPTION                                &
    TYPE = EXPLICIT

!+
!   This program demonstrates the use of OTS$CVT_TB_L from BASIC.
!   Several binary numbers are read and then converted to their
!   integer equivalents.
!-

!+
!   DECLARATIONS
!-

DECLARE STRING BIN_STR
DECLARE LONG BIN_VAL, I, RET_STATUS
DECLARE LONG CONSTANT FLAGS = 17        ! 2^0 + 2^4
EXTERNAL LONG FUNCTION OTS$CVT_TB_L (STRING, LONG, &
    LONG BY VALUE, LONG BY VALUE)

!+
!   MAIN PROGRAM
!-

!+
!   Read the data, convert it to binary, and print the result.
!-
```

```
    FOR I = 1 TO 5
        READ BIN_STR
        RET_STATUS = OTS$CVT_TB_L( BIN_STR, BIN_VAL, '4'L, FLAGS)
        PRINT BIN_STR;" treated as a binary number equals";BIN_VAL
    NEXT I

    !+
    !   Done, end the program.
    !-

    GOTO 32767

999 Data    "1111", "1 111", "1011011", "11111111", "00000000"

32767 END
```

This BASIC example program demonstrates how to call OTS$CVT_TB_L to convert binary text to a longword integer.

The output generated by this BASIC program is as follows:

```
1111 treated as a binary number equals 15
1 111 treated as a binary number equals 15
1011011 treated as a binary number equals 91
11111111 treated as a binary number equals 255
00000000 treated as a binary number equals 0
```

OTS$CVT_TI_L

OTS$CVT_TI_L — The Convert Signed Integer Text to Integer routine converts an ASCII text string representation of a signed decimal number to a signed integer value. The default size of the result is a longword.

Format

```
OTS$CVT_TI_L
   fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
   [,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**

type:	**character string**
access:	**read only**
mechanism:	**by descriptor, fixed-length or dynamic string**

Input ASCII text string that OTS$CVT_TI_L converts to a signed integer. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string.

The syntax of a valid ASCII text input string is as follows:

[+ or −] <integer-digits>

OTS$CVT_TI_L always ignores leading blanks.

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Signed integer that OTS$CVT_TI_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the signed integer. The value of the **output-value-size**argument determines the size of **varying-output-value**.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Number of bytes to be occupied by the value created when OTS$CVT_TI_L converts the ASCII text string to an integer value. The **output-value-size** argument contains the number of bytes in **varying-output-value**.

On VAX systems, valid values for the **output-value-size** argument are 1, 2, and 4. The value determines whether the integer value that OTS$CVT_TI_L creates is a byte, word, or longword.

On Alpha and I64 systems, valid values for the **output-value-size** argument are 1, 2, 4, and 8. The value determines whether the integer value that OTS$CVT_TI_L creates is a byte, word, longword, or quadword.

For VAX and Alpha systems, if you specify a 0 (zero) or omit the **output-value-size** argument, the size of the output value defaults to 4 (longword). If you specify any other value, OTS$CVT_TI_L returns an input conversion error.

flags-value

OpenVMS usage:	**mask_longword**

type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flags that OTS$CVT_TI_L uses to determine how blanks and tabs are interpreted. The **flags-value** argument is an unsigned longword containing the value of the flags.

Bit	Action if Set	Action if Clear
0	Ignore all blanks.	Ignore leading blanks but interpret blanks after the first legal character as zeros.
4	Ignore tabs.	Interpret tabs as invalid characters.

If you omit the **flags-value** argument, OTS$CVT_TI_L defaults all flags to clear.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TI_L encountered an invalid character in the **fixed-or-dynamic-input-string**, an overflow of **varying-output-value**, or an invalid **output-value-size**. In the case of an invalid character or of an overflow, **varying-output-value** is set to zero.

OTS$CVT_TL_L

OTS$CVT_TL_L — The Convert Logical Text to Integer routine converts an ASCII text string representation of a FORTRAN-77 L format to a signed integer.

Format

```
OTS$CVT_TL_L
   fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

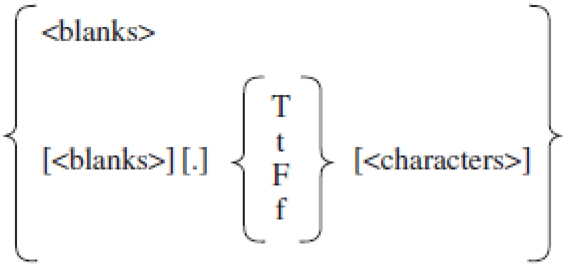
fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**
type:	**character string**

access:	**read only**
mechanism:	**by descriptor, fixed-length or dynamic string**

Input string containing an ASCII text representation of a FORTRAN-77 L format that OTS$CVT_TL_L converts to a signed integer value. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string.

Common ASCII text representations of a FORTRAN-77 logical are .TRUE., .FALSE., T, t, F, and f. In practice, an OTS$CVT_TL_L input string is valid if it adheres to the following syntax:



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One of the letters T, t, F, or f is required. Other elements in the preceding syntax are defined as follows:

Term	Description
blanks	One or more blanks
characters	One or more of any character

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Signed integer that OTS$CVT_TL_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the signed integer. The value of the **output-value-size** argument determines the size in bytes of the signed integer.

OTS$CVT_TL_L returns –1 as the contents of the **varying-output-value** argument if the character denoted by "letter" is T or t. Otherwise, OTS$CVT_TL_L sets **varying-output-value** to zero.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Number of bytes to be occupied by the signed integer created when OTS$CVT_TL_L converts the ASCII text string to an integer value. The **output-value-size** argument contains a value that equals the size in bytes of the output value. If **output-value-size** contains a zero or a negative number, OTS$CVT_TL_L returns an input conversion error.

On VAX systems, valid values for the **output-value-size** argument are 1, 2, and 4. The value determines whether the integer value that OTS$CVT_TL_L creates is a byte, word, or longword.

On Alpha and I64 systems, valid values for the **output-value-size** argument are 1, 2, 4, and 8. This value determines whether the integer value that OTS$CVT_TL_L creates is a byte, word, longword, or quadword.

For VAX, Alpha, and I64 systems, if you omit the **output-value-size** argument, the default is 4 (longword).

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TL_L encountered an invalid character in the **fixed-or-dynamic-input-string** or an invalid **output-value-size**. In the case of an invalid character **varying-output-value** is set to zero.

OTS$CVT_TO_L

OTS$CVT_TO_L — The Convert Octal Text to Unsigned Integer routine converts an ASCII text string representation of an unsigned octal value to an unsigned integer. The integer value can be of arbitrary length but is typically a byte, word, longword, or quadword. The default size of the result is a longword.

Format

```
OTS$CVT_TO_L
   fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
   [,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by descriptor, fixed-length or dynamic string**

Input string containing the string representation of an unsigned octal value that OTS$CVT_TO_L converts to an unsigned integer. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string. The valid input characters are blanks and the digits 0 through 7. No sign is permitted.

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Unsigned integer of specified size that OTS$CVT_TO_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the unsigned integer. The value of the **output-value-size** argument determines the size in bytes of the output value.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword integer (signed)**
access:	**read only**
mechanism:	**by value**

Arbitrary number of bytes to be occupied by the unsigned integer output value. The **output-value-size** argument contains a value that equals the size in bytes of the output value. If the value of**output-value-size** is zero or a negative number, OTS$CVT_TO_L returns an input conversion error. If you omit the **output-value-size** argument, the default is 4 (longword).

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flag that OTS$CVT_TO_L uses to determine how to interpret blanks within the input string. The **flags-value** argument contains the user-supplied flag described in the following table:

Bit	Action if Set	Action if Clear
0	Ignore all blanks.	Interpret blanks as zeros.

If you omit the **flags-value** argument, OTS$CVT_TO_L defaults the flag to clear.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TO_L encountered an invalid character in the **fixed-or-dynamic-input-string**, an overflow of **varying-output-value**, or an invalid **output-value-size**. In the case of an invalid character or of an overflow, **varying-output-value** is set to zero.

Example

```
OCTAL_CONV: PROCEDURE OPTIONS (MAIN) RETURNS (FIXED BINARY (31));

%INCLUDE $STSDEF;     /* Include definition of return status values */
DECLARE OTS$CVT_TO_L ENTRY
        (CHARACTER (*),       /* Input string passed by descriptor */
        FIXED BINARY (31),    /* Returned value passed by reference */
        FIXED BINARY VALUE,   /* Size for returned value passed by value */
        FIXED BINARY VALUE)   /* Flags passed by value */
        RETURNS (FIXED BINARY (31))   /* Return status */
        OPTIONS (VARIABLE);   /* Arguments may be omitted */

DECLARE INPUT CHARACTER (10);
DECLARE VALUE FIXED BINARY (31);
DECLARE SIZE  FIXED BINARY(31) INITIAL(4) READONLY STATIC; /* Longword */
DECLARE FLAGS FIXED BINARY(31) INITIAL(1) READONLY STATIC; /* Ignore
                                                              blanks */

ON ENDFILE (SYSIN) STOP;

DO WHILE ('1'B);              /* Loop continuously, until end of file */
        PUT SKIP (2);
        GET LIST (INPUT) OPTIONS (PROMPT ('Octal value: '));
        STS$VALUE = OTS$CVT_TO_L (INPUT, VALUE, SIZE, FLAGS);
        IF ^STS$SUCCESS THEN RETURN (STS$VALUE);
        PUT SKIP EDIT (INPUT, 'Octal equals', VALUE, 'Decimal')
                        (A,X,A,X,F(10),X,A);
        END;

END OCTAL_CONV;
```

This PL/I program translates an octal value in ASCII into a fixed binary value. The program is run interactively; press Ctrl/Z to quit.

```
$ RUN OCTAL
Octal value: 1
1  Octal equals 1 Decimal
Octal value: 11
11   Octal equals   9 Decimal
Octal value: 1017346
1017346 Octal equals 274150 Decimal
Octal value: Ctrl/Z
```

OTS$CVT_TU_L

OTS$CVT_TU_L — The Convert Unsigned Decimal Text to Integer routine converts an ASCII text string representation of an unsigned decimal value to an unsigned integer value. By default, the size of the result is a longword.

