
OpenVMS RTL General Purpose (OTSS) Manual

December 1995

This manual documents the general-purpose routines contained in the OTSS facility of the OpenVMS Run-Time Library.

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Contents

Preface	v
1 Overview of the OTS\$ Facility	
1.1 Run-Time Library General Purpose OTS\$ Routines	1-1
1.2 Linking OTS\$ Routines on an Alpha System	1-3
1.2.1 64-bit Addressing Support	1-4
OTS\$ Reference Section	
OTS\$CNVOUT	OTS-3
OTS\$CVT_L_TB	OTS-5
OTS\$CVT_L_TI	OTS-7
OTS\$CVT_L_TL	OTS-9
OTS\$CVT_L_TO	OTS-11
OTS\$CVT_L_TU	OTS-13
OTS\$CVT_L_TZ	OTS-15
OTS\$CVT_T_x	OTS-17
OTS\$CVT_TB_L	OTS-22
OTS\$CVT_TI_L	OTS-25
OTS\$CVT_TL_L	OTS-27
OTS\$CVT_TO_L	OTS-29
OTS\$CVT_TU_L	OTS-32
OTS\$CVT_TZ_L	OTS-34
OTS\$DIVC_x	OTS-37
OTS\$DIV_PK_LONG	OTS-40
OTS\$DIV_PK_SHORT	OTS-44
OTS\$MOVE3	OTS-47
OTS\$MOVE5	OTS-49
OTS\$MULC_x	OTS-51
OTS\$POWC_xC_x	OTS-54
OTS\$POWC_xJ	OTS-57
OTS\$POWDD	OTS-59
OTS\$POWDR	OTS-61
OTS\$POWDJ	OTS-63
OTS\$POWGG	OTS-65
OTS\$POWGJ	OTS-68
OTS\$POWHH_R3 (VAX Only)	OTS-70
OTS\$POWHJ_R3 (VAX Only)	OTS-72
OTS\$POWII	OTS-74

OTSS\$POWJJ	OTS-76
OTSS\$POWLULU	OTS-78
OTSS\$POWxLU	OTS-80
OTSS\$POWRD	OTS-82
OTSS\$POWRJ	OTS-85
OTSS\$POWRR	OTS-87
OTSS\$SCOPY_DXDX	OTS-89
OTSS\$SCOPY_R_DX	OTS-91
OTSS\$FREE1_DD	OTS-94
OTSS\$FREEN_DD	OTS-95
OTSS\$GET1_DD	OTS-96

Index

Tables

1-1	OTSS Conversion Routines	1-1
1-2	OTSS Division Routines	1-2
1-3	OTSS Move Data Routines	1-2
1-4	OTSS Multiplication Routine	1-2
1-5	OTSS Exponentiation Routines	1-2
1-6	OTSS Copy Source String Routines	1-3
1-7	OTSS Return String Area Routines	1-3
1-8	OTSS and Equivalent Math\$ Entry Points	1-4

Preface

This manual provides users of the OpenVMS operating system with detailed usage and reference information on general purpose routines supplied in the OTSS facility of the Run-Time Library.

Intended Audience

This manual is intended for system and application programmers who want to call Run-Time Library routines.

Document Structure

This manual is organized into two parts as follows:

- Part I contains a brief overview of the OTSS routines in Chapter 1.
- Part II, the OTSS Reference Section, provides detailed reference information on each routine contained in the OTSS facility of the Run-Time Library. This information is presented using the documentation format described in *OpenVMS Programming Interfaces: Calling a System Routine*. Routine descriptions appear in alphabetical order by routine name.

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 is presented in *OpenVMS Programming Interfaces: Calling a System Routine*. A description of VMS features and functionality available through calls to the OTSS Run-Time Library appears in the *OpenVMS Programming Concepts Manual*. Descriptions of other RTL facilities and their corresponding routines and usages are discussed in the following books:

Alpha

VAX

- *OpenVMS Alpha Guide to 64-Bit Addressing*
- *Digital Portable Mathematics Library*♦
- *OpenVMS VAX RTL Mathematics (MTHS) Manual*♦
- *OpenVMS RTL DECTalk (DTKS) Manual*
- *OpenVMS RTL Library (LIBS) Manual*
- *OpenVMS RTL Parallel Processing (PPLS) Manual*
- *OpenVMS RTL Screen Management (SMGS) Manual*
- *OpenVMS RTL String Manipulation (STRS) Manual*

The *Guide to DECthreads* contains guidelines and reference information for DECthreads, the Digital 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 VMS language software.

For a complete list and description of the manuals in the VMS documentation set, see the *Overview of OpenVMS Documentation*.

For additional information on OpenVMS products and services, access the Digital OpenVMS World Wide Web site. Use the following URL:

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Conventions

The name of the OpenVMS AXP operating system has been changed to OpenVMS Alpha. Any references to OpenVMS AXP or AXP are synonymous with OpenVMS Alpha or Alpha.

The following conventions are used to identify information specific to OpenVMS Alpha or to OpenVMS VAX:

Alpha

The Alpha icon denotes the beginning of information specific to OpenVMS Alpha.

VAX

The VAX icon denotes the beginning of information specific to OpenVMS VAX.

◆

The diamond symbol denotes the end of a section of information specific to OpenVMS Alpha or to OpenVMS VAX.

The following conventions are used in this manual:

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* or
GOLD *x*

A sequence such as PF1 *x* or GOLD *x* indicates that you must first press and release the key labeled PF1 or GOLD and then press and release another key or a pointing device button.

GOLD key sequences can also have a slash (/), dash (-), or underscore (_) as a delimiter in EVE commands.

Return

In examples, a key name enclosed in a box indicates that you press a key on the keyboard. (In text, a key name is not enclosed in a box.)

...

Horizontal ellipsis points in examples indicate 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.

.
. .
.

Vertical ellipsis points indicate 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, if you choose more than one option, you must enclose the choices in parentheses.

[]

In command format descriptions, brackets indicate optional elements. You can choose one, none, or all of the options. (Brackets are not optional, however, in the syntax of a directory name in an OpenVMS file specification or in the syntax of a substring specification in an assignment statement.)

