z/OS

Language Environment Programming Reference

SA22-7562-03

z/OS

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SA22-7562-03

Note

Before using this information and the product it supports, be sure to read the general information under “Notices” on page 529.

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About this document

This document supports z/OS (5694–A01) and z/OS.e (5655–G52).

IBM z/OS Language Environment (also called Language Environment) provides common services and language-specific routines in a single run-time environment for C, C++, COBOL, Fortran (z/OS only; no support for z/OS UNIX System Services or CICS®), PL/I, and assembler applications. It offers consistent and predictable results for language applications, independent of the language in which they are written.

Language Environment is the prerequisite run-time environment for applications generated with the following IBM compiler products:
- z/OS C/C++
- OS/390® C/C++
- C/C++ Compiler for MVS/ESA™
- AD/Cycle® C/370™ Compiler
- VisualAge for Java, Enterprise Edition for OS/390
- Enterprise COBOL for z/OS and OS/390
- COBOL for OS/390 & VM
- COBOL for MVS & VM (formerly COBOL/370)
- Enterprise PL/I for z/OS and OS/390
- VisualAge PL/I for OS/390
- PL/I for MVS & VM (formerly PL/I MVS™ & VM)
- VS FORTRAN and FORTRAN IV (in compatibility mode)

Restrictions: The following restrictions apply to z/OS.e:
- The following compilers are not licensed for use on z/OS.e:
  - COBOL
  - PL/I
  - FORTRAN
- The following subsystems are not licensed for use on z/OS.e:
  - CICS
  - IMS™
- Execution of applications written in the following languages is not functionally supported on z/OS.e:
  - COBOL (except for precompiled COBOL DB2® stored procedures and other precompiled COBOL applications using the Language Environment preinitialization interface
  - FORTRAN
- The following are not functional and/or not licensed for use on z/OS.e:
  - Language Environment Library Routine Retention (LRR)
  - Language Environment compatibility preinitialization for C and PL/I
  - Run-time library services (RTLS)
- Customers are not permitted to use lower levels of Language Environment on z/OS.e.

Language Environment supports, but is not required for, an interactive debug tool for debugging applications in your native z/OS environment. The IBM interactive Debug Tool is available with z/OS, or with the latest releases of the C/C++, COBOL, PL/I and VisualAge for Java compiler products.

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Language Environment supports, but is not required for, VS Fortran Version 2 compiled code (z/OS only).

Language Environment consists of the common execution library (CEL) and the run-time libraries for C/C++, COBOL, Fortran, and PL/I.

For more information on VisualAge for Java, Enterprise Edition for OS/390, program number 5655-JAV, see the product documentation.

This publication provides application programmers with a detailed description of each Language Environment run-time option and callable service, as well as information on how to use them. It also provides programming examples that illustrate how each callable service can be used in routines written in Language Environment-conforming high-level languages (HLLs) and assembler language. Before using Language Environment, you should be familiar with the HLLs in which your applications are written. You should also understand the operating systems and any subsystems in which you plan to run Language Environment applications. The first usage of every term listed in the glossary is indicated by *italics.* You can find the definitions for these terms in *z/OS Language Environment Concepts Guide*.

Using your documentation

The publications provided with Language Environment are designed to help you:

- Manage the run-time environment for applications generated with a Language Environment-conforming compiler.
- Write applications that use the Language Environment callable services.
- Develop interlanguage communication applications.
- Customize Language Environment.
- Debug problems in applications that run with Language Environment.
- Migrate your high-level language applications to Language Environment.

Language programming information is provided in the supported high-level language programming manuals, which provide language definition, library function syntax and semantics, and programming guidance information.

Each publication helps you perform different tasks, some of which are listed in Table 1. All books are available in printed and softcopy formats. For a complete list of publications that you may need, see “How to specify run-time options” on page 11.

Table 1. How to Use z/OS Language Environment Publications

To ...	Use ...
Evaluate Language Environment	*z/OS Language Environment Concepts Guide*
Plan for Language Environment	*z/OS Language Environment Concepts Guide* *z/OS Language Environment Run-Time Migration Guide*
Install Language Environment	*z/OS Program Directory*
Customize Language Environment	*z/OS Language Environment Customization*
Understand Language Environment program models and concepts	*z/OS Language Environment Concepts Guide* *z/OS Language Environment Programming Guide*

Table 1. How to Use z/OS Language Environment Publications (continued)

To ...	Use ...
Find syntax for Language Environment run-time options and callable services	*z/OS Language Environment Programming Reference*
Develop applications that run with Language Environment	*z/OS Language Environment Programming Guide* and your language programming guide
Debug applications that run with Language Environment, diagnose problems with Language Environment	*z/OS Language Environment Debugging Guide*
Get details on run-time messages	*z/OS Language Environment Run-Time Messages*
Develop interlanguage communication (ILC) applications	*z/OS Language Environment Writing Interlanguage Communication Applications* and your language programming guide
Migrate applications to Language Environment	*z/OS Language Environment Run-Time Migration Guide* and the migration guide for each Language Environment-enabled language

Where to find more information

Please see *z/OS Information Roadmap* for an overview of the documentation associated with z/OS, including the documentation available for z/OS Language Environment.

Accessing z/OS licensed documents on the Internet

z/OS licensed documentation is available on the Internet in PDF format at the IBM Resource Link™ Web site at:

`http://www.ibm.com/servers/resourcelink`

Licensed documents are available only to customers with a z/OS license. Access to these documents requires an IBM Resource Link user ID and password, and a key code. With your z/OS order you received a Memo to Licensees, (GI10-0671), that includes this key code. [1]

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You can use the PDF format on either **z/OS Licensed Product Library CD-ROM** or IBM Resource Link to print licensed documents.

1. z/OS.e customers received a Memo to Licensees, (GI10-0684) that includes this key code.

Using LookAt to look up message explanations

LookAt is an online facility that allows you to look up explanations for most messages you encounter, as well as for some system abends and codes. Using LookAt to find information is faster than a conventional search because in most cases LookAt goes directly to the message explanation.