Format

```
OTS$CVT_TU_L
   fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
   [,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by descriptor**

Input string containing an ASCII text string representation of an unsigned decimal value that OTS$CVT_TU_L converts to an unsigned integer value. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string. Valid input characters are the space and the digits 0 through 9. No sign is permitted.

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Unsigned integer that OTS$CVT_TU_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the unsigned integer. The value of the **output-value-size** argument determines the size of **varying-output-value**.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword integer (signed)**
access:	**read only**
mechanism:	**by value**

Number of bytes occupied by the value created when OTS$CVT_TU_L converts the input string. The **output-value-size** argument contains the number of bytes in **varying-output-value**.

On VAX systems, valid values for the **output-value-size** argument are 1, 2, and 4. The value determines whether the integer value that OTS$CVT_TU_L creates is a byte, word, or longword.

On Alpha and I64 systems, valid values for the **output-value-size** argument are 1, 2, 4, and 8. The value determines whether the integer value that OTS$CVT_TU_L creates is a byte, word, longword, or quadword.

For VAX, Alpha, and I64 systems, if you specify a 0 (zero) or omit the **output-value-size** argument, the size of the output value defaults to 4 (longword). If you specify any other value, OTS$CVT_TU_L returns an input conversion error.

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flags that OTS$CVT_TU_L uses to determine how blanks and tabs are interpreted. The **flags-value** argument contains the user-supplied flags as described in the following table:

Bit	Action if Set	Action if Clear
0	Ignore all blanks.	Ignore leading blanks but interpret blanks after the first legal character as zeros.
4	Ignore tabs.	Interpret tabs as invalid characters.

If you omit the **flags-value** argument, OTS$CVT_TU_L defaults all flags to clear.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TU_L encountered an invalid character in the **fixed-or-dynamic-input-string**, overflow of **varying-output-value**, or an invalid **output-value-size**. In the case of an invalid character or of an overflow, **varying-output-value** is set to zero.

OTS$CVT_TZ_L

OTS$CVT_TZ_L — The Convert Hexadecimal Text to Unsigned Integer routine converts an ASCII text string representation of an unsigned hexadecimal value to an unsigned integer. The integer value can be of arbitrary length but is typically a byte, word, longword, or quadword. The default size of the result is a longword.

Format

```
OTS$CVT_TZ_L
   fixed-or-dynamic-input-string ,varying-output-value [,output-value-size]
   [,flags-value]
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**

mechanism:	**by value**

Arguments

fixed-or-dynamic-input-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by descriptor, fixed-length or dynamic string**

Input string containing the string representation of an unsigned hexadecimal value that OTS$CVT_TZ_L converts to an unsigned integer. The **fixed-or-dynamic-input-string** argument is the address of a descriptor pointing to the input string. The valid input characters are blanks, the digits 0 through 7, and the letters A through F. Letters can be uppercase or lowercase. No sign is permitted.

varying-output-value

OpenVMS usage:	**varying_arg**
type:	**unspecified**
access:	**write only**
mechanism:	**by reference**

Unsigned integer of specified size that OTS$CVT_TZ_L creates when it converts the ASCII text string. The **varying-output-value** argument is the address of the unsigned integer. The value of the **output-value-size** argument determines the size in bytes of the output value.

output-value-size

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Arbitrary number of bytes to be occupied by the unsigned integer output value. The **output-value-size** argument contains a value that equals the size in bytes of the output value. If the value of**output-value-size** is zero or a negative number, OTS$CVT_TZ_L returns an input conversion error. If you omit the **output-value-size** argument, the default is 4 (longword).

flags-value

OpenVMS usage:	**mask_longword**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

User-supplied flags that OTS$CVT_TZ_L uses to determine how to interpret blanks within the input string. The **flags-value** argument contains these user-supplied flags as described in the following table:

Bit	Action if Set	Action if Clear
0	Ignore all blanks.	Interpret blanks as zeros.

If you omit the **flags-value** argument, OTS$CVT_TZ_L defaults the flag to clear.

Condition Values Returned

SS$_NORMAL	Normal successful completion.
OTS$_INPCONERR	Input conversion error. OTS$CVT_TZ_L encountered an invalid character in the **fixed-or-dynamic-input-string**, overflow of **varying-output-value**, or an invalid **output-value-size**. In the case of an invalid character or of an overflow, **varying-output-value** is set to zero.

Examples

1.
```
10      !+
        ! This BASIC program converts a character string representing
        ! a hexadecimal value to a longword.
        !-

100     !+
        ! Illustrate (and test) OTS convert hex-string to longword
        !-

        EXTERNAL LONG FUNCTION OTS$CVT_TZ_L
        EXTERNAL LONG CONSTANT OTS$_INPCONERR
        INPUT "Enter hex numeric";HEXVAL$
        RET_STAT% = OTS$CVT_TZ_L(HEXVAL$, HEX% )
        PRINT "Conversion error " IF RET_STAT% = OTS$_INPCONERR
        PRINT "Decimal value of ";HEXVAL$;" is";HEX%              &
             IF RET_STAT% <> OTS$_INPCONERR
```

This BASIC example accepts a hexadecimal numeric string, converts it to a decimal integer, and prints the result. One sample of the output generated by this program is as follows:

```
$ RUN HEX
Enter hex numeric?  A
Decimal value of A is 10
```

2.
```
HEX_CONV: PROCEDURE OPTIONS (MAIN) RETURNS (FIXED BINARY (31));

%INCLUDE $STSDEF;    /* Include definition of return status values */
DECLARE OTS$CVT_TZ_L ENTRY
        (CHARACTER (*),       /* Input string passed by descriptor  */
        FIXED BINARY (31),    /* Returned value passed by reference */
        FIXED BINARY VALUE,   /* Size for returned value passed by
                                                              value */
        FIXED BINARY VALUE)   /* Flags passed by value */
        RETURNS (FIXED BINARY (31))  /* Return status */
        OPTIONS (VARIABLE);   /* Arguments may be omitted */

DECLARE INPUT CHARACTER (10);
DECLARE VALUE FIXED BINARY (31);
DECLARE FLAGS FIXED BINARY(31) INITIAL(1) READONLY STATIC; /* Ignore
                                                              blanks */
```

```
ON ENDFILE (SYSIN) STOP;

DO WHILE ('1'B);              /* Loop continuously, until end of file */
        PUT SKIP (2);
        GET LIST (INPUT) OPTIONS (PROMPT ('Hex value: '));
        STS$VALUE = OTS$CVT_TZ_L (INPUT, VALUE, , FLAGS);
        IF ^STS$SUCCESS THEN RETURN (STS$VALUE);
        PUT SKIP EDIT (INPUT, 'Hex equals', VALUE, 'Decimal')
                        (A,X,A,X,F(10),X,A);
        END;

END HEX_CONV;
```

This PL/I example translates a hexadecimal value in ASCII into a fixed binary value. This program continues to prompt for input values until the user presses Ctrl/Z.

One sample of the output generated by this program is as follows:

```
$ RUN HEX
Hex value:  1A
1A      Hex equals       26 Decimal

Hex value:  C
C       Hex equals       12 Decimal

Hex value:  Ctrl/Z
```

OTS$DIVCx

OTS$DIVCx — The Complex Division routines return a complex result of a division on complex numbers.

Format

```
OTS$DIVC complex-dividend ,complex-divisor

OTS$DIVCD_R3 complex-dividend ,complex-divisor (VAX only)

OTS$DIVCG_R3 complex-dividend ,complex-divisor

OTS$DIVCS complex-dividend ,complex-divisor

OTS$DIVCT_R3 complex-dividend ,complex-divisor
```

Each of these formats corresponds to one of the floating-point complex types.

Returns

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex,**
access:	**write only**
mechanism:	**by value**

Complex result of complex division. OTS$DIVC returns an F-floating complex number. OTS$DIVCD_R3 returns a D-floating complex number. OTS$DIVCG_R3 returns a G-floating complex number. OST$DIVCS returns an IEEE S-floating complex number. OTS$DIVCT_R3 returns an IEEE T-floating complex number.

Arguments

complex-dividend

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**read only**
mechanism:	**by value**

Complex dividend. The **complex-dividend** argument contains a floating-point complex value. For OTS$DIVC, **complex-dividend** is an F-floating complex number. For OTS$DIVCD_R3, **complex-dividend** is a D-floating complex number. For OTS$DIVCG_R3, **complex-dividend** is a G-floating complex number. For OTS$DIVCT_R3, **complex-dividend** is an IEEE T-floating complex number.

complex-divisor

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**read only**
mechanism:	**by value**

Complex divisor. The **complex-divisor** argument contains the value of the divisor. For OTS$DIVC,**complex-divisor** is an F-floating complex number. For OTS$DIVCD_R3, **complex-divisor** is a D-floating complex number. For OTS$DIVCG_R3, **complex-divisor** is a G-floating complex number. For OTS$DIVCS, **complex-divisor** is an IEEE S-floating complex number. For OTS$DIVCS, **complex-dividend** is an IEEE S-floating complex number. For OTS$DIVCT_R3, **complex-divisor**is an IEEE T-floating complex number.

Description

These routines return a complex result of a division on complex numbers.

The complex result is computed as follows:

1. Let (a,b) represent the complex dividend.
2. Let (c,d) represent the complex divisor.
3. Let (r,i) represent the complex quotient.

The results of this computation are as follows:

$$r = (ac + bd)/(c^2 + d^2)$$
$$i = (bc - ad)/(c^2 + d^2)$$

On Alpha and I64 systems, some restrictions apply when linking OTS$DIVC or OTS$DIVCG_R3. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTDIV_F	Arithmetic fault. Floating-point division by zero.
SS$_FLTOVF_F	Arithmetic fault. Floating-point overflow.

Examples

1.

```
C+
C    This Fortran example forms the complex
C    quotient of two complex numbers using
C    OTS$DIVC and the Fortran random number
C    generator RAN.
C
C    Declare Z1, Z2, Z_Q, and OTS$DIVC as complex values.
C    OTS$DIVC will return the complex quotient of Z1 divided
C    by Z2:  Z_Q = OTS$DIVC( %VAL(REAL(Z1)), %VAL(AIMAG(Z1),
C    %VAL(REAL(Z2)), %VAL(AIMAG(Z2))
C-

        COMPLEX Z1,Z2,Z_Q,OTS$DIVC
C+
C    Generate a complex number.
C-
        Z1 = (8.0,4.0)
C+
C    Generate another complex number.
C-
        Z2 = (1.0,1.0)
C+
C    Compute the complex quotient of Z1/Z2.
C-
        Z_Q = OTS$DIVC( %VAL(REAL(Z1)), %VAL(AIMAG(Z1)), %VAL(REAL(Z2)),
     +                  %VAL(AIMAG(Z2)))
        TYPE *, ' The complex quotient of',Z1,' divided by ',Z2,' is'
        TYPE *, '      ',Z_Q
        END
```

This Fortran program demonstrates how to call OTS$DIVC. The output generated by this program is as follows:

```
The complex quotient of (8.000000,4.000000) divided by
 (1.000000,1.000000)
 is (6.000000,-2.000000)
```

2.

```
C+
C    This Fortran example forms the complex
C    quotient of two complex numbers by using
C    OTS$DIVCG_R3 and the Fortran random number
C    generator RAN.
C
C     Declare Z1, Z2, and Z_Q as complex values. OTS$DIVCG_R3
C     will return the complex quotient of Z1 divided by Z2:
```

```
C      Z_Q = Z1/Z2
C-

        COMPLEX*16 Z1,Z2,Z_Q
C+
C    Generate a complex number.
C-
        Z1 = (8.0,4.0)
C+
C    Generate another complex number.
C-
        Z2 = (1.0,1.0)
C+
C    Compute the complex quotient of Z1/Z2.
C-
        Z_Q = Z1/Z2
        TYPE *, ' The complex quotient of',Z1,' divided by ',Z2,' is'
        TYPE *, '     ',Z_Q
        END
```

This Fortran example uses the OTS$DIVCG_R3 entry point instead. Notice the difference in the precision of the output generated:

```
 The complex quotient of (8.000000000000000,4.000000000000000) divided
 by
(1.000000000000000,1.000000000000000) is
      (6.000000000000000,-2.000000000000000)
```

OTS$DIV_PK_LONG

OTS$DIV_PK_LONG — The Packed Decimal Division with Long Divisor routine divides fixed-point decimal data, which is stored in packed decimal form, when precision and scale requirements for the quotient call for multiple precision division. The divisor must have a precision of 30 or 31 digits.