{ }

In command format descriptions, braces indicate a required choice of options; you must choose one of the options listed.

boldface text

Boldface text represents the introduction of a new term or the name of an argument, an attribute, or a reason.

Boldface text is also used to show user input in Bookreader versions of the manual.

italic text

Italic text 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 *device-name* contains up to five alphanumeric characters).

UPPERCASE TEXT

Uppercase text indicates a command, the name of a routine, the name of a file, or the abbreviation for a system privilege.

Monospace type

Monospace type indicates code examples and interactive screen displays.

In the C programming language, monospace type in text identifies the following elements: keywords, the names of independently compiled external functions and files, syntax summaries, and references to variables or identifiers introduced in an example.

-

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 radices—binary, octal, or hexadecimal—are explicitly indicated.

Other conventions used in the documentation of Run-Time Library routines are described in *OpenVMS Programming Interfaces: Calling a System Routine*.

Overview of the OTS\$ Facility

1.1 Run-Time Library General Purpose OTS\$ Routines

This manual discusses the Run-Time Library OTS\$ routines that perform general purpose functions. These functions include data type conversions as part of a compiler's generated code, and some mathematical functions.

Most of the OTS\$ routines were originally designed to support language compilers. Because they provide useful functions, they were moved into the language-independent facility, OTS\$.

The OTS\$ facility provides you with routines that perform seven main tasks:

- Convert data types
- Divide complex and packed decimal values
- Move data to a specified destination address
- Multiply complex values
- Raise a base to an exponent
- Copy a source string to a destination string
- Return a string area to free storage

Table 1–1, Table 1–2, Table 1–3, Table 1–4, Table 1–5, Table 1–6, and Table 1–7 contain all of the OTS\$ routines grouped according to their functions.

Alpha

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

Table 1–1 OTS\$ Conversion Routines

Conversion Routine	Function
OTS\$CNVOUT	Convert a D-floating, G-floating, or H-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.

(continued on next page)

Overview of the OTS\$ Facility

1.1 Run-Time Library General Purpose OTS\$ Routines

Table 1–1 (Cont.) OTS\$ Conversion Routines

Conversion Routine	Function
OTSSCVT_TI_L	Convert signed integer text to an integer value.
OTSSCVT_TL_L	Convert logical text to an integer value.
OTSSCVT_TO_L	Convert octal text to an integer value.
OTSSCVT_TU_L	Convert unsigned decimal text to an integer value.
OTSSCVT_T_z	Convert numeric text to a D- or F-floating value.
OTSSCVT_T_x	Convert numeric text to a G- or H-floating value.
OTSSCVT_TZ_L	Convert hexadecimal text to an unsigned longword integer value.

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

Table 1–2 OTS\$ Division Routines

Division Routine	Function
OTSSDIVC _x	Perform complex division.
OTSSDIV_PK_LONG	Perform packed decimal division with a long divisor.
OTSSDIV_PK_SHORT	Perform packed decimal division with a short divisor.

Table 1–3 OTS\$ Move Data Routines

Move Data Routine	Function
OTSSMOVE3	Move data without fill.
OTSSMOVE5	Move data with fill.

Table 1–4 OTS\$ Multiplication Routine

Multiplication Routine	Function
OTSSMULC _x	Perform complex multiplication.

Table 1–5 OTS\$ Exponentiation Routines

Exponentiation Routine	Function
OTSSPOWC _x C _x	Raise a complex base to a complex floating-point exponent.
OTSSPOWC _x J	Raise a complex base to a signed longword exponent.
OTSSPOWDD	Raise a D-floating base to a D-floating exponent.
OTSSPOWDR	Raise a D-floating base to an F-floating exponent.
OTSSPOWDJ	Raise a D-floating base to a longword integer exponent.

(continued on next page)

Overview of the OTS\$ Facility

1.1 Run-Time Library General Purpose OTS\$ Routines

Table 1–5 (Cont.) OTS\$ Exponentiation Routines

Exponentiation Routine	Function
OTS\$POWG x	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\$POWH x	Raise an H-floating base to a floating-point exponent.
†OTS\$POWHJ	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.
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.
†VAX specific.	

Table 1–6 OTS\$ Copy Source String Routines

Copy Source String Routine	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

Return String Area Routine	Function
OTS\$FREE1_DD	Free one dynamic string.
OTS\$FREEM_DD	Free n dynamic strings.
OTS\$GET1_DD	Get one dynamic string.

1.2 Linking OTS\$ Routines on an Alpha System

Alpha

On Alpha 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.OBJ or the DPML\$SHR.EXE library. Math\$ entry points are available only on Alpha systems.

Table 1–8 lists the affected OTS\$ entry points with their equivalent math\$ entry points. Refer to the *Digital Portable Mathematics Library* for information about the math\$ entry points.

Overview of the OTS\$ Facility

1.2 Linking OTS\$ Routines on an Alpha System

Table 1–8 OTS\$ and Equivalent Math\$ Entry Points

OTS\$ Entry Point	Math\$ Entry Point
OTS\$DIVC	math\$cdiv_f
OTS\$DIVCG_R3	math\$cdiv_g
OTS\$MULCG_R3	math\$cmul_g
OTS\$POWII	math\$pow_qq
OTS\$POWJJ	math\$pow_qq
OTS\$POWLULU	math\$pow_qq
OTS\$POWRR	math\$pow_ff
OTS\$POWGG	math\$pow_gg
OTS\$POWRJ	math\$pow_fq
OTS\$POWRLU	math\$pow_fq
OTS\$POWGJ	math\$pow_gq
OTS\$POWGLU	math\$pow_gq
OTS\$POWCC	math\$cpow_f
OTS\$POWCGCG_R3	math\$cpow_g
OTS\$POWCJ	math\$cpow_fq

1.2.1 64-bit Addressing Support

Alpha

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

- Most routines accept 64-bit addresses for arguments passed by reference. Footnotes in the Reference Section of this manual indicate those routines that do not.
- Most routines also accept either 32-bit or 64-bit descriptors for arguments passed by descriptor. Footnotes in the Reference Section of this manual indicate those routines that do not.