You can access LookAt from the Internet at:

`http://www.ibm.com/eserver/zseries/zos/bkserv/lookat/`

or from anywhere in z/OS where you can access a TSO/E command line (for example, TSO/E prompt, ISPF, z/OS UNIX System Services running OMVS). You can also download code from the *z/OS Collection* (SK3T-4269) and the LookAt Web site that will allow you to access LookAt from a handheld computer (Palm Pilot VIIx suggested).

To use LookAt as a TSO/E command, you must have LookAt installed on your host system. You can obtain the LookAt code for TSO/E from a disk on your *z/OS Collection* (SK3T-4269) or from the **News** section on the LookAt Web site.

Some messages have information in more than one document. For those messages, LookAt displays a list of documents in which the message appears.

Summary of Changes

Summary of Changes
for SA22-7562-03
z/OS Version 1 Release 4

The book contains information previously presented in *z/OS Language Environment Programming Reference*, SA22-7562-02, which supports z/OS Version 1 Release 3.

New Information

- Information has been added to indicate that this book supports z/OS.e.

Changed Information

- The bit manipulation routines have been added to Chapter 1, “Language Environment quick reference tables” on page 1.
- Updates were made to the FILETAG run-time option.
- The options report in “RPTOPTS” on page 59 has been updated.
- The storage reports in “RPTSTG” on page 62 have been updated.

Moved Information

- ″How to read syntax diagrams″ has been moved to Chapter 2, “Language Environment run-time options” on page 9.
- The bit manipulation routines have been moved out of “Math services” on page 475 into Chapter 4, “Bit manipulation routines” on page 469.

Deleted Information

- The CBLOPTS run-time option has been removed. It remains in *z/OS Language Environment Customization*.
- The appendix on Managed System Infrastructure for Setup (msys for Setup) has been removed.
- The NONIPTSTACK | NONONIPTSTACK run-time option hace been removed because it is no longer supported. It was replaced by the THREADSTACK option.

This book contains terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

As part of an ongoing effort, several of the run-time options in Chapter 2, “Language Environment run-time options” on page 9 have been updated to improve the consistency and retrievability of the information.

Summary of Changes
for SA22-7562-02
z/OS Version 1 Release 3

The book contains information previously presented in *z/OS Language Environment Programming Reference*, SA22-7562-01, which supports z/OS Version 1 Release 2.

New Information

- Added information about the vendor heap manager (VHM) to the HEAPPOOLS and RPTSTG run-time options.
- Added product number to the CEEGPID callable service.

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- Added information to the RTEREUS run-time option.
- An appendix on Managed System Infrastructure for Setup (msys for Setup) has been added.
- An appendix with z/OS product accessibility information has been added.

You may notice changes in the style and structure of some content in this book — for example, headings that use uppercase for the first letter of initial words only, and procedures that have a different look and format. The changes are ongoing improvements to the consistency and retrievability of information in our books.

Summary of Changes
for SA22-7562-01
z/OS Version 1 Release 2

The book contains information previously presented in *z/OS Language Environment Programming Reference*, SA22-7562-00, which supports z/OS Version 1 Release 1.

New Information

- A change of the output parameter CEE_Version_ID for CEEGPID as a four-byte hex number in the form PPVVRRMM. For New Product Language Environment, the product number is 4.
- A new suboption has been added to the TERMTHDACT that will cause Language Environment to write the CEEDUMP on the CICS dump data set via an interface provided by CICS.
- A new FILETAG run-time option has been added.

Changed Information

- Changes to the run-time option defaults were made in Chapter 1, “Language Environment quick reference tables” on page 1 and Chapter 2, “Language Environment run-time options” on page 9.

This book contains terminology, maintenance, and editorial changes, including changes to improve consistency and retrievability.

Summary of Changes
for SA22-7562-00
z/OS Version 1 Release 1

This book contains information also presented in *OS/390 Language Environment for OS/390 & VM Programming Reference*. Some additional function is provided by APAR:

- APAR PQ38324 — A new GENOPTS option has been added to CEE3DMP. This new option generates a run-time options report and places it at the end of the enclave information whenever the TRACE, UATRACE, DUMP and UADUMP options are invoked.
- APAR PQ39927 and PQ39636— A new sub-option *reg_stor_amount* has been added to the TERMTHDACT run-time option. This new sub-option allows the user to control the the amount of storage to be dumped when a CEEDUMP is produced. The amount can range from 0 (no storage dumped) to 256 bytes. The number specified will be rounded up to the nearest multiple of 32.

Chapter 1. Language Environment quick reference tables

The following tables are a quick reference of the Language Environment run-time options, callable services, and math services. They list the location of the options and services and briefly state their function.

For detailed descriptions of these options and services, refer to their respective chapters in this book.

Run-time options

Table 2. Run-Time Options Quick Reference

Run-Time Options	Function	Page
ABPERC	Percolates a specified abend.	12
ABTERMENC	Sets the enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater.	13
AIXBLD | NOAIXBLD	Invokes the access method services (AMS) for VSAM indexed and relative data sets to complete the file and index definition procedures for COBOL routines.	14
ALL31	Indicates whether an application does or does not run entirely in AMODE(31).	15
ANYHEAP	Controls allocation of library heap storage not restricted to below the 16M line.	16
ARGPARSE	Specifies whether arguments on the command line are to be parsed in the usual C format.	18
AUTOTASK	Specifies whether Fortran Multitasking Facility is to be used by your program and the number of tasks that are allowed to be active.	18
BELOWHEAP	Controls allocation of library heap storage below the 16M line.	19
CBLOPTS	Specifies the format of the argument string on application invocation when the main program is COBOL.	20
CBLPSHPOP	Controls whether CICS PUSH HANDLE and CICS POP HANDLE commands are issued when a COBOL subprogram is called.	20
CBLQDA	Controls COBOL QSAM dynamic allocation.	21
CHECK	Indicates whether “checking errors” within an application should be detected.	22
COUNTRY	Specifies the default formats for date, time, currency symbol, decimal separator, and the thousands separator based on a country.	22
DEBUG | NODEBUG	Activates the COBOL batch debugging features specified by the “debugging lines” or the USE FOR DEBUGGING declarative.	24
DEPTHCONDLMT	Limits the extent to which conditions can be nested.	24
ENV	Specifies the operating system that your C application runs under.	25
ENVAR	Sets the initial values for the environment variables.	26
ERRCOUNT	Specifies how many conditions of severity 2, 3, and 4 can occur per thread before an enclave terminates abnormally.	28