Format

```
OTS$DIV_PK_LONG
   packed-decimal-dividend ,packed-decimal-divisor ,divisor-precision
   ,packed-decimal-quotient ,quotient-precision ,precision-data ,scale-data
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

packed-decimal-dividend

OpenVMS usage:	**varying_arg**

type:	**packed decimal string**
access:	**read only**
mechanism:	**by reference**

Dividend. The **packed-decimal-dividend** argument is the address of a packed decimal string that contains the shifted dividend.

Before being passed as input, the **packed-decimal-dividend** argument is always multiplied by 10^c, where *c* is defined as follows:

```
c = 31 - prec(packed-decimal-dividend)
```

Multiplying **packed-decimal-dividend** by 10^c makes **packed-decimal-dividend** a 31-digit number.

packed-decimal-divisor

OpenVMS usage:	**varying_arg**
type:	**packed decimal string**
access:	**read only**
mechanism:	**by reference**

Divisor. The **packed-decimal-divisor** argument is the address of a packed decimal string that contains the divisor.

divisor-precision

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Precision of the divisor. The **divisor-precision** argument is a signed word that contains the precision of the divisor. The high-order bits are filled with zeros.

packed-decimal-quotient

OpenVMS usage:	**varying_arg**
type:	**packed decimal string**
access:	**write only**
mechanism:	**by reference**

Quotient. The **packed-decimal-quotient** argument is the address of the packed decimal string into which OTS$DIV_PK_LONG writes the quotient.

quotient-precision

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**

mechanism:	**by value**

Precision of the quotient. The **quotient-precision** argument is a signed word that contains the precision of the quotient. The high-order bits are filled with zeros.

precision-data

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Additional digits of precision required. The **precision-data** argument is a signed word that contains the value of the additional digits of precision required.

OTS$DIV_PK_LONG computes the **precision-data** argument as follows:

```
precision-data = scale(packed-decimal-quotient)
+ scale(packed-decimal-divisor)
- scale(packed-decimal-dividend)
- 31 + prec(packed-decimal-dividend)
```

scale-data

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Scale factor of the decimal point. The **scale-data** argument is a signed word that contains the scale data.

OTS$DIV_PK_LONG defines the **scale-data** argument as follows:

```
scale-data = 31 - prec(packed-decimal-divisor)
```

Description

On VAX systems, before using this routine, you should determine whether it is best to use OTSDIV_PK_LONG, OTSDIV_PK_SHORT, or the VAX instruction DIVP. To determine this, you must first calculate *b*, where *b* is defined as follows:

```
b = scale(packed-decimal-quotient)
+ scale(packed-decimal-divisor)
- scale(packed-decimal-dividend)
+ prec(packed-decimal-dividend)
```

If *b* is greater than 31, then OTS$DIV_PK_LONG can be used to perform the division. If *b* is less than 31, you could use the instruction DIVP instead.

When using this routine on an OpenVMS Alpha system, an I64 system, or on an OpenVMS VAX system and you have determined that you cannot use DIVP, you need to determine whether you should use OTS$DIV_PK_LONG or OTS$DIV_PK_SHORT. To determine this, you must examine the value of **scale-data**. If **scale-data** is less than or equal to 1, then you should use OTS$DIV_PK_LONG. If **scale-data** is greater than 1, you should use OTS$DIV_PK_SHORT instead.

Condition Values Returned

SS$_FLTDIV	Fatal error. Division by zero.

Example

1

```
    OPTION                                  &
        TYPE = EXPLICIT

    !+
    !   This program uses OTS$DIV_PK_LONG to perform packed decimal
    !   division.
    !-


    !+
    !   DECLARATIONS
    !-

    DECLARE DECIMAL (31, 2)     NATIONAL_DEBT
    DECLARE DECIMAL (30, 3)     POPULATION
    DECLARE DECIMAL (10, 5)     PER_CAPITA_DEBT

    EXTERNAL SUB OTS$DIV_PK_LONG (DECIMAL(31,2), DECIMAL (30, 3), &
        WORD BY VALUE, DECIMAL(10, 5), WORD BY VALUE, WORD BY VALUE, &
        WORD BY VALUE)

    !+
    !   Prompt the user for the required input.
    !-

    INPUT   "Enter national debt: ";NATIONAL_DEBT
    INPUT   "Enter current population: ";POPULATION


    !+
    !   Perform the division and print the result.
    !
    !   scale(divd) = 2
    !   scale(divr) = 3
    !   scale(quot) = 5
    !
    !   prec(divd) = 31
    !   prec(divr) = 30
    !   prec(quot) = 10
    !
    !   prec-data  = scale(quot) + scale(divr) - scale(divd) - 31 +
    !                prec(divd)
    !   prec-data  =   5     +   3     -     2    - 31 +   31
    !   prec-data  = 6
    !
    !   b = scale(quot) + scale(divr) - scale(divd) + prec(divd)
    !   b =   5     +   3     -     2    +    31
    !   b = 37
    !
```

```
!   c = 31 - prec(divd)
!   c = 31 -   31
!   c = 0
!
!   scale-data = 31 - prec(divr)
!   scale-data = 31 -   30
!   scale-data = 1
!
!   b is greater than 31, so either OTS$DIV_PK_LONG or
!      OTS$DIV_PK_SHORT may be used to perform the division.
!      If b is less than or equal to 31, then the DIVP
!      instruction may be used.
!
!   scale-data is less than or equal to 1, so OTS$DIV_PK_LONG
!      should be used instead of OTS$DIV_PK_SHORT.
!
!-

CALL OTS$DIV_PK_LONG( NATIONAL_DEBT, POPULATION, '30'W,
PER_CAPITA_DEBT, & '10'W, '6'W, '1'W)

PRINT   "The per capita debt is ";PER_CAPITA_DEBT
END
```

This BASIC example program uses OTS$DIV_PK_LONG to perform packed decimal division. One example of the output generated by this program is as follows:

```
$ RUN DEBT
Enter national debt: ?  12345678
Enter current population: ?  1212
The per capita debt is 10186.20297
```

OTS$DIV_PK_SHORT

OTS$DIV_PK_SHORT — The Packed Decimal Division with Short Divisor routine divides fixed-point decimal data when precision and scale requirements for the quotient call for multiple-precision division.

Format

```
OTS$DIV_PK_SHORT
   packed-decimal-dividend ,packed-decimal-divisor ,divisor-precision
   ,packed-decimal-quotient ,quotient-precision ,precision-data
```

Returns

OpenVMS usage:	**cond_value**
type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Arguments

packed-decimal-dividend

OpenVMS usage:	**varying_arg**
type:	**packed decimal string**
access:	**read only**
mechanism:	**by reference**

Dividend. The **packed-decimal-dividend** argument is the address of a packed decimal string that contains the shifted dividend.

Before being passed as input, the **packed-decimal-dividend** argument is always multiplied by 10^c, where *c* is defined as follows:

```
c = 31 - prec(packed-decimal-dividend)
```

Multiplying **packed-decimal-dividend** by 10^c makes **packed-decimal-dividend** a 31-digit number.

packed-decimal-divisor

OpenVMS usage:	**varying_arg**
type:	**packed decimal string**
access:	**read only**
mechanism:	**by reference**

Divisor. The **packed-decimal-divisor** argument is the address of a packed decimal string that contains the divisor.

divisor-precision

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Precision of the divisor. The **divisor-precision** argument is a signed word integer that contains the precision of the divisor; high-order bits are filled with zeros.

packed-decimal-quotient

OpenVMS usage:	**varying_arg**
type:	**packed decimal string**
access:	**write only**
mechanism:	**by reference**

Quotient. The **packed-decimal-quotient** argument is the address of a packed decimal string into which OTS$DIV_PK_SHORT writes the quotient.

quotient-precision

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**

mechanism:	**by value**

Precision of the quotient. The **quotient-precision** argument is a signed word that contains the precision of the quotient; high-order bits are filled with zeros.

precision-data

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Additional digits of precision required. The **precision-data** argument is a signed word that contains the value of the additional digits of precision required.

OTS$DIV_PK_SHORT computes the **precision-data** argument as follows:

```
precision-data = scale(packed-decimal-quotient)
+ scale(packed-decimal-divisor)
- scale(packed-decimal-dividend)
- 31 + prec(packed-decimal-dividend)
```

Description

On VAX systems, before using this routine, you should determine whether it is best to use OTSDIV_PK_LONG, OTSDIV_PK_SHORT, or the VAX instruction DIVP. To determine this, you must first calculate *b*, where *b* is defined as follows:

```
b = scale(packed-decimal-quotient) + scale(packed-decimal-divisor) -
  scale(packed-decimal-dividend) + prec(packed-decimal-dividend)
```

If *b* is greater than 31, then OTS$DIV_PK_SHORT can be used to perform the division. If *b* is less than 31, you could use the VAX instruction DIVP instead.

When using this routine on an OpenVMS Alpha system, an I64 system, or on an OpenVMS VAX system and you have determined that you cannot use DIVP, you need to determine whether you should use OTS$DIV_PK_LONG or OTS$DIV_PK_SHORT. To determine this, you must examine the value of **scale-data**. If **scale-data** is less than or equal to 1, then you should use OTS$DIV_PK_LONG. If **scale-data** is greater than 1, you should use OTS$DIV_PK_SHORT instead.

Condition Values Returned

SS$_FLTDIV	Fatal error. Division by zero.

OTS$JUMP_TO_BPV (I64 Only)

OTS$JUMP_TO_BPV (I64 Only) — The Jump to Bound Procedure Value routine transfers control to a bound procedure.

Format

```
OTS$JUMP_TO_BPV bound-func-value ,standard-args ,...
```

Returns

None.

Arguments

bound-func-value

OpenVMS usage:	**quadword address**
type:	**address**
access:	**read only**
mechanism:	**by value in register R1 (GP)**

Function value for the procedure being called.

standard-args

Zero or more arguments to be passed to the called routine, passed using standard conventions (including the AI register).

Description

When a procedure value that refers to a bound procedure descriptor is used to make a call, the routine designated in the OTS_ENTRY field (typically OTS$JUMP_TO_BPV) receives control with the GP register pointing to the bound procedure descriptor (instead of a global offset table). This routine performs the following steps:

1. Load the "real" target entry address into a volatile branch register, for example, B6.
2. Load the dynamic environment value into the appropriate uplevel-addressing register for the target function, for example, OTS$JUMP_TO_BPV uses R9.
3. Load the "real" target GP address into the GP register.
4. Transfer control (branch, not call) to the target entry address.

Control arrives at the real target procedure address with both the GP and environment register values established appropriately.

Support routine OTS$JUMP_TO_BPV is included as a standard library routine. The operation of OTS$JUMP_TO_BPV is logically equivalent to the following code:

```
OTS$JUMP_TO_BPV::
     add     gp=gp,24         ; Adjust GP to point to entry address
     ld8     r9=[gp],16       ; Load target entry address
     mov     b6=r9
     ld8     r9=[gp],-8       ; Load target environment value
     ld8     gp=[gp]          ; Load target GP
     br      b6               ; Transfer to target
```

Note that there can be multiple OTS$JUMP_TO_BPV-like support routines, corresponding to different target registers where the environment value should be placed. The code that creates the bound function descriptor is also necessarily compiled by the same compiler that compiles the target procedure, thus can correctly select an appropriate support routine.

Condition Values Returned

None.

OTS$MOVE3

OTS$MOVE3 — The Move Data Without Fill routine moves up to 2^{32} - 1 bytes (2,147,483,647 bytes) from a specified source address to a specified destination address.

Format