See the *OpenVMS Alpha Guide to 64-Bit Addressing* for more information about 64-bit virtual addressing capabilities. ♦

OTS\$ Reference Section

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

OTSS\$CNVOUT

Convert D-Floating, G-Floating or H-Floating Number to Character String

The Convert Floating to Character String routines convert a D-floating, G-floating or H-floating number to a character string in the Fortran E format.

Format

OTSS\$CNVOUT D-G-or-H-float-pt-input-val ,fixed-length-resultant-string
,digits-in-fraction

OTSS\$CNVOUT_G D-G-or-H-float-pt-input-val ,fixed-length-resultant-string
,digits-in-fraction

VAX

OTSS\$CNVOUT_H D-G-or-H-float-pt-input-val ,fixed-length-resultant-string
,digits-in-fraction ♦

Returns

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

Arguments

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

OpenVMS usage: floating_point
type: D_floating, G_floating, H_floating
access: read only
mechanism: by reference

Value that OTSS\$CNVOUT converts to a character string. For OTSS\$CNVOUT, the **D-G-or-H-float-pt-input-val** argument is the address of a D-floating number containing the value. For OTSS\$CNVOUT_G, the **D-G-or-H-float-pt-input-val** argument is the address of a G-floating number containing the value. For OTSS\$CNVOUT_H, the **D-G-or-H-float-pt-input-val** argument is the address of an H-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 OTSS\$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.

OTSS\$ Routines

OTSS\$CNVOUT

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.
OTSS\$_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

OTSS\$CVT_L_TB

Convert an Unsigned Integer to Binary Text

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

OTSS\$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 OTSS\$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 OTSS\$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

OTSS\$ Routines

OTSS\$CVT_L_TB

value of the integer to be converted is also zero, OTSS\$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.
OTSS_OUTCONERR	Output conversion error. The result would have exceeded the fixed-length string; the output string is filled with asterisks (*).

OTSS\$CVT_L_TI

Convert Signed Integer to Decimal Text

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

OTSS\$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

A signed integer that OTSS\$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.

VAX

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. ♦

Alpha

On Alpha 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 OTSS\$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

OTSS\$ Routines

OTSS\$CVT_L_TI

Minimum number of digits to be generated when OTSS\$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, OTSS\$CVT_L_TI inserts leading zeros into the output string. If **number-of-digits** is zero and **varying-input-value** is zero, OTSS\$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).

VAX

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. ♦

Alpha

On Alpha 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 OTSS\$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.
OTSS\$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 (*).

OTSS\$CVT_L_TL

Convert Integer to Logical Text

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

Format

OTSS\$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 OTSS\$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 OTSS\$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, OTSS\$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.
OTSS_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).

OT\$ Routines

OT\$CVT_L_TL

Example

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

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

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

OTSS\$CVT_L_TO

Convert Unsigned Integer to Octal Text

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

Format

OTSS\$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 OTSS\$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 OTSS\$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 OTSS\$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, OTSS\$CVT_L_TO inserts

OTSS\$ Routines

OTSS\$CVT_L_TO

leading zeros into the output string. If **number-of-digits** is 0 and **varying-input-value** is 0, OTSS\$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 OTSS\$CVT_L_TO. If it is omitted, the default is 4 (longword).

Condition Values Returned

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

OTSS\$CVT_L_TU

Convert Unsigned Integer to Decimal Text

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

Format

OTSS\$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 OTSS\$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.

VAX

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.) ♦

Alpha

On Alpha 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 (fixed-length) that OTSS\$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

OTSS\$ Routines

OTSS\$CVT_L_TU

Minimum number of digits in the ASCII text string that OTSS\$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, OTSS\$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, OTSS\$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).

VAX

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

Alpha

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

Condition Values Returned

SS\$NORMAL	Normal successful completion.
OTSS_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 (*).

OTSS\$CVT_L_TZ

Convert Integer to Hexadecimal Text

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

Format

OTSS\$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 OTSS\$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 OTSS\$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 OTSS\$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 OTSS\$CVT_L_TZ creates is less than this minimum number, OTSS\$CVT_L_TZ inserts leading zeros in the output string. If the minimum number of digits is zero and the integer

OTSS\$ Routines

OTSS\$CVT_L_TZ

value to be converted is also zero, OTSS\$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 OTSS\$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.
OTSS\$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 => "OTSS$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 OTSS\$CVT_L_TZ to convert a longword integer to hexadecimal text.

OTSS\$CVT_T_x Convert Numeric Text to D-, F-, G-, or H-Floating Value

The Convert Numeric Text to D-, F-, G-, or H-Floating routines convert an ASCII text string representation of a numeric value to a D-floating, F-floating, G-floating, or H-floating value.

Format

OTSS\$CVT_T_D fixed-or-dynamic-input-string ,floating-point-value [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]
 OTSS\$CVT_T_F fixed-or-dynamic-input-string ,floating-point-value [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]
 OTSS\$CVT_T_G fixed-or-dynamic-input-string ,floating-point-value [,digits-in-fraction] [,scale-factor] [,flags-value] [,extension-bits]
 OTSS\$CVT_T_H 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 OTSS\$CVT_T_x converts to a D-floating, F-floating, G-floating, or H-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:

$$[<\text{blanks}>] \left[\begin{array}{c} + \\ - \end{array} \right] [<\text{digits}>][.][<\text{digits}>] \left\{ \begin{array}{c} E \\ e \\ D \\ d \\ Q \\ q \end{array} \right\} [<\text{blanks}>] \left[\begin{array}{c} + \\ - \end{array} \right] [<\text{digits}>]$$

OTSS\$ Routines

OTSS\$CVT_T_x

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
access: write only
mechanism: by reference

Floating-point value that OTSS\$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
OTSS\$CVT_T_D	D-floating
OTSS\$CVT_T_F	F-floating
OTSS\$CVT_T_G	G-floating
OTSS\$CVT_T_H	H-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 $10^{\text{scale-factor}}$ 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, OTSS\$CVT_T_x defaults all flags to clear.

extension-bits

OpenVMS usage: byte_unsigned (D-, F-floating)
 word_unsigned (G-, H-floating)
 type: byte (unsigned) (D-, F-floating)
 word (unsigned) (G-, H-floating)
 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
OTSS\$CVT_T_D	8	Byte (unsigned)
OTSS\$CVT_T_F	8	Byte (unsigned)
OTSS\$CVT_T_G	11	Word (unsigned)
OTSS\$CVT_T_H	15	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 OTSS\$CVT_T_H carries its calculations to only 128 bits. However the error should be small.