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Table 2. Run-Time Options Quick Reference (continued)

Run-Time Options	Function	Page
ERRUNIT	Identifies the unit number to which run-time error information is to be directed.	29
EXECOPS	Specifies whether run-time options can be specified on the command line.	29
FILEHIST	FILEHIST specifies whether to allow the file definition of a file referred to by a ddname to be changed during run time.	30
FILETAG	FILETAG ensures control of untagged HFS files and standard streams terminal files when set up for conversion, and for control of certain open functions which tag new or empty HFS files.	31
FLOW | NOFLOW	Controls the FLOW output produced by OS/VS COBOL programs.	33
HEAP	Controls allocation of the user heap.	33
HEAPCHK	Specifies that user heap storage can be inspected for damage and request a heap storage diagnostics report.	36
HEAPPOOLS	Specifies that (Quick) heap storage manager can be used.	37
INFOMSGFILTER	Allows the user to eliminate unwanted informational messages.	39
INQPCOPN | NOINQPCOPN	INQPCOPN controls whether the OPENED specifier on an INQUIRE by unit statement can be used to determine whether a preconnected unit has had any I/O statements directed to it.	40
INTERRUPT	Causes attentions recognized by the host operating system to be recognized by Language Environment.	40
LIBRARY	This option specifies the name of the logical library used for finding RTLS version-controlled modules.	41
LIBSTACK	Controls the allocation of the thread's library stack storage.	42
MSGFILE	Specifies the *ddname* of the run-time diagnostics file.	43
MSGQ	Specifies the number of ISI blocks allocated on a per-thread basis during execution.	47
NATLANG	Specifies the national language to use for the run-time environment.	47
OCSTATUS | NOOCSTATUS	Controls whether the OPEN and CLOSE status specifiers are verified.	51
PC	Specifies that Fortran static common blocks are not shared among load modules.	52
PLIST	Specifies the format of the invocation arguments received by your C application when it is invoked.	52
PLITASKCOUNT	Controls the maximum number of tasks active at one time while you are running PL/I MTF applications.	54
POSIX	Specifies whether the enclave can run with the POSIX semantics.	55
PROFILE	Controls the use of an optional profiler which collects performance data for the running application.	56
PRTUNIT	Identifies the unit number used for PRINT and WRITE statements that do not specify a unit number.	57
PUNUNIT	Identifies the unit number used for PUNCH statements that do not specify a unit number.	57

Table 2. Run-Time Options Quick Reference (continued)

Run-Time Options	Function	Page
RDRUNIT	Identifies the unit number used for READ statements that do not specify a unit number.	58
REDIR	Specifies whether redirections for `stdin`, `stderr`, and `stdout` are allowed from the command line.	59
RECPAD	Specifies whether a formatted input record is padded with blanks.	58
RPTOPTS	Specifies that a report of the run-time options in use by the application be generated.	59
RPTSTG	Specifies that a report of the storage used by the application be generated at the end of execution.	62
RTEREUS | NORTEREUS	Initializes the run-time environment to be reusable when the first COBOL program is invoked.	72
RTLS	With RTLS(ON), the module search order for most Language Environment modules and dynamically-called user modules is modified. The RTLS logical library is first searched, followed by the normal MVS module search order. See “LIBRARY” on page 41 and “VERSION” on page 100.	74
SIMVRD | NOSIMVRD	Specifies whether your COBOL programs use a VSAM KSDS to simulate variable length relative organization data sets.	75
STACK	Controls the allocation and management of stack storage.	76
STORAGE	Controls the contents of storage that is allocated and freed.	79
TERMTHDACT	Sets the level of information produced due to an unhandled error of severity 2 or greater.	81
TEST | NOTEST	Specifies that a debug tool is to be given control according to the suboptions specified.	88
THREADHEAP	Controls the allocation and management of thread-level heap storage.	90
THREADSTACK	Controls the allocation of thread-level stack storage for both the upward and downward-growing stack.	92
TRACE	Determines whether Language Environment run-time library tracing is active.	94
TRAP	Specifies how Language Environment routines handle abends and program interrupts.	95
UPSI	Sets the eight UPSI switches on or off.	98
USRHDLR	Registers user condition handlers.	98
VCTRSAVE	Specifies whether any language in an application uses the vector facility when user-written condition handlers are called.	100
VERSION	Specifies the version of the RTLS logical library used for finding RTLS version-controlled modules.	100
XPLINK	Controls the initialization of the XPLINK environment.	101
XUFLOW	Specifies whether an exponent underflow causes a program interrupt.	103

Bit manipulation routines

Table 3. Bit Manipulation Routines

Callable Service	Function	Page
CEESICLR	Bit clear	469
CEESISET	Bit set	469
CEESISHF	Bit shift	470
CEESITST	Bit test	470

Condition handling callable services

Table 4. Condition Handling Callable Services

Callable Service	Function	Page
CEE3CIB	Returns a pointer to a condition information block (CIB) associated with a given condition token.	118
CEE3GRN	Gets the name of the most current Language Environment-conforming routine in which a condition occurred.	149
CEE3GRO	Returns the offset within a failing routine of the most recent condition.	157
CEE3SPM	Queries and modifies the enablement of Language Environment hardware conditions.	190
CEE3SRP	Sets the resume point at the next instruction in the calling routine to be used by CEEMRCE.	198
CEEDCOD	Decodes an existing condition token.	250
CEEGQDT	Provides a mechanism by which application code can retrieve the *q_data_token* from the Instance Specific Information (ISI).	310
CEEHDLR	Registers a user condition handler for the current stack frame.	326
CEEHDLU	Unregisters a user-written condition handler for the current stack frame.	336
CEEITOK	Computes the initial condition token for the current condition information block.	349
CEEMRCE	Resumes execution of a user routine at the location established by CEE3SRP.	376
CEEMRCR	Moves the resume cursor to a position relative to the current position of the handle cursor.	383
CEENCOD	Dynamically constructs a condition token.	401
CEESGL	Raises, or signals, a condition to the condition manager.	450