```
OTS$MOVE3 length-value ,source-array ,destination-array
```

Corresponding JSB Entry Point

```
OTS$MOVE3_R5
```

Returns

None.

Arguments

length-value

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Number of bytes of data to move. The **length-value** argument is a signed longword that contains the number of bytes to move. The value of **length-value** may range from 0 to 2,147,483,647 bytes.

source-array

OpenVMS usage:	**vector_byte_unsigned**
type:	**byte (unsigned)**
access:	**read only**
mechanism:	**by reference, array reference**

Data to be moved by OTS$MOVE3. The **source-array** argument contains the address of an unsigned byte array that contains this data.

destination-array

OpenVMS usage:	**vector_byte_unsigned**
type:	**byte (unsigned)**
access:	**write only**
mechanism:	**by reference, array reference**

Address into which **source-array** will be moved. The **destination-array** argument is the address of an unsigned byte array into which OTS$MOVE3 writes the source data.

Description

OTS$MOVE3 performs the same function as the VAX MOVC3 instruction except that the **length-value** is a longword integer rather than a word integer. When called from the JSB entry point, the register outputs of OTS$MOVE3_R5 follow the same pattern as those of the MOVC3 instruction:

R0	0
R1	Address of one byte beyond the source string
R2	0
R3	Address of one byte beyond the destination string
R4	0
R5	0

For more information, see the description of the MOVC3 instruction in the *VAX Architecture Reference Manual*. See also the routine LIB$MOVC3, which is a callable version of the MOVC3 instruction.

Condition Values Returned

None.

OTS$MOVE5

OTS$MOVE5 — The Move Data with Fill routine moves up to 2^{32} - 1 bytes (2,147,483,647 bytes) from a specified source address to a specified destination address, with separate source and destination lengths, and with fill. Overlap of the source and destination arrays does not affect the result.

Format

```
OTS$MOVE5
   longword-int-source-length ,source-array ,fill-value
   ,longword-int-dest-length ,destination-array
```

Corresponding JSB Entry Point

```
OTS$MOVE5_R5
```

Returns

None.

Arguments

longword-int-source-length

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**

mechanism:	**by value**

Number of bytes of data to move. The **longword-int-source-length** argument is a signed longword that contains this number. The value of **longword-int-source-length** may range from 0 to 2,147,483,647.

source-array

OpenVMS usage:	**vector_byte_unsigned**
type:	**byte (unsigned)**
access:	**read only**
mechanism:	**by reference, array reference**

Data to be moved by OTS$MOVE5. The **source-array** argument contains the address of an unsigned byte array that contains this data.

fill-value

OpenVMS usage:	**byte_unsigned**
type:	**byte (unsigned)**
access:	**read only**
mechanism:	**by value**

Character used to pad the source data if **longword-int-source-length** is less than **longword-int-dest-length**. The **fill-value** argument contains the address of an unsigned byte that is this character.

longword-int-dest-length

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Size of the destination area in bytes. The **longword-int-dest-length** argument is a signed longword containing this size. The value of **longword-int-dest-length** may range from 0 through 2,147,483,647.

destination-array

OpenVMS usage:	**vector_byte_unsigned**
type:	**byte (unsigned)**
access:	**write only**
mechanism:	**by reference, array reference**

Address into which **source-array** is moved. The **destination-array** argument is the address of an unsigned byte array into which OTS$MOVE5 writes the source data.

Description

OTS$MOVE5 performs the same function as the VAX MOVC5 instruction except that the **longword-int-source-length** and **longword-int-dest-length** arguments are longword integers rather than word integers. When called from the JSB entry point, the register outputs of OTS$MOVE5_R5 follow the same pattern as those of the MOVC5 instruction:

R0	Number of unmoved bytes remaining in source string
R1	Address of one byte beyond the source string
R2	0
R3	Address of one byte beyond the destination string
R4	0
R5	0

For more information, see the description of the MOVC5 instruction in the *VAX Architecture Reference Manual*. See also the routine LIB$MOVC5, which is a callable version of the MOVC5 instruction.

Condition Values Returned

None.

OTS$MULCx

OTS$MULCx — The Complex Multiplication routines calculate the complex product of two complex values.

Format

```
OTS$MULCD_R3 complex-multiplier ,complex-multiplicand (VAX only)

OTS$MULCG_R3 complex-multiplier ,complex-multiplicand

OTS$MULCT_R3 complex-multiplier ,complex-multiplicand

OTS$MULCS complex-multiplier ,complex-multiplicand
```

These formats correspond to the D-floating, G-floating, IEEE S-floating, and IEEE T-floating complex types.

Returns

OpenVMS usage:	**complex_number**
type:	**D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex,**
access:	**write only**
mechanism:	**by value**

Complex result of multiplying two complex numbers. OTS$MULCD_R3 returns a D-floating complex number. OTS$MULCG_R3 returns a G-floating complex number. OTS$MULCS returns an IEEE S-Floating complex number. OTS$MULCT_R3 returns an IEEE T-floating complex number.

Arguments

complex-multiplier

OpenVMS usage:	**complex_number**

type:	**D_floating complex, G_floating complex, S_floating complex, S_floating complex**
access:	**read only**
mechanism:	**by value**

Complex multiplier. The **complex-multiplier** argument contains the complex multiplier. For OTS$MULCD_R3, **complex-multiplier** is a D-floating complex number. For OTS$MULCG_R3, **complex-multiplier** is a G-floating complex number. For OTS$MULCS, complex-multiplier is a IEEE S-Floating complex number. For OTS$MULCT_R3, **complex-multiplier** is an IEEE T-floating complex number.

complex-multiplicand

OpenVMS usage:	**complex_number**
type:	**D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**read only**
mechanism:	**by value**

Complex multiplicand. The **complex-multiplicand** argument contains the complex multiplicand. For OTS$MULCD_R3, **complex-multiplicand** is a D-floating complex number. For OTS$MULCG_R3, **complex-multiplicand** is a G-floating complex number. For OTS$MULCS, **complex-multiplicand**is an IEEE S-floating complex number. For OTS$MULCT_R3, **complex-multiplicand** is an IEEE T-floating complex number.

Description

OTS$MULC*x* calculates the complex product of two complex values.

The complex product is computed as follows:

1. Let (a,b) represent the complex multiplier.
2. Let (c,d) represent the complex multiplicand.
3. Let (r,i) represent the complex product.

The results of this computation are as follows:

$$(a,b) * (c,d) = (ac-bd) + \sqrt{-1}\,(ad+bc)$$

$$\text{Therefore: } r = ac - bd$$

$$\text{Therefore: } i = ad + bc$$

On Alpha and I64 systems, some restrictions apply when linking OTS$MULCG_R3, OTS$MULCS, and OTS$MULCT_R3. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF_F	Floating value overflow can occur.
SS$_ROPRAND	Reserved operand. OTS$MULCx encountered a floating-point reserved operand because of incorrect user input. A floating-point reserved operand is a floating-point datum with a sign bit of 1 and a biased

exponent of zero. Floating-point reserved operands are reserved for future OpenVMS use.

Example

```
C+
C    This Fortran example forms the product of
C    two complex numbers using OTS$MULCD_R3
C    and the Fortran random number generator RAN.
C
C    Declare Z1, Z2, and Z_Q as complex values. OTS$MULCD_R3
C    returns the complex product of Z1 times Z2:
C    Z_Q = Z1 * Z2
C-

        COMPLEX*16 Z1,Z2,Z_Q
C+
C    Generate a complex number.
C-
        Z1 = (8.0,4.0)
C+
C    Generate another complex number.
C-
        Z2 = (2.0,3.0)
C+
C    Compute the complex product of Z1*Z2.
C-
        Z_Q = Z1 * Z2
        TYPE *, ' The complex product of',Z1,' times ',Z2,' is'
        TYPE *, '      ',Z_Q
        END
```

This Fortran example uses OTS$MULCD_R3 to multiply two complex numbers. The output generated by this program is as follows:

```
 The complex product of (8.000000000000000,4.000000000000000) times
(2.000000000000000,3.000000000000000) is
      (4.000000000000000,32.00000000000000)
```

OTS$POWCxCx

OTS$POWCxCx — The Raise a Complex Base to a Complex Floating-Point Exponent routines raise a complex base to a complex exponent.

Format

```
OTS$POWCC complex-base ,complex-exponent-value

OTS$POWCDCD_R3 complex-base ,complex-exponent-value (VAX only)

OTS$POWCGCG_R3 complex-base ,complex-exponent-value

OTS$POWCSCS complex-base ,complex-exponent-value

OTS$POWCTCT_R3 complex-base ,complex-exponent-value
```

Each of these formats corresponds to one of the floating-point complex types.

Returns

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**write only**
mechanism:	**by value**

Result of raising a complex base to a complex exponent. OTS$POWCC returns an F-floating complex number. OTS$POWCDCD_R3 returns a D-floating complex number. OTS$POWCGCG_R3 returns a G-floating complex number. OTS$POWCSCS returns an IEEE S-floating complex number. OTS$POWCTCT_R3 returns an IEEE T-floating complex number.

Arguments

complex-base

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**read only**
mechanism:	**by value**

Complex base. The **complex-base** argument contains the value of the base. For OTS$POWCC, **complex-base** is an F-floating complex number. For OTS$POWCDCD_R3, **complex-base** is a D-floating complex number. For OTS$POWCGCG_R3, **complex-base** is a G-floating complex number. For OTS$POWCSCS, **complex-base** is an IEEE S-floating complex number. For OTS$POWCTCT_R3, **complex-base** is an IEEE T-floating complex number.

complex-exponent-value

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**read only**
mechanism:	**by value**

Complex exponent. The **complex-exponent-value** argument contains the value of the exponent. For OTS$POWCC, **complex-exponent-value** is an F-floating complex number. For OTS$POWCDCD_R3, **complex-exponent-value** is a D-floating complex number. For OTS$POWCGCG_R3, **complex-exponent-value** is a G-floating complex number. For OTS$POWCSCS, **complex-exponent-value** is an IEEE S-floating complex number. For OTS$POWCTCT_R3, **complex-exponent-value** is an IEEE T-floating complex number.

Description

OTS$POWCC, OTS$POWCDCD_R3, OTS$POWCGCG_R3, OTS$POWCSCS, and OTS$POWCSCT_R3 raise a complex base to a complex exponent. The American National Standard FORTRAN-77 (ANSI X3.9—1978) defines complex exponentiation as follows:

*x^y = exp(y * log(x))*

In this example, *x* and *y* are of type COMPLEX.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWCC or OTS$POWCGCG_R3. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

MTH$_INVARGMAT	Invalid argument in math library. Base is (0.,0.).
MTH$_FLOOVEMAT	Floating-point overflow in math library.
SS$_ROPRAND	Reserved operand.

Examples

1.
```
C+
C    This Fortran example raises a complex base to a complex
C    power using OTS$POWCC.
C
C    Declare Z1, Z2, Z3, and OTS$POWCC as complex values. Then OTS$POWCC
C    returns the complex result of Z1**Z2:   Z3 = OTS$POWCC(Z1,Z2),
C    where Z1 and Z2 are passed by value.
C-