OTSS\$ Routines OTSS\$CVT_T_x

Description

The OTSS\$CVT_T_D, OTSS\$CVT_T_F, OTSS\$CVT_T_G, and OTSS\$CVT_T_H 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.

Alpha

Although Alpha systems do not generally support H-floating operations, you can use OTSS\$CVT_T_H to convert a text string to an H-floating value on an Alpha system.) ♦

Condition Values Returned

SS\$NORMAL	Normal successful completion.
OTSS\$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 OTSS$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 = OTSS$CVT_T_F(T(I),A,%VAL(5),,)
      TYPE *, ' Output of OTSS$CVT_T_F is      ',A
      TYPE *, ' '
2      CONTINUE
      END
```


This Fortran example demonstrates the use of OTSS\$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
```

OTSS\$CVT_TB_L

Convert Binary Text to Unsigned Integer

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

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

OTSS\$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, OTSS\$CVT_TB_L defaults all flags to clear.

Condition Values Returned

SS\$NORMAL	Normal successful completion.
OTSS\$INPCONERR	Input conversion error. OTSS\$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 OTSS$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 OTSS$CVT_TB_L (STRING, LONG, &
    LONG BY VALUE, LONG BY VALUE)

```

OTSS\$ Routines OTSS\$CVT_TB_L

```
!+
!  MAIN PROGRAM
!-

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

FOR I = 1 TO 5
  READ BIN_STR
  RET_STATUS = OTSS$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 OTSS\$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
```

OTSS\$CVT_TI_L

Convert Signed Integer Text to Integer

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

OTSS\$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 OTSS\$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:

[⁺] <integer-digits>

OTSS\$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 OTSS\$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

OTSS\$ Routines

OTSS\$CVT_TI_L

Number of bytes to be occupied by the value created when OTSS\$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**.

VAX

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

Alpha

On Alpha systems, valid values for the **output-value-size** argument are 1, 2, 4, and 8. This value determines whether the integer value that OTSS\$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, OTSS\$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 OTSS\$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, OTSS\$CVT_TI_L defaults all flags to clear.

Condition Values Returned

SS\$NORMAL

Normal successful completion.

OTSS\$INPCONERR

Input conversion error. OTSS\$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.

OTSS\$CVT_TL_L Convert Logical Text to Integer

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

Format

OTSS\$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 OTSS\$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 OTSS\$CVT_TL_L input string is valid if it adheres to the following syntax:

$$\left\{ \begin{array}{l} \langle \text{blanks} \rangle \\ \left[\langle \text{blanks} \rangle \right] \left\{ \begin{array}{l} T \\ t \\ F \\ f \end{array} \right\} \langle \text{characters} \rangle \end{array} \right\}$$

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

OTSS\$ Routines

OTSS\$CVT_TL_L

varying-output-value

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

Signed integer that OTSS\$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.

OTSS\$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, OTSS\$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 OTSS\$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, OTSS\$CVT_TL_L returns an input conversion error.

VAX

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

Alpha

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

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

Condition Values Returned

SS\$NORMAL

Normal successful completion.

OTSS_INPCONERR

Input conversion error. OTSS\$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.

OTSS\$CVT_TO_L

Convert Octal Text to Unsigned Integer

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

OTSS\$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 OTSS\$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 OTSS\$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, OTSS\$CVT_TO_L returns an input conversion error. If you omit the **output-value-size** argument, the default is 4 (longword).

OTSS\$ Routines

OTSS\$CVT_TO_L

flags-value

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

User-supplied flag that OTSS\$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, OTSS\$CVT_TO_L defaults the flag to clear.

Condition Values Returned

SS\$NORMAL	Normal successful completion.
OTSS\$INPCONERR	Input conversion error. OTSS\$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 $STSDEF;          /* Include definition of return status values */
DECLARE OTSS$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$VALUE = OTSS$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; simply 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

Convert Unsigned Decimal Text to Integer

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**.

VAX

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

Alpha

On Alpha systems, valid values for the **output-value-size** argument are 1, 2, 4, and 8. This value determines whether the integer value that OTSS\$CVT_TU_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, OTSS\$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 OTSS\$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, OTSS\$CVT_TU_L defaults all flags to clear.

Condition Values Returned

SS\$NORMAL	Normal successful completion.
OTSS\$INPCONERR	Input conversion error. OTSS\$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

Convert Hexadecimal Text to Unsigned Integer

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, OTSS\$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 OTSS\$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, OTSS\$CVT_TZ_L defaults the flag to clear.

Condition Values Returned

SS\$ _NORMAL	Normal successful completion.
OTSS\$ _INPCONERR	Input conversion error. OTSS\$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
  
```

OTSS\$ Routines OTSS\$CVT_TZ_L

```
2. HEX_CONV: PROCEDURE OPTIONS (MAIN) RETURNS (FIXED BINARY (31));
%INCLUDE $STSDEF;          /* Include definition of return status values */
DECLARE OTSS$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$VALUE = OTSS$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
```

OTSS\$DIVCx Complex Division

The Complex Division routines return a complex result of a division on complex numbers.

Format

OTSS\$DIVC complex-dividend ,complex-divisor

VAX

OTSS\$DIVCD_R3 complex-dividend ,complex-divisor ♦

OTSS\$DIVCG_R3 complex-dividend ,complex-divisor

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

Returns

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

Complex result of complex division. OTSS\$DIVC returns an F-floating complex number. OTSS\$DIVCD_R3 returns a D-floating complex number. OTSS\$DIVCG_R3 returns a G-floating complex number.