Date and time callable services

Table 5. Date and Time Callable Services

Callable Service	Function	Page
CEECBLDY	Converts a string representing a date to a COBOL integer format.	204
CEEDATE	Converts a number representing a Lilian date to a date written in character format.	228

Table 5. Date and Time Callable Services (continued)

Callable Service	Function	Page
CEEDATM	Converts a number representing the number of seconds since 00:00:00 14 October 1582 to character format.	235
CEEDAYS	Converts a string representing a date to a Lilian format.	243
CEEDYWK	Calculates the day of the week on which a Lilian date falls.	262
CEEGMT	Computes the current Greenwich Mean Time (GMT) as both a Lilian date and as the number of seconds since 00:00:00 14 October 1582.	297
CEEGMTO	Computes values to the calling routine that represent the difference between the local system time and Greenwich Mean Time.	301
CEEISEC	Converts separate binary integers representing year, month, day, hour, minute, second, and millisecond to a number representing the number of seconds since 00:00:00 14 October 1582.	342
CEELOCT	Gets the current local time in three formats.	361
CEEQCEN	Queries the century within which Language Environment assumes two-digit year values lie.	408
CEESCEN	Sets the century in which Language Environment assumes two-digit year values lie.	422
CEESECI	Converts a number representing the number of seconds since 00:00:00 14 October 1582 to seven separate binary integers representing year, month, day, hour, minute, second, and millisecond.	431
CEESECS	Converts a string representing a timestamp into a number representing the number of seconds since 00:00:00 14 October 1582.	436

Dynamic storage callable services

Table 6. Dynamic Storage Callable Services

Callable Service	Function	Page
CEE3RPH	Sets the heading displayed at the top of the storage or options reports that are generated when you specify the RPTSTG(ON) or RPTOPTS(ON) run-time options.	187
CEECRHP	Creates additional heaps.	216
CEECZST	Changes the size of a previously allocated storage element, while preserving its contents.	221
CEEDSHP	Discards an entire heap that you created previously with a call to CEECRHP.	257
CEEFRST	Frees storage previously allocated by CEEGTST.	284
CEEGTST	Allocates storage from a heap whose ID you specify.	321

General callable services

Table 7. General Callable Services

Callable Service	Function	Page
CEE3DMP	Generates a Language Environment formatted dump of the run-time environment and member language libraries.	129
CEE3PRM	Returns to the calling routine the argument string that was specified at program invocation.	184
CEE3USR	Sets or queries one of two 4-byte fields known as the user area fields.	199
CEEGPID	Retrieves the version of Language Environment currently in use.	305
CEERAN0	Generates a sequence of uniform pseudo-random numbers between 0.0 and 1.0 using the multiplicative congruential method with a user-specified seed.	419
CEETEST	Invokes a tool for debugging.	463

Initialization and termination services

Table 8. Initialization and Termination Services

Callable Service	Function	Page
CEE3ABD	Stops the enclave with an abend. The abend can be issued either with or without clean-up.	115
CEE3GRC	Gets the enclave return code.	136
CEE3SRC	Sets the enclave return code.	197

Locale callable services

Table 9. Locale Callable Services

Callable Service	Function	Page
CEEFMON	Formats monetary strings.	275
CEEFTDS	Formats time and date into a character string.	290
CEELCNV	Queries locale numeric conventions.	355
CEEQDTC	Queries locale date and time conventions and returns the specified format information.	411
CEEQRYL	Queries the active locale environment.	417
CEESCOL	Compares the collation weights of two strings.	427
CEESETL	Sets the locale operating environment.	444
CEESTXF	Transforms string characters into collation weights.	456

Math services

Table 10. Math Services

Math Service	Function	Page
CEESxABS	Absolute value	475

Table 10. Math Services (continued)

Math Service	Function	Page
CEESxACS	Arccosine	476
CEESxASN	Arcsine	477
CEESxATH	Hyperbolic arctangent	478
CEESxATN	Arctangent	479
CEESxAT2	Arctangent of two arguments	480
CEESxCJG	Conjugate complex	480
CEESxCOS	Cosine	481
CEESxCSH	Hyperbolic cosine	483
CEESxCTN	Cotangent	484
CEESxDIM	Positive difference	486
CEESxDVD	Division	487
CEESxERC	Error function complement	487
CEESxERF	Error function	488
CEESxEXP	Exponential (base e)	489
CEESxGMA	Gamma function	490
CEESxIMG	Imaginary part of complex	491
CEESxINT	Truncation	492
CEESxLGM	Log gamma function	493
CEESxLG1	Logarithm base 10	494
CEESxLG2	Logarithm base 2	495
CEESxLOG	Logarithm base e	496
CEESxMLT	Floating-point complex multiplication	497
CEESxMOD	Modular arithmetic	497
CEESxNIN	Nearest integer	499
CEESxNWN	Nearest whole number	499
CEESxSGN	Transfer of sign	500
CEESxSIN	Sine	501
CEESxSNH	Hyperbolic sine	503
CEESxSQT	Square root	504
CEESxTAN	Tangent	505
CEESxTNH	Hyperbolic tangent	507
CEESxXPx	Exponential (**)	507

Message handling callable services

Table 11. Message Handling Callable Services

Callable Service	Function	Page
CEECMI	Stores message insert data.	209
CEEMGET	Retrieves a message corresponding to a condition token returned from a callable service.	365

Table 11. Message Handling Callable Services (continued)

Callable Service	Function	Page
CEEMOUT	Writes a specified message to the message string file.	372
CEEMSG	Retrieves a message corresponding to a condition token received and writes it to the message file.	395

National Language Support callable services

Table 12. National Language Support and National Language Architecture Callable Services

Callable Service	Function	Page
CEE3CTY	Changes or queries the current national country setting.	122
CEE3LNG	Changes or queries the current national language.	164
CEE3MCS	Gets the default currency symbol for a country specified in *country_code*.	173
CEE3MDS	Gets the default decimal separator for the country specified in *country_code*.	176
CEE3MTS	Gets the default thousands separator for the country that you specify in *country_code*	180
CEEFMDA	Gets the default date picture string for a country specified in *country_code*.	268
CEEFMDT	Gets the default date and time picture strings for the country specified in *country_code*.	271
CEEFMTM	Gets the default time picture string for the country specified in *country_code*.	281

Chapter 2. Language Environment run-time options

This chapter describes the Language Environment run-time options, their syntax, and their usage.