        COMPLEX Z1,Z2,Z3,OTS$POWCC
C+
C    Generate a complex base.
C-
        Z1 = (2.0,3.0)
C+
C    Generate a complex power.
C-
        Z2 = (1.0,2.0)
C+
C    Compute the complex value of Z1**Z2.
C-
        Z3 = OTS$POWCC( %VAL(REAL(Z1)), %VAL(AIMAG(Z1)),
     +                  %VAL(REAL(Z2)), %VAL(AIMAG(Z2)))
        TYPE *, ' The value of',Z1,'**',Z2,' is',Z3
        END
```

   This Fortran example uses OTS$POWCC to raise an F-floating complex base to an F-floating complex exponent.

   The output generated by this program is as follows:

```
 The value of (2.000000,3.000000)** (1.000000,2.000000) is
(-0.4639565,-0.1995301)
```

2.
```
C+
C    This Fortran example raises a complex base to a complex
C    power using OTS$POWCGCG_R3.
C
C    Declare Z1, Z2, and Z3 as complex values. OTS$POWCGCG_R3
C    returns the complex result of Z1**Z2: Z3 = Z1**Z2.
C-
```

```
        COMPLEX*16 Z1,Z2,Z3
C+
C    Generate a complex base.
C-
        Z1 = (2.0,3.0)
C+
C    Generate a complex power.
C-
        Z2 = (1.0,2.0)
C+
C    Compute the complex value of Z1**Z2.
C-
        Z3 = Z1**Z2
        TYPE 1,Z1,Z2,Z3
   1    FORMAT(' The value of (',F11.8,',',F11.8,')**(',F11.8,
     +  ',',F11.8,') is (',F11.8,',',F11.8,').')
        END
```

This Fortran example program shows how to use OTS$POWCGCG_R3. Notice the high precision in the output generated by this program:

```
The value of ( 2.00000000, 3.00000000)**( 1.00000000, 2.00000000) is
(-0.46395650,-0.46395650).
```

OTS$POWCxJ

OTS$POWCxJ — The Raise a Complex Base to a Signed Longword Integer Exponent routines return the complex result of raising a complex base to an integer exponent.

Format

`OTS$POWCJ complex-base ,longword-integer-exponent`

`OTS$POWCDJ_R3 complex-base ,longword-integer-exponent (VAX only)`

`OTS$POWCGJ_R3 complex-base ,longword-integer-exponent (VAX only)`

`OTS$POWCSJ complex-base ,longword-integer-exponent`

`OTS$POWCTJ_R3 complex-base ,longword-integer-exponent`

Each of these formats corresponds to one of the floating-point complex types.

Returns

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, IEEE S_floating complex, IEEE T_floating complex**
access:	**write only**
mechanism:	**by value**

Complex result of raising a complex base to an integer exponent. OTS$POWCJ returns an F-floating complex number. OTS$POWCDJ_R3 returns a D-floating complex number. OTS$POWCGJ_R3 returns a G-floating complex number. OTS$POWCGS_R3 returns an IEEE S-floating complex number.

OTS$POWCGT_R3 returns an IEEE T-floating complex number. In each format, the result and base are of the same data type.

Arguments

complex-base

OpenVMS usage:	**complex_number**
type:	**F_floating complex, D_floating complex, G_floating complex, S_floating complex, T_floating complex,**
access:	**read only**
mechanism:	**by value**

Complex base. The **complex-base** argument contains the complex base. For OTS$POWCJ, **complex-base** is an F-floating complex number. For OTS$POWCDJ_R3, **complex-base** is a D-floating complex number. For OTS$POWCGJ_R3, **complex-base** is a G-floating complex number. For OTS$POWCSJ, **complex-base** is an IEEE S-floating complex number. For OTS$POWCTJ_R3,**complex-base** is an IEEE T-floating complex number.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword containing the exponent.

Description

The OTS$POWC*x*J routines return the complex result of raising a complex base to an integer exponent. The complex result is as follows:

Base	**Exponent**	**Result**
Any	> 0	The product of (base**2 ^{i}), where *i* is each nonzero bit in **longword-integer-exponent**.
(0.,0.)	<= 0	Undefined exponentiation.
Not (0.,0.)	< 0	The product of (base**2 ^{i}), where *i* is each nonzero bit in **longword-integer-exponent**.
Not (0.,0.)	0	(1.0,0.0)

On Alpha and I64 systems, some restrictions apply when linking OTS$POWCJ, OTS$POWCSJ, and OTS$POWCTJ_R3. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTDIV	Floating-point division by zero.
SS$_FLTOVF	Floating-point overflow.

MTH$_UNDEXP	Undefined exponentiation.

Example

```
+
C    This Fortran example raises a complex base to
C    a NONNEGATIVE integer power using OTS$POWCJ.
C
C    Declare Z1, Z2, Z3, and OTS$POWCJ as complex values.
C    Then OTS$POWCJ returns the complex result of
C    Z1**Z2:   Z3 = OTS$POWCJ(Z1,Z2),
C    where Z1 and Z2 are passed by value.
C-
        COMPLEX Z1,Z3,OTS$POWCJ
        INTEGER Z2
C+
C    Generate a complex base.
C-
        Z1 = (2.0,3.0)
C+
C    Generate an integer power.
C-
        Z2 = 2

C+
C    Compute the complex value of Z1**Z2.
C-
        Z3 = OTS$POWCJ( %VAL(REAL(Z1)), %VAL(AIMAG(Z1)), %VAL(Z2))
        TYPE 1,Z1,Z2,Z3
  1     FORMAT(' The value of (',F10.8,',',F11.8,')**',I1,' is
     +  (',F11.8,',',F12.8,').')
        END
```

The output generated by this Fortran program is as follows:

```
The value of (2.00000000, 3.00000000)**2 is
(-5.00000000, 12.00000000).
```

OTS$POWDD

OTS$POWDD — The Raise a D-Floating Base to a D-Floating Exponent routine raises a D-floating base to a D-floating exponent.

Format

```
OTS$POWDD D-floating-point-base ,D-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a D-floating base to a D-floating exponent.

Arguments

D-floating-point-base

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**read only**
mechanism:	**by value**

Base. The **D-floating-point-base** argument is a D-floating number containing the base.

D-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**read only**
mechanism:	**by value**

Exponent. The **D-floating-point-exponent** argument is a D-floating number that contains the exponent.

Description

OTS$POWDD raises a D-floating base to a D-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The D-floating result for OTS$POWDD is given by the following:

Base	**Exponent**	**Result**
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

Condition Values Signaled

MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.

MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **D-floating-point-base** is zero and **D-floating-point-exponent** is zero or negative, or if the **D-floating-point-base** is negative.

OTS$POWDJ

OTS$POWDJ — The Raise a D-Floating Base to a Longword Exponent routine raises a D-floating base to a longword exponent.

Format

```
OTS$POWDJ D-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a D-floating base to a longword exponent.

Arguments

D-floating-point-base

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**read only**
mechanism:	**by value**

Base. The **D-floating-point-base** argument is a D-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword that contains the signed longword integer exponent.

Description

OTS$POWDJ raises a D-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0
> 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **D-floating-point-base** is zero and **longword-integer-exponent** is zero or negative, or if the **D-floating-point-base** is negative.

OTS$POWDR

OTS$POWDR — The Raise a D-Floating Base to an F-Floating Exponent routine raises a D-floating base to an F-floating exponent.

Format

```
OTS$POWDR D-floating-point-base ,F-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a D-floating base to an F-floating exponent.

Arguments

D-floating-point-base

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**read only**
mechanism:	**by value**

Base. The **D-floating-point-base** argument is a D-floating number containing the base.

F-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**read only**
mechanism:	**by value**

Exponent. The **F-floating-point-exponent** argument is an F-floating number that contains the exponent.

Description

OTS$POWDR raises a D-floating base to an F-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

OTS$POWDR converts the F-floating exponent to a D-floating number. The D-floating result for OTS$POWDR is given by the following:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log 2\ (base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log 2\ (base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **D-floating-point-base** is zero and **F-floating-point-exponent** is zero or negative, or if the **D-floating-point-base** is negative.

OTS$POWGG

OTS$POWGG — The Raise a G-Floating Base to a G-Floating Exponent routine raises a G-floating base to a G-floating exponent.

Format

```
OTS$POWGG G-floating-point-base ,G-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**G_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a G-floating base to a G-floating exponent.

Arguments

G-floating-point-base

OpenVMS usage:	**floating_point**
type:	**G_floating**
access:	**read only**
mechanism:	**by value**

Base that OTS$POWGG raises to a G-floating exponent. The **G-floating-point-base** argument is a G-floating number containing the base.

G-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**G_floating**
access:	**read only**
mechanism:	**by value**

Exponent to which OTS$POWGG raises the base. The **G-floating-point-exponent** argument is a G-floating number containing the exponent.

Description

OTS$POWGG raises a G-floating base to a G-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The G-floating result for OTS$POWGG is as follows:

Base	Exponent	Result
= 0	> 0	0.0

Base	Exponent	Result
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWGG. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponent. This error is signaled if **G-floating-point-base** is zero and **G-floating-point-exponent** is zero or negative, or if **G-floating-point-base** is negative.

Example

```
C+
C   This example demonstrates the use of OTS$POWGG,
C   which raises a G-floating point base
C   to a G-floating point power.
C-
        REAL*8 X,Y,RESULT,OTS$POWGG
C+
C   The arguments of OTS$POWGG are passed by value. Fortran can
C   only pass INTEGER and REAL*4 expressions as VALUE. Since
C   INTEGER and REAL*4 values are one longword long, while REAL*8
C   values are two longwords long, equate the base (and power) to
C   two-dimensional INTEGER vectors. These vectors will be passed
C   by VALUE.
C-
        INTEGER N(2),M(2)
        EQUIVALENCE (N(1),X), (M(1),Y)
        X = 8.0
        Y = 2.0
C+
C  To pass X by value, pass N(1) and N(2) by value. Similarly for Y.
C-
        RESULT = OTS$POWGG(%VAL(N(1)),%VAL(N(2)),%VAL(M(1)),%VAL(M(2)))
        TYPE *,' 8.0**2.0 IS ',RESULT
```

```
        X = 9.0
        Y = -0.5
C+
C   In Fortran, OTS$POWWGG is indirectly called by simply using the
C   exponentiation operator.
C-
        RESULT = X**Y
        TYPE *,' 9.0**-0.5 IS ',RESULT
        END
```

This Fortran example uses OTS$POWGG to raise a G-floating base to a G-floating exponent.

The output generated by this example is as follows:

```
8.0**2.0 IS    64.0000000000000
9.0**-0.5 IS  0.333333333333333
```

OTS$POWGJ

OTS$POWGJ — The Raise a G-Floating Base to a Longword Exponent routine raises a G-floating base to a longword exponent.

Format

```
OTS$POWGJ G-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**G_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a G-floating base to a longword exponent.

Arguments

G-floating-point-base

OpenVMS usage:	**floating_point**
type:	**G_floating**
access:	**read only**
mechanism:	**by value**

Base that OTS$POWGJ raises to a longword exponent. The **G-floating-point-base** argument is a G-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**

access:	**read only**
mechanism:	**by value**

Exponent to which OTS$POWGJ raises the base. The **longword-integer-exponent** argument is a signed longword containing the exponent.