Arguments

complex-dividend

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

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

complex-divisor

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

Complex divisor. The **complex-divisor** argument contains the value of the divisor. For OTSS\$DIVC, **complex-divisor** is an F-floating complex number. For OTSS\$DIVCD_R3, **complex-divisor** is a D-floating complex number. For OTSS\$DIVCG_R3, **complex-divisor** is a G-floating complex number.

OTSS\$ Routines OTSS\$DIVCx

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:

$$r = (ac + bd)/(c^2 + d^2)$$

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

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$DIVC or OTSS\$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   OTSS$DIVC and the FORTRAN random number
C   generator RAN.
C
C   Declare Z1, Z2, Z_Q, and OTSS$DIVC as complex values.
C   OTSS$DIVC will return the complex quotient of Z1 divided
C   by Z2: Z_Q = OTSS$DIVC( %VAL(REAL(Z1)), %VAL(AIMAG(Z1)),
C   %VAL(REAL(Z2)), %VAL(AIMAG(Z2))
C-
      COMPLEX Z1,Z2,Z_Q,OTSS$DIVC
C+
C   Generate a complex number.
C-
      Z1 = (8.0,4.0)
C+
C   Generate another complex number.
C-
      Z2 = (1.0,1.0)
C+
C   Compute the complex quotient of Z1/Z2.
C-
      Z_Q = OTSS$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 OTSS\$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 OTSS$DIVCG_R3 and the FORTRAN random number
   C generator RAN.
   C
   C Declare Z1, Z2, and Z_Q as complex values. OTSS$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 OTSS\$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

Packed Decimal Division with Long Divisor

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:

$c = 31 - \text{prec}(\text{packed-decimal-dividend})$

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 OTSS\$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.

OTSS\$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.

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

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

OTSS\$ Routines

OTSS\$DIV_PK_LONG

Description

VAX

On VAX systems, before using this routine, you should determine whether it is best to use OTSS\$DIV_PK_LONG, OTSS\$DIV_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 OTSS\$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 or on an OpenVMS VAX system and you have determined that you cannot use DIVP, you need to determine whether you should use OTSS\$DIV_PK_LONG or OTSS\$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 OTSS\$DIV_PK_LONG. If **scale-data** is greater than 1, you should use OTSS\$DIV_PK_SHORT instead.

Condition Value Signaled

SS\$FLTDIV Fatal error. Division by zero.

Example

```
1
OPTION                                &
    TYPE = EXPLICIT

!+
!   This program uses OTSS$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 OTSS$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
```

OTSS\$ Routines OTSS\$DIV_PK_LONG

```

!+
!   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 OTSS$DIV_PK_LONG or
!   OTSS$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 OTSS$DIV_PK_LONG
!   should be used instead of OTSS$DIV_PK_SHORT.
!
!-

CALL OTSS$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 OTSS\$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

Packed Decimal Division with Short Divisor

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:

$c = 31 - \text{prec}(\text{packed-decimal-dividend})$

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. 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 a packed decimal string into which OTSS\$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. 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.

OTSS\$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 OTSS\$DIV_PK_LONG, OTSS\$DIV_PK_SHORT, or the VAX instruction DIVP. To determine this, you must first calculate *b*, where *b* is defined as follows:

$$b = \text{scale}(\text{packed-decimal-quotient}) + \text{scale}(\text{packed-decimal-divisor}) - \text{scale}(\text{packed-decimal-dividend}) + \text{prec}(\text{packed-decimal-dividend})$$

If *b* is greater than 31, then OTSS\$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 or on an OpenVMS VAX system and you have determined that you cannot use DIVP, you need to determine whether you should use OTSS\$DIV_PK_LONG or OTSS\$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 OTSS\$DIV_PK_LONG. If **scale-data** is greater than 1, you should use OTSS\$DIV_PK_SHORT instead.

OT\$ Routines
OT\$DIV_PK_SHORT

Condition Value Signaled

SS\$FLT DIV

Fatal error. Division by zero.

OTSS\$MOVE3

Move Data Without Fill

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

OTSS\$MOVE3 length-value ,source-array ,destination-array

Corresponding JSB Entry Point

OTSS\$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 OTSS\$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 OTSS\$MOVE3 writes the source data.

OTSS\$ Routines

OTSS\$MOVE3

Description

OTSS\$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 OTSS\$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.

OTSS\$MOVE5

Move Data with Fill

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

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

Corresponding JSB Entry Point

OTSS\$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 OTSS\$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

OTSS\$ Routines

OTSS\$MOVE5

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 OTSS\$MOVE5 writes the source data.

Description

OTSS\$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 OTSS\$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.

OTSS\$MULCx Complex Multiplication

The Complex Multiplication routines calculate the complex product of two complex values.

Format

VAX

OTSS\$MULCD_R3 complex-multiplier,complex-multiplicand ♦

OTSS\$MULCG_R3 complex-multiplier ,complex-multiplicand

These formats correspond to the D-floating and G-floating complex types.

Returns

OpenVMS usage: complex_number
 type: D_floating complex, G_floating complex
 access: write only
 mechanism: by value

Complex result of multiplying two complex numbers. OTSS\$MULCD_R3 returns a D-floating complex number. OTSS\$MULCG_R3 returns a G-floating complex number.

Arguments

complex-multiplier

OpenVMS usage: complex_number
 type: D_floating complex, G_floating complex
 access: read only
 mechanism: by value

Complex multiplier. The **complex-multiplier** argument contains the complex multiplier. For OTSS\$MULCD_R3, **complex-multiplier** is a D-floating complex number. For OTSS\$MULCG_R3, **complex-multiplier** is a G-floating complex number.

complex-multiplicand

OpenVMS usage: complex_number
 type: D_floating complex, G_floating complex
 access: read only
 mechanism: by value

Complex multiplicand. The **complex-multiplicand** argument contains the complex multiplicand. For OTSS\$MULCD_R3, **complex-multiplicand** is a D-floating complex number. For OTSS\$MULCG_R3, **complex-multiplicand** is an F-floating complex number.

OTSS\$ Routines OTSS\$MULCx

Description

OTSS\$MULCD_R3 and OTSS\$MULCG_R3 calculate 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:

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

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

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

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$MULCG_R3. See Chapter 1 for more information about these restrictions. ♦

Condition Values Signaled

SS\$FLT0VF_F

Floating value overflow can occur.

SS\$ROPRAND

Reserved operand. OTSS\$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 use by Digital.

Example