IBM-supplied default keywords appear **above** the main path or options path in the syntax diagrams. In the parameter list, IBM-supplied default choices are underlined. The minimum unambiguous abbreviation of each Language Environment option is also indicated in its syntax diagram with capital letters (for example, ABPerc indicates that ABP is the minimum abbreviation).

For a list of Language Environment run-time options, see “Run-time options” on page 1.

How to read syntax diagrams

This section describes how to read syntax diagrams. It defines syntax diagram symbols, items that may be contained within the diagrams (keywords, variables, delimiters, operators, fragment references, operands) and provides syntax examples that contain these items.

Syntax diagrams pictorially display the order and parts (options and arguments) that comprise a command statement. They are read from left to right and from top to bottom, following the main path of the horizontal line.

Symbols

The following symbols may be displayed in syntax diagrams:

Symbol	Definition
►►──	Indicates the beginning of the syntax diagram.
──►	Indicates that the syntax diagram is continued to the next line.
►──	Indicates that the syntax is continued from the previous line.
──►◄	Indicates the end of the syntax diagram.

Syntax items

Syntax diagrams contain many different items. Syntax items include:

- Keywords - a command name or any other literal information.
- Variables - variables are italicized, appear in lowercase and represent the name of values you can supply.
- Delimiters - delimiters indicate the start or end of keywords, variables, or operators. For example, a left parenthesis is a delimiter.
- Operators - operators include add (+), subtract (-), multiply (*), divide (/), equal (=), and other mathematical operations that may need to be performed.
- Fragment references - a part of a syntax diagram, separated from the diagram to show greater detail.
- Separators - a separator separates keywords, variables or operators. For example, a comma (,) is a separator.

Keywords, variables, and operators may be displayed as required, optional, or default. Fragments, separators, and delimiters may be displayed as required or optional.

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Item type	Definition
Required	Required items are displayed on the main path of the horizontal line.
Optional	Optional items are displayed below the main path of the horizontal line.
Default	Default items are displayed above the main path of the horizontal line.

Syntax examples

The following table provides syntax examples.

Table 13. Syntax examples

Item	Syntax example
Required item. Required items appear on the main path of the horizontal line. You must specify these items.	```►►─KEYWORD─required_item──────────────►◄``` (KEYWORD followed by required_item)
Required choice. A required choice (two or more items) appears in a vertical stack on the main path of the horizontal line. You must choose one of the items in the stack.	```►►─KEYWORD─┬─required_choice1─┬──────►◄ └─required_choice2─┘``` (KEYWORD followed by required_choice1 or required_choice2)
Optional item. Optional items appear below the main path of the horizontal line.	```►►─KEYWORD─┬──────────────┬──────►◄ └─optional_item─┘``` (KEYWORD followed by optional_item, or nothing)
Optional choice. An optional choice (two or more items) appears in a vertical stack below the main path of the horizontal line. You may choose one of the items in the stack.	```►►─KEYWORD─┬──────────────────┬──────►◄ ├─optional_choice1─┤ └─optional_choice2─┘``` (KEYWORD followed by optional_choice1 or optional_choice2, or nothing)
Default. Default items appear above the main path of the horizontal line. The remaining items (required or optional) appear on (required) or below (optional) the main path of the horizontal line. The following example displays a default with optional items.	```┌─default_choice1──┐ ►►─KEYWORD─┼──────────────────┼──────►◄ ├─optional_choice2─┤ └─optional_choice3─┘``` (KEYWORD followed by default_choice1, optional_choice2, optional_choice3, or nothing)

Table 13. Syntax examples (continued)

Item	Syntax example
Variable. Variables appear in lowercase italics. They represent names or values.	►►─KEYWORD─*variable*──────────────────────────►◄
Repeatable item. An arrow returning to the left above the main path of the horizontal line indicates an item that can be repeated. A character within the arrow means you must separate repeated items with that character. An arrow returning to the left above a group of repeatable items indicates that one of the items can be selected, or a single item can be repeated.	►►─KEYWORD──┬─repeatable_item─┬──────────────►◄ │◄────────────────┘ ►►─KEYWORD──┬─,──────────────┬──────────────►◄ │◄─repeatable_item─┘
Fragment. The ─┤ fragment ├─ symbol indicates that a labelled group is described below the main syntax diagram. Syntax is occasionally broken into fragments if the inclusion of the fragment would overly complicate the main syntax diagram.	►►─KEYWORD─┤ fragment ├──────────────────────►◄ **fragment:** ├──┬─,required_choice1──────────────────┬──┤ │ │ ┌─,default_choice─┐ │ └─,required_choice2─┤ ├─────────────┘ └─,optional_choice─┘

How to specify run-time options

When specifying run-time options, use commas to separate any suboptions of those options. If you do not specify a suboption, you must still include the comma to indicate the omission of the suboption. For example: `STACK(,,ANYWHERE,FREE,,)`. Trailing commas, however, are not required. `STACK(,,ANYWHERE,FREE)` is valid. If you do not specify any suboptions, they are ignored. Either of the following is valid: `STACK` or `STACK()`.

If you run applications that are invoked by one of the `exec` family of functions, such as a program executed under the z/OS UNIX System Services shell, you can also use the _CEE_RUNOPTS environment variable to specify run-time options.

Refer to *z/OS Language Environment Programming Guide* for a detailed description of the various ways in which you can specify Language Environment run-time options and program arguments, and use _CEE_RUNOPTS.

Restriction: The double quotes character (") may not be part of the run-time options string for applications running under Turkish code page 1026. Use the single quote character (') instead.