Description

OTS$POWGJ raises a G-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0
> 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWGJ. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponent. This error is signaled if **G-floating-point-base** is zero and **longword-integer-exponent** is zero or negative, or if **G-floating-point-base** is negative.

OTS$POWHH_R3 (VAX Only)

OTS$POWHH_R3 (VAX Only) — On VAX systems, the Raise an H-Floating Base to an H-Floating Exponent routine raises an H-floating base to an H-floating exponent.

Format

```
OTS$POWHH_R3 H-floating-point-base ,H-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**H_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an H-floating base to an H-floating exponent.

Arguments

H-floating-point-base

OpenVMS usage:	**floating_point**
type:	**H_floating**
access:	**read only**
mechanism:	**by value**

Base. The **H-floating-point-base** argument is an H-floating number containing the base.

H-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**H_floating**
access:	**read only**
mechanism:	**by value**

Exponent. The **H-floating-point-exponent** argument is an H-floating number that contains the H-floating exponent.

Description

OTS$POWHH_R3 raises an H-floating base to an H-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The H-floating result for OTS$POWHH_R3 is as follows:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation

Base	Exponent	Result
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **H-floating-point-base** is zero and **H-floating-point-exponent** is zero or negative, or if the **H-floating-point-base** is negative.

Example

```
C+
C Example of OTS$POWHH, which raises an H_floating
C point base to an H_floating point power. In Fortran,
C it is not directly called.
C-
        REAL*16 X,Y,RESULT
        X = 9877356535.0
        Y = -0.5837653
C+
C In Fortran, OTS$POWWHH is indirectly called by simply using the
C exponentiation operator.
C-
        RESULT = X**Y
        TYPE *,' 9877356535.0**-0.5837653 IS ',RESULT
        END
```

This Fortran example demonstrates how to call OTS$POWHH_R3 to raise an H-floating base to an H-floating power.

The output generated by this program is as follows:

```
9877356535.0**-0.5837653 IS   1.463779145994628357482343598205427E-0006
```

OTS$POWHJ_R3 (VAX Only)

OTS$POWHJ_R3 (VAX Only) — On VAX systems, the Raise an H-Floating Base to a Longword Exponent routine raises an H-floating base to a longword exponent.

Format

```
OTS$POWHJ_R3 H-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**H_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an H-floating base to a longword exponent.

Arguments

H-floating-point-base

OpenVMS usage:	**floating_point**
type:	**H_floating**
access:	**read only**
mechanism:	**by value**

Base. The **H-floating-point-base** argument is an H-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword that contains the signed longword exponent.

Description

OTS$POWHJ_R3 raises an H-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.

Base	Exponent	Result
< 0	= 0	1.0
> 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **H-floating-point-base** is zero and **longword-integer-exponent** is zero or negative, or if the **H-floating-point-base** is negative.

OTS$POWII

OTS$POWII — The Raise a Word Base to a Word Exponent routine raises a word base to a word exponent.

Format

```
OTS$POWII word-integer-base ,word-integer-exponent
```

Returns

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**write only**
mechanism:	**by value**

Result of raising a word base to a word exponent.

Arguments

word-integer-base

OpenVMS usage:	**word_signed**
type:	**word (signed)**

access:	**read only**
mechanism:	**by value**

Base. The **word-integer-base** argument is a signed word containing the base.

word-integer-exponent

OpenVMS usage:	**word_signed**
type:	**word (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **word-integer-exponent** argument is a signed word containing the exponent.

Description

The OTS$POWII routine raises a word base to a word exponent.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWII. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTDIV	Arithmetic trap. This error is signaled by the hardware if a floating-point division by zero occurs.
SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **word-integer-base** is zero and **word-integer-exponent** is zero or negative, or if **word-integer-base** is negative.

OTS$POWJJ

OTS$POWJJ — The Raise a Longword Base to a Longword Exponent routine raises a signed longword base to a signed longword exponent.

Format

```
OTS$POWJJ longword-integer-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**write only**
mechanism:	**by value**

Result of raising a signed longword base to a signed longword exponent.

Arguments

longword-integer-base

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Base. The **longword-integer-base** argument is a signed longword containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword containing the exponent.

Description

The OTS$POWJJ routine raises a signed longword base to a signed longword exponent.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWJJ. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTDIV	Arithmetic trap. This error is signaled by the hardware if a floating-point division by zero occurs.
SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **longword-integer-base** is zero and **longword-integer-exponent** is zero or negative, or if **longword-integer-base** is negative.

OTS$POWLULU

OTS$POWLULU — The Raise an Unsigned Longword Base to an Unsigned Longword Exponent routine raises an unsigned longword integer base to an unsigned longword integer exponent.

Format

```
OTS$POWLULU unsigned-lword-int-base, unsigned-lword-int-exponent
```

Returns

OpenVMS usage:	**longword_unsigned**

type:	**longword (unsigned)**
access:	**write only**
mechanism:	**by value**

Result of raising an unsigned longword integer base to an unsigned longword integer exponent.

Arguments

unsigned-lword-int-base

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Unsigned longword integer base. The **unsigned-lword-int-base** argument contains the value of the integer base.

unsigned-lword-int-exponent

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Unsigned longword integer exponent. The **unsigned-lword-int-exponent** argument contains the value of the integer exponent.

Description

OTS$POWLULU returns the unsigned longword integer result of raising an unsigned longword integer base to an unsigned longword integer exponent. Note that overflow cannot occur in this routine. If the result or intermediate result is greater than 32 bits, the low-order 32 bits are used.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWLULU. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

MTH$_UNDEXP	Both the base and exponent values are zero.

OTS$POWRD

OTS$POWRD — The Raise an F-Floating Base to a D-Floating Exponent routine raises an F-floating base to a D-floating exponent.

Format

```
OTS$POWRD F-floating-point-base ,D-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an F-floating base to a D-floating exponent.

Arguments

F-floating-point-base

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**read only**
mechanism:	**by value**

Base. The **F-floating-point-base** argument is an F-floating number containing the base.

D-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**D_floating**
access:	**read only**
mechanism:	**by value**

Exponent. The **D-floating-point-exponent** argument is a D-floating number that contains the exponent.

Description

OTS$POWRD raises an F-floating base to a D-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

OTS$POWRD first converts the F-floating base to D-floating. The D-floating result for OTS$POWRD is as follows:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*LOG2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*LOG2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **F-floating-point-base**is zero and **D-floating-point-exponent** is zero or negative, or if **F-floating-point-base** is negative.

Example

```
C+
C   This Fortran example uses OTS$POWRD, to raise an F-floating point
C   base to a D-floating point exponent. The result is a D-floating value.
C-
        REAL*4 X
        REAL*8 Y,RESULT,OTS$POWRD
        INTEGER M(2)
        EQUIVALENCE (M(1),Y)
        X = 9768.0
        Y = 9.0
C+
C  The arguments of OTS$POWRD are passed by value.
C-
        RESULT = OTS$POWRD(%VAL(X),%VAL(M(1)),%VAL(M(2)))
        TYPE *,' 9768.0**9.0 IS ',RESULT
        X = 7689.0
        Y = -0.587436654545
C+
C   In Fortran, OTS$POWRD is indirectly called by the exponentiation
C   operator.
C-
        RESULT = X**Y
        TYPE *,' 7689.0**-0.587436654545 IS ',RESULT
        END
```

This Fortran example uses OTS$POWRD to raise an F-floating base to a D-floating exponent. Notice the difference in the precision of the result produced by this routine in comparison to the result produced by OTS$POWRR. The output generated by this program is as follows:

```
9768.0**9.0 IS   8.0956338648832908E+35
7689.0**-0.587436654545 IS   5.2155199252836588E-03
```

OTS$POWRJ

OTS$POWRJ — The Raise an F-Floating Base to a Longword Exponent routine raises an F-floating base to a longword exponent.

Format

```
OTS$POWRJ F-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an F-floating base to a longword exponent.

Arguments

F-floating-point-base

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**read only**
mechanism:	**by value**

Base. The **F-floating-point-base** argument is an F-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword that contains the longword exponent.

Description

OTS$POWRJ raises an F-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base*$**2^{i}$), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0

Base	Exponent	Result
> 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base***2 ^{i}), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWRJ. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **F-floating-point-base**is zero and **longword-integer-exponent** is zero or negative, or if **F-floating-point-base** is negative.

OTS$POWRR

OTS$POWRR — The Raise an F-Floating Base to an F-Floating Exponent routine raises an F-floating base to an F-floating exponent.

Format

```
OTS$POWRR F-floating-point-base ,F-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an F-floating base to an F-floating exponent.

Arguments

F-floating-point-base

OpenVMS usage:	**floating_point**
type:	**F_floating**

access:	**read only**
mechanism:	**by value**

Base. The **F-floating-point-base** argument is an F-floating number containing the base.

F-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**F_floating**
access:	**read only**
mechanism:	**by value**

Exponent. The **F-floating-point-exponent** argument is an F-floating number that contains the exponent.

Description

OTS$POWRR raises an F-floating base to an F-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The F-floating result for OTS$POWRR is as follows:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

On Alpha and i64 systems, some restrictions apply when linking OTS$POWRR. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **F-floating-point-base**is zero and **F-floating-point-exponent** is zero or negative, or if **F-floating-point-base** is negative.

Example

```
C+
C  This Fortran example demonstrates the use
C  of OTS$POWRR, which raises an F-floating
C  point base to an F-floating point power.
C-

        REAL*4 X,Y,RESULT,OTS$POWRR
        X = 8.0
        Y = 2.0

C+
C  The arguments of OTS$POWRR are passed by value.
C-

        RESULT = OTS$POWRR(%VAL(X),%VAL(Y))
        TYPE *,' 8.0**2.0 IS ',RESULT
        X = 9.0
        Y = -0.5

C+
C  In Fortran, OTS$POWRR is indirectly called by simply
C  using the exponentiation operator.
C-

        RESULT = X**Y
        TYPE *,' 9.0**-0.5 IS ',RESULT
        END
```

This Fortran example uses OTS$POWRR to raise an F-floating point base to an F-floating point exponent. The output generated by this program is as follows:

```
8.0**2.0 IS    64.00000
9.0**-0.5 IS   0.3333333
```

OTS$POWSJ

OTS$POWSJ — The Raise an IEEE S-Floating Base to a Longword Exponent routine raises an IEEE S-floating base to a longword exponent.

Format

```
OTS$POWSJ S-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**S_floating**
access:	**write only**

mechanism:	**by value**

Result of raising an IEEE S-floating base to a longword exponent.

Arguments

S-floating-point-base

OpenVMS usage:	**floating_point**
type:	**S_floating**
access:	**read only**
mechanism:	**by value**

Base. The **S-floating-point-base** argument is an IEEE S-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword that contains the longword exponent.

Description

OTS$POWSJ raises an IEEE S-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base*$**2^{i}$), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0
> 0	< 0	1.0/(*base*$**2^{i}$), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base*$**2^{i}$), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWSJ. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **S-floating-point-base**is zero and **longword-integer-exponent** is zero or negative, or if **S-floating-point-base** is negative.

OTS$POWSS

OTS$POWSS — The Raise an IEEE S-Floating Base to an IEEE S-Floating Exponent routine raises a IEEE S-floating base to an IEEE S-floating exponent.

Format

```
OTS$POWSS S-floating-point-base ,S-floating-point-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**IEEE S_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an IEEE S-floating base to an IEEE S-floating exponent.