```
C+
C   This FORTRAN example forms the product of
C   two complex numbers using OTSS$MULCD_R3
C   and the FORTRAN random number generator RAN.
C
C   Declare Z1, Z2, and Z_Q as complex values. OTSS$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 OTSS\$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  
(4.000000000000000,32.000000000000000)
```

OTSS\$POWCxCx

Raise a Complex Base to a Complex Floating-Point Exponent

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

Format

OTSS\$POWCC complex-base ,complex-exponent-value

VAX

OTSS\$POWCDCD_R3 complex-base ,complex-exponent-value ♦

OTSS\$POWCGCG_R3 complex-base ,complex-exponent-value

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

Returns

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

Result of raising a complex base to a complex exponent. OTSS\$POWCC returns an F-floating complex number. OTSS\$POWCDCD_R3 returns a D-floating complex number. OTSS\$POWCGCG_R3 returns a G-floating complex number.

Arguments

complex-base

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

Complex base. The **complex-base** argument contains the value of the base. For OTSS\$POWCC, **complex-base** is an F-floating complex number. For OTSS\$POWCDCD_R3, **complex-base** is a D-floating complex number. For OTSS\$POWCGCG_R3, **complex-base** is a G-floating complex number.

complex-exponent-value

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

Complex exponent. The **complex-exponent-value** argument contains the value of the exponent. For OTSS\$POWCC, **complex-exponent-value** is an F-floating complex number. For OTSS\$POWCDCD_R3, **complex-exponent-value** is a D-floating complex number. For OTSS\$POWCGCG_R3, **complex-exponent-value** is a G-floating complex number.

Description

OTSS\$POWCC, OTSS\$POWCDCD_R3 and OTSS\$POWCGCG_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 type COMPLEX.

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$POWCC or OTSS\$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 OTSS$POWCC.
   C
   C Declare Z1, Z2, Z3, and OTSS$POWCC as complex values. Then OTSS$POWCC
   C returns the complex result of Z1**Z2: Z3 = OTSS$POWCC(Z1,Z2),
   C where Z1 and Z2 are passed by value.
   C-
           COMPLEX Z1,Z2,Z3,OTSS$POWCC
   C+
   C Generate a complex base.
   C-
           Z1 = (2.0,3.0)
   C+
   C Generate a complex power.
   C-
           Z2 = (1.0,2.0)
   C+
   C Compute the complex value of Z1**Z2.
   C-
           Z3 = OTSS$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 OTSS\$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)

```

OTSS\$ Routines OTSS\$POWCxCx

```
2. C+
C   This FORTRAN example raises a complex base to a complex
C   power using OTSS$POWCGCG_R3.
C
C   Declare Z1, Z2, and Z3 as complex values. OTSS$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 OTSS\$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).

OTSS\$POWCxJ

Raise a Complex Base to a Signed Longword Integer Exponent

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

OTSS\$POWCJ complex-base ,longword-integer-exponent

VAX

OTSS\$POWCDJ_R3 complex-base ,longword-integer-exponent

OTSS\$POWCGJ_R3 complex-base,longword-integer-exponent ♦

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

Returns

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

Complex result of raising a complex base to an integer exponent. OTSS\$POWCJ returns an F-floating complex number. OTSS\$POWCDJ_R3 returns a D-floating complex number. OTSS\$POWCGJ_R3 returns a G-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
 access: read only
 mechanism: by value

Complex base. The **complex-base** argument contains the complex base. For OTSS\$POWCJ, **complex-base** is an F-floating complex number. For OTSS\$POWCDJ_R3, **complex-base** is a D-floating complex number. For OTSS\$POWCGJ_R3, **complex-base** is a G-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.

OTS\$ Routines

OTS\$POWCxJ

Description

OTS\$POWCJ, OTS\$POWCDJ_R3, and OTS\$POWCGJ_R3 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)

Alpha

On Alpha systems, some restrictions apply when linking OTS\$POWCJ. 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+
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).
```

OTSS\$POWDD

Raise a D-Floating Base to a D-Floating Exponent

The Raise a D-Floating Base to a D-Floating Exponent routine raises a D-floating base to a D-floating exponent.

Format

OTSS\$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

OTSS\$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 OTSS\$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

OTS\$ Routines

OTS\$POWDD

Base	Exponent	Result
> 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

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.

OTSS\$POWDR

Raise a D-Floating Base to an F-Floating Exponent

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

Format

OTSS\$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

OTSS\$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.

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

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

OTS\$ Routines

OTS\$POWDR

Base	Exponent	Result
< 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.

OTSS\$POWDJ

Raise a D-Floating Base to a Longword Exponent

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

Format

OTSS\$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

OTSS\$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.

OTS\$ Routines OTS\$POWDJ

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 D-floating-point-base is zero and longword-integer-exponent is zero or negative, or if the D-floating-point-base is negative.

OTSS\$POWGG

Raise a G-Floating Base to a G-Floating Exponent

The Raise a G-Floating Base to a G-Floating Exponent routine raises a G-floating base to a G-floating exponent.

Format

OTSS\$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 OTSS\$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 OTSS\$POWGG raises the base. The **G-floating-point-exponent** argument is a G-floating number containing the exponent.

Description

OTSS\$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 OTSS\$POWGG is as follows:

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

OTSS\$ Routines

OTSS\$POWGG

Base	Exponent	Result
> 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.