Run-time options

Following are the Language Environment run-time options and examples of how to use them.

ABPERC

Derivation
ABnormal PERColation

ABPERC percolates an abend whose code you specify. This provides Language Environment condition handling semantics for all abends except the one specified.

Restriction: TRAP(ON) must be in effect for ABPERC to have an effect.

When you run with ABPERC and encounter the specified abend:

- User condition handlers are not enabled.
- Under z/OS UNIX, POSIX signal handling semantics are not enabled for the abend.
- No storage report or run-time options report is generated.
- No Language Environment messages or Language Environment formatted dump output is generated.
- The assembler user exit is not driven for enclave termination.
- The abnormal termination exit, if there is one, is not driven.
- Files opened by HLLs are not closed by Language Environment, so records might be lost.
- Resources acquired by Language Environment are not freed.
- A debugging tool, if one is active, is not notified of the error.

Tip: You can also use the CEEBXITA assembler user exit to specify a list of abend codes for Language Environment to percolate. For more information about CEEBXITA, see *z/OS Language Environment Programming Guide*

Non-CICS default: ABPERC(NONE)

CICS default: ABPERC is ignored under CICS.

Syntax

```
►►──ABPerc──(──┬─NONE───┬──)──────────────────────────────────────►◄
               └─abcode─┘
```

NONE Specifies that all abends are handled according to Language Environment condition handling semantics.

abcode
Specifies the abend code to percolate. The *abcode* can be specified as:

S*hhh* A system abend code, where *hhh* is the hex system abend code

U*dddd* A user abend code, where *dddd* is a decimal user abend code. Any 4-character string can also be used as *dddd*.

z/OS UNIX consideration

- ABPERC percolates an abend regardless of the thread in which it occurs.

Usage notes

- Language Environment ignores ABPERC(S0C*x*). In this instance, no abend is percolated, and Language Environment condition handling semantics are in effect.
- You can identify only one abend code with this option. However, an abend U0000 is interpreted in the same way as S000.

ABTERMENC

Derivation

ABnormal TERMination of the ENClave

ABTERMENC sets the enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater.

Restriction: TRAP(ON) must be in effect for ABTERMENC to have an effect.

Non-CICS default: ABTERMENC(ABEND)

CICS default: ABTERMENC(ABEND)

Syntax

```
                   ┌─ABEND──┐
►►──ABTermenc──(───┴─RETCODE─┴──)──────────────────────────────────►◄
```

ABEND

When an unhandled condition of severity 2 or greater is encountered, Language Environment issues an abend to end the enclave.

Default abend processing occurs as follows:

- Language Environment sets an abend code value that depends on the type of unhandled condition.
- Language Environment sets a reason code value that depends on the type of unhandled condition.
- Language Environment does not request a system dump.
- Language Environment issues an abend to terminate the task.

RETCODE

When an unhandled condition of severity 2 or greater is encountered, Language Environment issues a return code and reason code to end the enclave.

z/OS UNIX consideration

- In a multithreaded application with ABTERMENC(ABEND), Language Environment issues an abend on the task associated with the initial processing thread (IPT), regardless of which thread experienced the unhandled condition. All non-IPT threads are terminated normally. This means that the thread that encountered the unhandled condition is terminated normally if it is a non-IPT thread.

Usage notes

- You can use the assembler user exit, CEEAUE_ABND, to modify the behavior of this run-time option by setting the CEEAUE_ABND flag. See *z/OS Language Environment Programming Guide* for more information.
- To gather information about the unhandled condition, see “TERMTHDACT” on page 81.

For more information

- For information about return code calculation and abend codes, see *z/OS Language Environment Programming Guide*.

AIXBLD (COBOL Only)

Derivation

Alternate IndeX BuiLD

AIXBLD invokes the access method services (AMS) for VSAM indexed and relative data sets (KSDS and RRDS) to complete the file and index definition procedures for COBOL programs.

AIXBLD conforms to the ANSI 1985 COBOL standard.

Non-CICS default: NOAIXBLD

CICS default: AIXBLD is ignored under CICS.

Syntax

```
                ┌─NOAIXBLD─┐
►►──────────────┼─NOAIX────┼──────────────────────────────────────────►◄
                │─AIXBLD───┤
                └─AIX──────┘
```

NOAIXBLD|NOAIX
Does not invoke the access method services for VSAM indexed and relative data sets. NOAIXBLD can be abbreviated NOAIX.

AIXBLD|AIX
Invokes the access method services for VSAM indexed and relative data sets. AIXBLD can be abbreviated AIX.

z/OS UNIX consideration

- If you also specify the MSGFILE run-time option, the access method services messages are directed to the MSGFILE *ddname* or to the default SYSOUT.

Performance consideration

Running your program under AIXBLD requires more storage, which can degrade performance. Therefore, use AIXBLD only during application development to build alternate indices. Use NOAIXBLD when you have already defined your VSAM data sets.

For more information

- See *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for more details.
- See “MSGFILE” on page 43 for information about the MSGFILE run-time option.

ALL31

Derivation

ALL AMODE 31

ALL31 specifies whether an application can run entirely in AMODE 31 or whether the application has one or more AMODE 24 routines.

It is recommended that ALL31 have the same setting for all enclaves in a process. Language Environment does not support the invocation of a nested enclave requiring ALL31(OFF) from an enclave running with ALL31(ON) in non-CICS environments.

Non-CICS default: ALL31(ON)

CICS default: ALL31(ON)

Syntax

```
►►──ALL31──(──┬─ON──┬──)──────────────────────────────────────────►◄
              └─OFF─┘
```

ON If the initial routine of the Language Environment application is AMODE 31, this setting indicates that no other routines in the application will be AMODE 24.

If the initial routine of the Language Environment application is AMODE 24, ALL31 is dynamically switched to OFF.

When ALL31(ON) remains in effect:

- AMODE switching across calls to Language Environment common run-time routines is minimized. For example, no AMODE switching is performed on calls to Language Environment callable services.
- Language Environment allocates storage for the common anchor area (CAA) and other control blocks in unrestricted storage.
- COBOL EXTERNAL data is allocated in unrestricted storage.