Arguments

S-floating-point-base

OpenVMS usage:	**floating_point**
type:	**IEEE S_floating**
access:	**read only**
mechanism:	**by value**

Base that OTS$POWSS raises to an IEEE S-floating exponent. The **S-floating-point-base** argument is an IEEE S-floating number containing the base.

S-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**IEEE S_floating**
access:	**read only**

mechanism:	**by value**

Exponent to which OTS$POWSS raises the base. The **S-floating-point-exponent** argument is an IEEE S-floating number containing the exponent.

Description

OTS$POWSS raises an IEEE S-floating base to an IEEE S-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The S-floating result for OTS$POWSS is as follows:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWSS. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponent. This error is signaled if **S-floating-point-base** is zero and **S-floating-point-exponent** is zero or negative, or if **S-floating-point-base** is negative.

Example

The following example demonstrates the use of OTS$POWSS.

```
C+
C This Fortran example demonstrates the use of
C OTS$POWSS, which raises an IEEE S-floating
C point base to an IEEE S-floating point power.
C-
```

```
 OPTIONS /FLOAT=IEEE_FLOAT

 REAL*4 X,Y,RESULT,OTS$POWSS
 X = 10.0
 Y = 3.0

C+
C The arguments of OTS$POWSS are passed by value.
C-

 RESULT = OTS$POWSS(%VAL(X),%VAL(Y))
 TYPE *,' 10.0**3.0 IS ',RESULT
 X = 9.0
 Y = -0.5

C+
C In Fortran, OTS$POWSS is indirectly called by
C simply using the exponentiation operator.
C-

 RESULT = X**Y
 TYPE *,' 9.0**-0.5 IS ',RESULT
 END
```

This Fortran example uses OTS$POWSS to raise an IEEE S-floating point base to an IEEE S-floating point exponent. The output generated by this program is as follows:

```
   10.0**3.0 IS    1000.000
   9.0**-0.5 IS   0.3333333
```

OTS$POWTJ

OTS$POWTJ — The Raise a T-Floating base to a Longword Exponent routine raises an IEEE T-floating base to a longword exponent.

Format

```
OTS$POWTJ T-floating-point-base ,longword-integer-exponent
```

Returns

OpenVMS usage:	**floating_point**
type:	**IEEE T_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an IEEE T-floating base to a longword exponent.

Arguments

T-floating-point-base

OpenVMS usage:	**floating_point**

type:	**IEEE T_floating**
access:	**read only**
mechanism:	**by value**

Base. The **T-floating-point-base** argument is an IEEE T-floating number containing the base.

longword-integer-exponent

OpenVMS usage:	**longword_signed**
type:	**longword (signed)**
access:	**read only**
mechanism:	**by value**

Exponent. The **longword-integer-exponent** argument is a signed longword that contains the longword exponent.

Description

OTS$POWTJ raises an IEEE T-floating base to a longword exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base***2^i), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0
> 0	< 0	1.0/(*base***2^i), where *i* is each nonzero bit position in **longword-integer-exponent**.
= 0	< 0	Undefined exponentiation.
< 0	< 0	1.0/(*base***2^i), where *i* is each nonzero bit position in **longword-integer-exponent**.

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWTJ. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.

MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponentiation. This error is signaled if **T-floating-point-base** is zero and **longword-integer-exponent** is zero or negative, or if **T-floating-point-base** is negative.

OTS$POWTT

OTS$POWTT — The Raise an IEEE T-Floating Base to an IEEE T-Floating Exponent routine raises an IEEE T-floating base to an IEEE T-floating exponent.

Format

OTS$POWTT T-floating-point-base ,T-floating-point-exponent

Returns

OpenVMS usage:	**floating_point**
type:	**IEEE T_floating**
access:	**write only**
mechanism:	**by value**

Result of raising an IEEE T-floating base to an IEEE T-floating exponent.

Arguments

T-floating-point-base

OpenVMS usage:	**floating_point**
type:	**IEEE T_floating**
access:	**read only**
mechanism:	**by value**

Base that OTS$POWTT raises to an IEEE T-floating exponent. The **T-floating-point-base** argument is an IEEE T-floating number containing the base.

T-floating-point-exponent

OpenVMS usage:	**floating_point**
type:	**IEEE T_floating**
access:	**read only**
mechanism:	**by value**

Exponent to which OTS$POWTT raises the base. The **T-floating-point-exponent** argument is an IEEE T-floating number containing the exponent.

Description

OTS$POWTT raises an IEEE T-floating base to an IEEE T-floating exponent.

The internal calculations and the floating-point result have the same precision as the base value.

The T-floating result for OTS$POWTT is as follows:

Base	Exponent	Result
= 0	> 0	0.0
= 0	= 0	Undefined exponentiation
= 0	< 0	Undefined exponentiation
< 0	Any	Undefined exponentiation
> 0	> 0	$2^{[exponent*\log2(base)]}$
> 0	= 0	1.0
> 0	< 0	$2^{[exponent*\log2(base)]}$

Floating-point overflow can occur.

Undefined exponentiation occurs if the base is zero and the exponent is zero or negative, or if the base is negative.

On Alpha and I64 systems, some restrictions apply when linking OTS$POWTT. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

SS$_FLTOVF	Arithmetic trap. This error is signaled by the hardware if a floating-point overflow occurs.
MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library.
MTH$_UNDEXP	Undefined exponent. This error is signaled if **T-floating-point-base** is zero and **T-floating-point-exponent** is zero or negative, or if **T-floating-point-base** is negative.

Example

The following example demonstrates the use of OTS$POWTT.

```
C+
C This Fortran example demonstrates the use of
C OTS$POWTT, which raises an IEEE T-floating
C point base to an IEEE T-floating point power.
C-

 OPTIONS /FLOAT=IEEE_FLOAT

 REAL*8 X,Y,RESULT,OTS$POWTT
 X = 10.0
 Y = 3.0

C+
C The arguments of OTS$POWTT are passed by value.
C-
```

```
 RESULT = OTS$POWTT(%VAL(X),%VAL(Y))
 TYPE *,' 10.0**3.0 IS ',RESULT
 X = 9.0
 Y = -0.5

C+
C In Fortran, OTS$POWTT is indirectly called by
C simply using the exponentiation operator.
C-

 RESULT = X**Y
 TYPE *,' 9.0**-0.5 IS ',RESULT
 END
```

This Fortran example uses OTS$POWTT to raise an IEEE T-floating point base to an IEEE T-floating point exponent. The output generated by this program is as follows:

```
   10.0**3.0 IS    1000.00000000000
   9.0**-0.5 IS   0.333333333333333
```

OTS$POWxLU

OTS$POWxLU — The Raise a Floating-Point Base to an Unsigned Longword Integer Exponent routines raise a floating-point base to an unsigned longword integer exponent.

Format

```
OTS$POWRLU floating-point-base ,unsigned-lword-int-exponent

OTS$POWDLU floating-point-base ,unsigned-lword-int-exponent

OTS$POWGLU floating-point-base ,unsigned-lword-int-exponent

OTS$POWSLU floating-point-base ,unsigned-lword-int-exponent

OTS$POWTLU floating-point-base ,unsigned-lword-int-exponent

OTS$POWHLU_R3 floating-point-base ,unsigned-lword-int-exponent (VAX only)
```

Returns

OpenVMS usage:	**floating_point**
type:	**F_floating, D_floating, G_floating, H_floating, IEEE S_floating, IEEE T_floating**
access:	**write only**
mechanism:	**by value**

Result of raising a floating-point base to an unsigned longword integer exponent. OTS$POWRLU returns an F-floating number. OTS$POWDLU returns a D-floating number. OTS$POWGLU returns a G-floating number. OTS$POWSLU returns an IEEE S-floating number. OTS$POWTLU returns an IEEE T-floating number.

On VAX systems, OTS$POWHLU_R3 returns an H-floating number.

Arguments

floating-point-base

OpenVMS usage:	**floating_point**
type:	**F_floating, D_floating, G_floating, H_floating, IEEE S_floating, IEEE T_floating**
access:	**read only**
mechanism:	**by value**

Floating-point base. The **floating-point-base** argument contains the value of the base. For OTS$POWRLU, **floating-point-base** is an F-floating number. For OTS$POWDLU, **floating-point-base** is a D-floating number. For OTS$POWGLU, **floating-point-base** is a G-floating number. For OTS$POWHLU_R3, **floating-point-base** is an H-floating number. For OTS$POWSLU, **floating-point-base** is an IEE S-floating number. For OTS$POWTLU, **floating-point-base** is an IEEE T-floating number.

unsigned-lword-int-exponent

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Integer exponent. The **unsigned-lword-int-exponent** argument contains the value of the unsigned longword integer exponent.

Description

The OTS$POW*x*LU routines return the result of raising a floating-point base to an unsigned longword integer exponent. The floating-point result is as follows:

Base	Exponent	Result
Any	> 0	Product of (*base*$*2^{i}$), where *i* is each nonzero bit position in **longword-integer-exponent**.
> 0	= 0	1.0
= 0	= 0	Undefined exponentiation.
< 0	= 0	1.0

On Alpha and I64 systems, some restrictions apply when linking OTS$POWRLU, OTS$POWGLU, OTS$POWSLU, and OTS$POWTLU. See Chapter 1 for more information about these restrictions.

Condition Values Signaled

MTH$_FLOOVEMAT	Floating-point overflow in math library.
MTH$_FLOUNDMAT	Floating-point underflow in math library. This can only occur if the caller has floating-point underflow enabled.

MTH$_UNDEXP	Undefined exponentiation. This occurs if both the **floating-point-base** and**unsigned-longword-integer-exponent** arguments are zero.

OTS$SCOPY_DXDX

OTS$SCOPY_DXDX — The Copy a Source String Passed by Descriptor to a Destination String routine copies a source string to a destination string. Both strings are passed by descriptor.

Format

```
OTS$SCOPY_DXDX source-string ,destination-string
```

Corresponding JSB Entry Point

```
OTS$SCOPY_DXDX6
```

Returns

OpenVMS usage:	**word_unsigned**
type:	**word (unsigned)**
access:	**write only**
mechanism:	**by value**

Number of bytes not moved to the destination string if the length of **source-string** is greater than the length of **destination-string**. The value is 0 (zero) otherwise.

Arguments

source-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by descriptor**

Source string. The **source-string** argument is the address of a descriptor pointing to the source string. The descriptor class can be unspecified, fixed length, dynamic, scalar decimal, array, noncontiguous array, or varying.

destination-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor**

Destination string. The **destination-string** argument is the address of a descriptor pointing to the destination string. The class field determines the appropriate action.

See the Description section for further information.

Description

OTS$SCOPY_DXDX copies a source string to a destination string. It passes the source string by descriptor. If the length of the source string is greater than the length of the destination string, OTS$SCOPY_DXDX returns the number of bytes not moved to the destination string. If the length of the source string is less than or equal to the length of the destination string, it returns 0 (zero). All error conditions except truncation are signaled; truncation is ignored.