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$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 OTSS$POWGG,
C which raises a G-floating point base
C to a G-floating point power.
C-
      REAL*8 X,Y,RESULT,OTSS$POWGG
C+
C The arguments of OTSS$POWGG are passed by value. FORTRAN can
C only pass INTEGER and REAL*4 expressions as VALUE. Since
C INTEGER and REAL*4 values are one longword long, while REAL*8
C values are two longwords long, equate the base (and power) to
C two-dimensional INTEGER vectors. These vectors will be passed
C by VALUE.
C-
      INTEGER N(2),M(2)
      EQUIVALENCE (N(1),X), (M(1),Y)
      X = 8.0
      Y = 2.0
C+
C To pass X by value, pass N(1) and N(2) by value. Similarly for Y.
C-
      RESULT = OTSS$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, OTSS$POWGG 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 64.00000000000000  
9.0**-0.5 IS 0.3333333333333333
```

OTS\$POWGJ

Raise a G-Floating Base to a Longword Exponent

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.

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

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$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)

Raise an H-Floating Base to an H-Floating Exponent

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	$2^{[exponent*\log_2(base)]}$
> 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 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 OTSS$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, OTSS$POWHH 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 OTSS\$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)

Raise an H-Floating Base to a Longword Exponent

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

Raise a Word Base to a Word Exponent

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.

Alpha

On Alpha 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

Raise a Longword Base to a Longword Exponent

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.

Alpha

On Alpha 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

Raise an Unsigned Longword Base to an Unsigned Longword Exponent

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.

Alpha

On Alpha 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\$POWxLU

Raise a Floating-Point Base to an Unsigned Longword Integer Exponent

The Raise a Floating-Point Base to an Unsigned Longword Integer Exponent routines raises 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

VAX

OTS\$POWHLU_R3 floating-point-base ,unsigned-lword-int-exponent ♦

Returns

OpenVMS usage: floating_point
type: F_floating, D_floating, G_floating, H_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.

VAX

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
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.

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

OTSS\$POWRLU, OTSS\$POWDLU, OTSS\$POWGLU, and OTSS\$POWHLU_R3 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

Alpha

On Alpha systems, some restrictions apply when linking OTSS\$POWRLU or OTSS\$POWGLU. 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\$POWRD

Raise an F-Floating Base to a D-Floating Exponent

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

Base	Exponent	Result
< 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 demonstrates the use
C  of OTSS$POWRD, which raises an F-floating point
C  base to a D-floating point exponent. The result is a
C  D-floating value.
C-

      REAL*4 X
      REAL*8 Y,RESULT,OTSS$POWRD
      INTEGER M(2)
      EQUIVALENCE (M(1),Y)
      X = 9768.0
      Y = 9.0

C+
C  The arguments of OTSS$POWRD are passed by value.
C-

      RESULT = OTSS$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, OTSS$POWRD is indirectly called by simply
C  using the exponentiation operator.
C-

      RESULT = X**Y
      TYPE *, ' 7689.0**-0.587436654545 IS ',RESULT
      END

```

This Fortran example uses OTSS\$POWRD to raise an F-floating base to a D-floating exponent. Notice the difference in the precision of the result produced by

OT\$\$ Routines
OT\$\$POWRD

this routine in comparison to the result produced by OT\$\$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
```

OTSS\$POWRJ

Raise an F-Floating Base to a Longword Exponent

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

Format

OTSS\$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

OTSS\$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.

OTS\$ Routines OTS\$POWRJ

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.

Alpha

On Alpha 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.

OTSS\$POWRR

Raise an F-Floating Base to an F-Floating Exponent

The Raise an F-Floating Base to an F-Floating Exponent routine raises an F-floating base to an F-floating exponent.

Format

OTSS\$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

OTSS\$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 OTSS\$POWRR is as follows:

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

OTS\$ Routines OTS\$POWRR

Base	Exponent	Result
> 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.

Alpha

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

Condition Values Signaled

SS\$FLTQVF	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
```

OTSS\$COPY_DXDX

Copy a Source String Passed by Descriptor to a Destination String

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

OTSS\$COPY_DXDX source-string ,destination-string

Corresponding JSB Entry Point

OTSS\$COPY_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.

OTSS\$ Routines

OTSS\$COPY_DXDX

Description

OTSS\$COPY_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, OTSS\$COPY_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 OTSS\$COPY_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 (CURLLEN) to the actual number of bytes copied.

Condition Values Signaled

OTSS\$_FATINTERR	Fatal internal error.
OTSS\$_INVSTRDES	Invalid string descriptor.
OTSS\$_INSVIRMEM	Insufficient virtual memory.

OTSS\$COPY_R_DX

Copy a Source String Passed by Reference to a Destination String

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

```
OTSS$COPY_R_DX word-int-source-length-val ,source-string-address
                ,destination-string
```

Corresponding JSB Entry Point

```
OTSS$COPY_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. OTSS\$COPY_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

OTS\$ Routines

OTS\$SCOPY_R_DX

the string is dynamic. For varying strings, the string's current length (CURLLEN) 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 (CURLLEN) field to the actual number of bytes copied.

Condition Values Signaled

OTSS_FATINTERR	Fatal internal error.
OTSS_INVSTRDES	Invalid string descriptor.
OTSS_INSVIRMEM	Insufficient virtual memory.

Example

A Fortran example that demonstrates the manipulation of dynamic strings appears at the end of OTSS\$GET1_DD. This example uses OTSS\$COPY_R_DX, OTSS\$GET1_DD, and OTSS\$FREE1_DD.

OTSS\$FREE1_DD

Strings, Free One Dynamic

The Free One Dynamic String routine returns one dynamic string area to free storage.

Format

OTSS\$FREE1_DD dynamic-descriptor

Corresponding JSB Entry Point

OTSS\$FREE1_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

OTSS\$FREE1_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 Value Signaled

OTSS_FATINTERR Fatal internal error.

Example

A Fortran example that demonstrates the manipulation of dynamic strings appears at the end of OTSS\$GET1_DD. This example uses OTSS\$FREE1_DD, OTSS\$GET1_DD, and OTSS\$COPY_R_DX.

OTSS\$SFREEN_DD

Strings, Free n Dynamic

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

OTSS\$SFREEN_DD descriptor-count-value ,first-descriptor

Corresponding JSB Entry Point

OTSS\$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 OTSS\$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

OTSS\$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

OTSS_FATINTERR Fatal internal error.

OTS\$GET1_DD Strings, Get One Dynamic

The Get One Dynamic String routine allocates a specified number of bytes of dynamic virtual memory to a specified string descriptor.

Format

OTS\$GET1_DD word-integer-length-value ,dynamic-descriptor

Corresponding JSB Entry Point

OTS\$GET1_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\$GET1_DD allocates a specified number of bytes of dynamic virtual memory to a specified string descriptor. This routine is identical to OTS\$COPY_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\$GET1_DD allocates new space.

Condition Values Signaled

OTSS_FATINTERR	Fatal internal error.
OTSS_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 OTSS$GET1_DD(%VAL(0), DSC)

C+
C   Initialize a descriptor to the string CRLF and copy the
C   character CRLF to it.
C-

CALL OTSS$GET1_DD(%VAL(2), CRLF_DSC)
CRLF = CHAR(13)//CHAR(10)
CALL OTSS$COPY_R_DX( %VAL(2), %REF(CRLF(1:1)), CRLF_DSC)

C+
C   Initialize a temporary descriptor.
C-

CALL OTSS$GET1_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 OTSS$COPY_R_DX( %VAL(DATA_LEN),
1     %REF(DATA_LINE(1:1)),
2     TEMP_DSC)
  CALL STR$CONCAT( DSC, DSC, TEMP_DSC, CRLF_DSC )
END DO