OFF Indicates that one or more routines of a Language Environment application are AMODE 24.

When ALL31(OFF) is in effect:

- Language Environment uses more storage below the 16M line.
- AMODE switching across calls to Language Environment common run-time routines is performed. For example, AMODE switching is performed on calls to Language Environment callable services.
- Language Environment allocates storage for the common anchor area (CAA) and other control blocks in storage below the 16M line.

- COBOL EXTERNAL data is allocated in storage below the 16M line.

  Restriction: If you use the default setting ALL31(OFF), you must also use the setting STACK(,,BELOW,,,). AMODE 24 routines require stack storage below the 16M line.

z/OS UNIX considerations

- In a multithread environment, the ALL31 option applies to all threads in a process.
- In a multithread environment, the thread start routine specified in the C pthread_create() function call is invoked in AMODE 31.

Usage notes

- **Restrictions:** You must specify ALL31(OFF) if your COBOL applications contain one of the following programs:
  - VS COBOL II NORES
  - OS/VS COBOL (non-CICS)
- PL/I considerations— For PL/I MTF applications, Language Environment provides AMODE switching. Therefore, the first routine of a task can be in AMODE 24.
- Fortran considerations—Use ALL31(ON) if all of the compile units in the enclave have been compiled with VS FORTRAN Version 1 or Version 2 and there are no requirements for 24-bit addressing mode. Otherwise, use ALL31(OFF).
- XPLINK considerations—When an application is running in an XPLINK environment (that is, either the XPLINK(ON) run-time option was specified, or the initial program contained at least one XPLINK compiled part), the ALL31 run-time option is forced to ON. No AMODE 24 routines are allowed in an enclave that uses XPLINK. No message is issued to indicate this action. If a Language Environment run-time options report is generated using the RPTOPTS run-time option, the ALL31 option is reported as ″Override″ under the LAST WHERE SET column.
- **Recommendation:** ALL31 should have the same setting for all enclaves in a process. Language Environment does not support the invocation of a nested enclave requiring ALL31(OFF) from an enclave running with ALL31(ON) in non-CICS environments.

Performance Consideration

If your application consists entirely of AMODE 31 routines, it will run faster and use less below-the-line storage with ALL31(ON) than with ALL31(OFF).

For More Information

- See “STACK” on page 76 for information about the STACK run-time option.
- See “XPLINK” on page 101 for information about the XPLINK run-time option.

ANYHEAP

The ANYHEAP run-time option controls the allocation of unrestricted library heap storage (anywhere heap). Storage that is unrestricted can be located anywhere in 31-bit addressable storage.

Non-CICS default: ANYHEAP(16K,8K,ANYWHERE,FREE)

CICS default: ANYHEAP(4K,4080,ANYWHERE,FREE)

Syntax

```
►►─ANyheap─(─┬──────────┬─,─┬──────────┬─,─┬─ANYWHERE─┬─,──────►
             └─init_size─┘   └─incr_size─┘   ├─ANY──────┤
                                             └─BELOW────┘

►─┬─FREE─┬─)──────────────────────────────────────────────────►◄
  └─KEEP─┘
```

init_size
: Determines the initial size of the anywhere heap. This value can be specified as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr_size
: Determines the minimum size of any subsequent increment to the anywhere heap This value can be specified as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

ANYWHERE|ANY
: Specifies that anywhere heap can be allocated anywhere in 31–bit addressable storage. If there is no storage available above the 16M line, storage is acquired below the 16 MB line.

BELOW
: Specifies that anywhere heap is allocated below the 16M line.

FREE
: Specifies that an anywhere heap increment is released when the last of the storage within that increment is freed.

KEEP
: Specifies that an anywhere heap increment is **not** released when the last of the storage within that increment is freed.

CICS considerations

- If ANYHEAP(0) is specified, the initial anywhere heap segment is obtained on the first use and will be based on the increment size.
- The maximum initial and increment size for the anywhere heap is 1 gigabyte (1024M).
- The default increment size is 4080 bytes, rather than 4096 bytes, to accommodate the 16 byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line). If you choose to change the increment size, it is recommended that you adjust for the 16 byte CICS storage check zone.

z/OS UNIX considerations

- In a multithread environment, the anywhere heap is shared by all threads in the process.
- When ALL31(ON) is in effect, Language Environment allocates thread-specific control blocks from the anywhere heap.

Performance consideration

You can improve performance with the ANYHEAP run-time option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 62 for information on how to generate a report you can use to determine the optimum values for the ANYHEAP run-time option.

For more information

- For more information about heap storage and heap storage tuning with storage report numbers, see *z/OS Language Environment Programming Guide*.

ARGPARSE | NOARGPARSE (C only)

Derivation

ARGument PARSE

ARGPARSE specifies whether command line arguments to a C/C++ program are to be parsed. This option does not apply to non-C/C++ languages and can be specified with the `#pragma runopts` directive or the ARGPARSE or NOARGPARSE compiler option.

Restriction: You cannot set ARGPARSE during Language Environment installation.

Non-CICS default: ARGPARSE

CICS default: ARGPARSE is ignored under CICS.

Syntax

```
      ┌─ARGPARSE──┐
►►────┴─NOARGPARSE─┴──────────────────────────────────────────────►◄
```

ARGPARSE
Specifies that arguments given on the command line are to be parsed and given to the `main()` function in the usual C argument format (`argv`, and `argc`).

NOARGPARSE
Specifies that arguments given on the command line are not parsed but are passed to the `main()` function as one string. Therefore, `argc` has a value of 2, and `argv[1]` contains a pointer to the command line string.

Usage notes

- You must specify ARGPARSE for the REDIR run-time option to have an effect.

For more information

- See “REDIR | NOREDIR (C Only)” on page 59 for a description of REDIR.

AUTOTASK | NOAUTOTASK (Fortran only)

AUTOTASK specifies whether Fortran multitasking facility (MTF) is to be used by your program and the number of tasks that are allowed to be active.

Non-CICS default: NOAUTOTASK

CICS default: AUTOTASK is ignored under CICS.