An equivalent JSB entry point is provided, with R0 being the first argument (the descriptor of the source string), and R1 the second (the descriptor of the destination string). On return, R0 through R5 and the PSL are as they would be after a VAX MOVC5 instruction. R0 through R5 contain the following:

R0	Number of bytes of source string not moved to destination string
R1	Address one byte beyond the last copied byte in the source string
R2	0
R3	Address one byte beyond the destination string
R4	0
R5	0

For further information, see the *VAX Architecture Reference Manual*.

The actions taken by OTS$SCOPY_DXDX depend on the descriptor class of the destination string. The following table describes these actions for each descriptor class:

Descriptor Class	Action
S, Z, SD, A, NCA	Copy the source string. If needed, space fill or truncate on the right.
D	If the area specified by the destination descriptor is large enough to contain the source string, copy the source string and set the new length in the destination descriptor. If the area specified is not large enough, return the previous space allocation if any, and then dynamically allocate the amount of space needed. Copy the source string and set the new length and address in the destination descriptor.
VS	Copy source string to destination string up to the limit of the destination descriptor's MAXSTRLEN field with no padding. Adjust the string's current length field (CURLEN) to the actual number of bytes copied.

Condition Values Signaled

OTS$_FATINTERR	Fatal internal error.
OTS$_INVSTRDES	Invalid string descriptor.
OTS$_INSVIRMEM	Insufficient virtual memory.

OTS$SCOPY_R_DX

OTS$SCOPY_R_DX — The Copy a Source String Passed by Reference to a Destination String routine copies a source string passed by reference to a destination string.

Format

```
OTS$SCOPY_R_DX
   word-int-source-length-val ,source-string-address ,destination-string
```

Corresponding JSB Entry Point

```
OTS$SCOPY_R_DX6
```

Returns

OpenVMS usage:	**word_unsigned**
type:	**word (unsigned)**
access:	**write only**
mechanism:	**by value**

Number of bytes not moved to the destination string if the length of the source string pointed to by **source-string-address** is greater than the length of **destination-string**. Otherwise, the value is 0 (zero).

Arguments

word-int-source-length-val

OpenVMS usage:	**word_unsigned**
type:	**word (unsigned)**
access:	**read only**
mechanism:	**by value**

Length of the source string. The **word-int-source-length-val** argument is an unsigned word integer containing the length of the source string.

source-string-address

OpenVMS usage:	**char_string**
type:	**character string**
access:	**read only**
mechanism:	**by reference**

Source string. The **source-string-address** argument is the address of the source string.

destination-string

OpenVMS usage:	**char_string**
type:	**character string**
access:	**write only**
mechanism:	**by descriptor**

Destination string. The **destination-string** argument is the address of a descriptor pointing to the destination string. OTS$SCOPY_R_DX determines the appropriate action based on the descriptor's

CLASS field. The descriptor's LENGTH field alone or both the POINTER and LENGTH fields can be modified if the string is dynamic. For varying strings, the string's current length (CURLEN) is rewritten.

Description

OTS$SCOPY_R_DX copies a source string to a destination string. It passes the source string by reference preceded by a length argument. The length argument, **word-int-source-length-val**, is passed by value.

If the length of the source string is greater than the length of the destination string, OTS$SCOPY_R_DX returns the number of bytes not moved to the destination string. If the length of the source string is less than or equal to the length of the destination string, it returns 0 (zero). All conditions except truncation are signaled; truncation is ignored.

An equivalent JSB entry point is provided, with R0 being the first argument, R1 the second, and R2 the third, if any. The length argument is passed in bits 15:0 of the appropriate register. On return, R0 through R5 and the PSL are as they would be after a VAX MOVC5 instruction. R0 through R5 contain the following:

R0	Number of bytes of source string not moved to destination string
R1	Address one byte beyond the last copied byte in the source string
R2	0
R3	Address one byte beyond the destination string
R4	0
R5	0

For additional information, see the *VAX Architecture Reference Manual*.

The actions taken by OTS$SCOPY_R_DX depend on the descriptor class of the destination string. The following table describes these actions for each descriptor class:

Descriptor Class	Action
S, Z, SD, A, NCA	Copy the source string. If needed, space fill or truncate on the right.
D	If the area specified by the destination descriptor is large enough to contain the source string, copy the source string and set the new length in the destination descriptor. If the area specified is not large enough, return the previous space allocation (if any) and then dynamically allocate the amount of space needed. Copy the source string and set the new length and address in the destination descriptor.
VS	Copy source string to destination string up to the limit of the descriptor's MAXSTRLEN field with no padding. Adjust the string's current length (CURLEN) field to the actual number of bytes copied.

Condition Values Signaled

OTS$_FATINTERR	Fatal internal error.
OTS$_INVSTRDES	Invalid string descriptor.
OTS$_INSVIRMEM	Insufficient virtual memory.

Example

A Fortran example that demonstrates the manipulation of dynamic strings appears at the end of OTS$SGET1_DD. This example uses OTS$SCOPY_R_DX, OTS$SGET1_DD, and OTS$SFREE1_DD.

OTS$SFREE1_DD

OTS$SFREE1_DD — The Strings, Free One Dynamic routine returns one dynamic string area to free storage.

Format

```
OTS$SFREE1_DD dynamic-descriptor
```

Corresponding JSB Entry Point

```
OTS$SFREE1_DD6
```

Returns

None.

Arguments

dynamic-descriptor

OpenVMS usage:	**quadword_unsigned**
type:	**quadword (unsigned)**
access:	**modify**
mechanism:	**by reference**

Dynamic string descriptor. The **dynamic-descriptor** argument is the address of the dynamic string descriptor. The descriptor is assumed to be dynamic and its class field is not checked.

Description

OTS$SFREE1_DD deallocates the described string space and flags the descriptor as describing no string at all. The descriptor's POINTER and LENGTH fields contain 0.

Condition Values Signaled

OTS$_FATINTERR	Fatal internal error.

Example

A Fortran example that demonstrates the manipulation of dynamic strings appears at the end of OTS$SGET1_DD. This example uses OTS$SFREE1_DD, OTS$SGET1_DD, and OTS$SCOPY_R_DX.

OTS$SFREEN_DD

OTS$SFREEN_DD — The Free *n* Dynamic Strings routine takes as input a vector of one or more dynamic string areas and returns them to free storage.

Format

```
OTS$SFREEN_DD descriptor-count-value ,first-descriptor
```

Corresponding JSB Entry Point

```
OTS$SFREEN_DD6
```

Returns

None.

Arguments

descriptor-count-value

OpenVMS usage:	**longword_unsigned**
type:	**longword (unsigned)**
access:	**read only**
mechanism:	**by value**

Number of adjacent descriptors to be flagged as having no allocated area (the descriptor's POINTER and LENGTH fields contain 0) and to have their allocated areas returned to free storage by OTS$SFREEN_DD. The **descriptor-count-value** argument is an unsigned longword containing this number.

first-descriptor

OpenVMS usage:	**quadword_unsigned**
type:	**quadword (unsigned)**
access:	**modify**
mechanism:	**by reference**

First string descriptor of an array of string descriptors. The **first-descriptor** argument is the address of the first string descriptor. The descriptors are assumed to be dynamic, and their class fields are not checked.

Description

OTS$SFREEN_DD6 deallocates the described string space and flags each descriptor as describing no string at all. The descriptor's POINTER and LENGTH fields contain 0.

Condition Values Signaled

OTS$_FATINTERR	Fatal internal error.

OTS$SGET1_DD

OTS$SGET1_DD — The Get One Dynamic String routine allocates a specified number of bytes of dynamic virtual memory to a specified string descriptor.

Format

```
OTS$SGET1_DD word-integer-length-value ,dynamic-descriptor
```

Corresponding JSB Entry Point

```
OTS$SGET1_DD_R6
```

Returns

None.

Arguments

word-integer-length-value

OpenVMS usage:	**word_unsigned**
type:	**word (unsigned)**
access:	**read only**
mechanism:	**by value**

Number of bytes to be allocated. The **word-integer-length-value** argument contains the number of bytes. The amount of storage allocated is automatically rounded up. If the number of bytes is zero, a small number of bytes is allocated.

dynamic-descriptor

OpenVMS usage:	**quadword_unsigned**
type:	**quadword (unsigned)**
access:	**modify**
mechanism:	**by reference**

Dynamic string descriptor to which the area is to be allocated. The **dyn-str** argument is the address of the dynamic string descriptor. The CLASS field is not checked but it is set to dynamic (CLASS = 2). The LENGTH field is set to **word-integer-length-value** and the POINTER field is set to the string area allocated (first byte beyond the header).

Description

OTS$SGET1_DD allocates a specified number of bytes of dynamic virtual memory to a specified string descriptor. This routine is identical to OTS$SCOPY_DXDX except that no source string is copied. You can write anything you want in the allocated area.

If the specified string descriptor already has dynamic memory allocated to it, but the amount allocated is either greater than or less than **word-integer-length-value**, that space is deallocated before OTS$SGET1_DD allocates new space.

Condition Values Signaled

OTS$_FATINTERR	Fatal internal error.
OTS$_INSVIRMEM	Insufficient virtual memory.

Example

```
        PROGRAM STRING_TEST

C+
C       This program demonstrates the use of some dynamic string
C       manipulation routines.
C-

C+
C       DECLARATIONS
C-

        IMPLICIT NONE
        CHARACTER*80    DATA_LINE
        INTEGER*4       DATA_LEN, DSC(2), CRLF_DSC(2), TEMP_DSC(2)
        CHARACTER*2     CRLF

C+
C       Initialize the output descriptor.  It should be empty.
C-

        CALL OTS$SGET1_DD(%VAL(0), DSC)

C+
C       Initialize a descriptor to the string CRLF and copy the
C       character CRLF to it.
C-

        CALL OTS$SGET1_DD(%VAL(2), CRLF_DSC)
        CRLF = CHAR(13)//CHAR(10)
        CALL OTS$SCOPY_R_DX( %VAL(2), %REF(CRLF(1:1)), CRLF_DSC)

C+
C       Initialize a temporary descriptor.
C-

        CALL OTS$SGET1_DD(%VAL(0), TEMP_DSC)

C+
C       Prompt the user.
C-

        WRITE(6, 999)
999     FORMAT(1X, 'Enter your message, end with Ctrl/Z.')

C+
C       Read lines of text from the terminal until end-of-file.
C       Concatenate each line to the previous input.  Include a
C       CRLF between each line.
C-
```

```
        DO WHILE (.TRUE.)
            READ(5, 998, ERR = 10) DATA_LEN, DATA_LINE
998         FORMAT(Q,A)
            CALL OTS$SCOPY_R_DX( %VAL(DATA_LEN),
     1         %REF(DATA_LINE(1:1)),
     2         TEMP_DSC)
            CALL STR$CONCAT( DSC, DSC, TEMP_DSC, CRLF_DSC )
        END DO

C+
C       The user has typed Ctrl/Z.  Output the data we read.
C-

10      CALL LIB$PUT_OUTPUT( DSC )
C+
C       Free the storage allocated to the dynamic strings.
C-

        CALL OTS$SFREE1_DD( DSC )
        CALL OTS$SFREE1_DD( CRLF_DSC )
        CALL OTS$SFREE1_DD( TEMP_DSC )

C+
C       End of program.
C-

        STOP
        END
```

This Fortran example program demonstrates the manipulation of dynamic strings using OTS$SGET1_DD, OTS$SFREE1_DD, and OTS$SCOPY_R_DX.