```

OTSS\$ Routines

OTSS\$GET1_DD

```
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 OTSS$FREE1_DD( DSC )
    CALL OTSS$FREE1_DD( CRLF_DSC )
    CALL OTSS$FREE1_DD( TEMP_DSC )

C+
C   End of program.
C-

    STOP
    END
```

This Fortran example program demonstrates the manipulation of dynamic strings using OTSS\$GET1_DD, OTSS\$FREE1_DD, and OTSS\$COPY_R_DX.

C

Complex numbers

- division of, OTS-38
- multiplication of, OTS-52

Conversion

- floating-point to character string, OTS-4
- integer to binary text, OTS-6
- integer to Fortran L format, OTS-9
- signed text to integer, OTS-25
- unsigned decimal to integer, OTS-32

conversions

- integer to binary text, OTS-5

Conversions

- binary text to unsigned integer, OTS-22
- hexadecimal text to unsigned integer, OTS-34
- integer to hexadecimal, OTS-15
- integer to logical text, OTS-9
- integer to octal text, OTS-11
- numeric text to floating-point, OTS-17
- octal text to unsigned integer, OTS-29

Copying strings, OTS-89

D

Division

- complex number, OTS-38
- packed decimal, OTS-42, OTS-45

Dynamic length strings

- allocating, OTS-96
- deallocating, OTS-94, OTS-95

E

Exponentiation

- complex base to complex exponent, OTS-55
- complex base to signed integer exponent, OTS-58
- D-floating base, OTS-59, OTS-61, OTS-63
- F-floating base, OTS-82, OTS-85, OTS-87
- G-floating base, OTS-65, OTS-68
- H-floating base, OTS-70, OTS-72
- signed longword base, OTS-76
- word base to word exponent, OTS-74

M

Memory allocation

- for dynamic length strings, OTS-96
- freeing dynamic length strings, OTS-94, OTS-95

Multiplication

- of complex numbers, OTS-52

O

- OTSSCNVOUT routine, OTS-3
- OTSSCNVOUT_G routine, OTS-3
- OTSSCNVOUT_H routine, OTS-3
- OTSSCVT_L_TB routine, OTS-5
- OTSSCVT_L_TI routine, OTS-7
- OTSSCVT_L_TL routine, OTS-9
- OTSSCVT_L_TO routine, OTS-11
- OTSSCVT_L_TU routine, OTS-13
- OTSSCVT_L_TZ routine, OTS-15
- OTSSCVT_TB_L routine, OTS-22
- OTSSCVT_TI_L routine, OTS-25
- OTSSCVT_TL_L routine, OTS-27
- OTSSCVT_TO_L routine, OTS-29
- OTSSCVT_TU_L routine, OTS-32
- OTSSCVT_TZ_L routine, OTS-34
- OTSSCVT_T_x routine, OTS-17
- OTSSDIVCD_R3 routine, OTS-37
- OTSSDIVCG_R3 routine, OTS-37
- OTSSDIVC routine, OTS-37
- OTSSDIV_PK_LONG routine, OTS-40
- OTSSDIV_PK_SHORT routine, OTS-44
- OTSSMOVE3 routine, OTS-47
- OTSSMOVE5 routine, OTS-49
- OTSSMULCD_R3 routine, OTS-51
- OTSSMULCG_R3 routine, OTS-51
- OTSSPOWCxIx routine, OTS-54
- OTSSPOWCxJ routine, OTS-57
- OTSSPOWDD routine, OTS-59
- OTSSPOWDJ routine, OTS-63
- OTSSPOWDLU routine, OTS-80
- OTSSPOWDR routine, OTS-61
- OTSSPOWGG routine, OTS-65
- OTSSPOWGJ routine, OTS-68

OTSSPOWGLU routine, OTS-80
OTSSPOWHH_R3 routine, OTS-70
OTSSPOWHJ_R3 routine, OTS-72
OTSSPOWHLU_R3 routine, OTS-80
OTSSPOWII routine, OTS-74
OTSSPOWJJ routine, OTS-76
OTSSPOWLULU routine, OTS-78
OTSSPOWRD routine, OTS-82
OTSSPOWRJ routine, OTS-85
OTSSPOWRLU routine, OTS-80
OTSSPOWRR routine, OTS-87
OTSSCOPY_DXDX routine, OTS-89
OTSSCOPY_R_DX routine, OTS-91
OTSSFREE1_DD routine, OTS-94
OTSSFREEN_DD routine, OTS-95

OTSSGET1_DD routine, OTS-96

R

Run-Time Library routines
 general purpose, 1-1

S

Strings
 copying by descriptor, OTS-89
 copying by reference, OTS-91
 dynamic length
 allocating, OTS-96
 deallocating, OTS-94, OTS-95