Syntax

```
►►─┬─NOAUTOtask──────────────────────────┬──────────────────────────►◄
   └─AUTOtask──┬──────────────────────────┬─┘
               └─(──loadmod──,──numtasks──)─┘
```

NOAUTOTASK
Disables the MTF and nullifies the effects of previous specifications of AUTOTASK parameters.

loadmod
The name of the load module that contains the concurrent subroutines that run in the subtasks created by MTF.

numtasks
The number of subtasks created by MTF. This value can range from 1 through 99.

BELOWHEAP

The BELOWHEAP run-time option controls the allocation of restricted library heap storage (below heap). Storage that is restricted must be located below the 16M line (24-bit addressable storage).

Non-CICS default: BELOWHEAP(8K,4K,FREE)

CICS default: BELOWHEAP(4K,4080,FREE)

Syntax

```
                                                  ┌─FREE─┐
►►─BElowheap──(──┬──────────┬──,──┬──────────┬──,──┼──────┼──)──────────►◄
                 └─init_size─┘     └─incr_size─┘     └─KEEP─┘
```

init_size
Determines the minimum initial size of the below heap storage. This value can be specified as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr_size
Determines the minimum size of any subsequent increment to the area below the 16M line, and is specified in *n*, *n*K, or *n*M bytes of storage. This value is rounded up to the nearest multiple of 8 bytes.

FREE Specifies that storage allocated to BELOWHEAP increments is released when the last of the storage is freed.

KEEP Specifies that storage allocated to BELOWHEAP increments is **not** released when the last of the storage within that increment is freed.

CICS consideration

- The default increment size is 4080 bytes, rather than 4096 bytes, to accommodate the 16 byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line). If you choose to change the increment size, it is recommended that you adjust for the 16 byte CICS storage check zone.

z/OS UNIX considerations

- In a multithread environment, the below heap is shared by all threads in the process.
- When ALL31(OFF) is in effect, Language Environment allocates thread-specific control blocks from the below heap.

Usage notes

- If BELOWHEAP(0) is specified, the initial below heap segment is obtained on the first use and is based on the increment size.

Performance consideration

You can improve performance with the BELOWHEAP run-time option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 62 for information on how to generate a report you can use to determine the optimum values for the BELOWHEAP run-time option.

For more information

- For more information about heap storage and heap storage tuning with storage report numbers, see *z/OS Language Environment Programming Guide*.

CBLOPTS (COBOL only)

Derivation
COBOL OPTionS

CBLOPTS specifies the format of the parameter string on application invocation when the main program is COBOL. CBLOPTS determines whether run-time options or program arguments appear first in the parameter string.

Since you can specify this option only in CEEUOPT, CEEROPT or CEEDOPT at initialization, see *z/OS Language Environment Customization* for details.

CBLPSHPOP (COBOL only)

Derivation
COBOL PUSH POP

CBLPSHPOP controls whether CICS PUSH HANDLE and CICS POP HANDLE commands are issued when a COBOL subroutine is called.

CBLPSHPOP is ignored in non-CICS environments.

Tip: Specify CBLPSHPOP(ON) to avoid compatibility problems when calling COBOL subroutines that contain CICS CONDITION, AID, or ABEND condition handling commands.

You can set the CBLPSHPOP run-time option on an enclave basis using CEEUOPT.

Non-CICS default: CBLPSHPOP is ignored.

CICS default: CBLPSHPOP(ON)

Syntax

```
►►──CBLPshpop──(──┬──ON──┬──)──────────────────────────────────────►◄
                  └──OFF─┘
```

ON Automatically issues the following when a COBOL subroutine is called:
- An EXEC CICS PUSH HANDLE command as part of the routine initialization.
- An EXEC CICS POP HANDLE command as part of the routine termination.

OFF Does not issue CICS PUSH HANDLE and CICS POP HANDLE commands on a call to a COBOL subroutine.

Performance consideration

- If your application calls COBOL subroutines under CICS, performance is better with CBLPSHPOP(OFF) than with CBLPSHPOP(ON).

For more information

- For more information about CEEUOPT, see *z/OS Language Environment Customization*.
- To determine where to locate information about CICS commands, see *CICS Master Index*.

CBLQDA (COBOL only)

Derivation
COBOL QSAM Dynamic Allocation

CBLQDA controls COBOL QSAM dynamic allocation on an OPEN statement.

Non-CICS default: CBLQDA(OFF)

CICS default: CBLQDA is ignored under CICS.

Syntax

```
►►──CBLQda──(──┬──OFF──┬──)──────────────────────────────────────►◄
               └──ON───┘
```

OFF Specifies that COBOL QSAM dynamic allocation is not permitted.

ON Specifies that COBOL QSAM dynamic allocation is permitted. ON conforms to the 1985 COBOL Standard.

Usage notes

- CBLQDA(OFF) is the recommended default because it prevents a temporary data set from being created in case there is a misspelling in your JCL. If you specify CBLQDA(ON) and have a misspelling in your JCL, Language Environment creates a temporary file, writes to it, and then z/OS deletes it. You receive a return code of 0, but no output.
- CBLQDA does not affect dynamic allocation for the message file specified in MSGFILE or the Language Environment formatted dump file (CEEDUMP) .

CHECK (COBOL only)

If your COBOL application has been compiled with the SSRANGE compile option, specifying the CHECK(ON) run-time option enables range checking of each index, subscript, and reference modification.

Non-CICS default: CHECK(ON)

CICS default: CHECK(ON)

Syntax

```
►►──CHeck──(──┬─ON──┬──)──────────────────────────────────────────►◄
              └─OFF─┘
```

ON Specifies that run-time range checking is performed.

OFF Specifies that run-time range checking is not performed.

Usage notes

- CHECK(ON) has no effect if the NOSSRANGE COBOL compile option was specified.

Performance consideration

If your COBOL program was compiled with the SSRANGE compile option, and you are not testing or debugging an application, performance improves when you specify CHECK(OFF).

COUNTRY

Specifying a `country_code` with the COUNTRY run-time option determines:

- date and time formats
- the currency symbol
- the decimal separator
- the thousands separator

COUNTRY affects only the Language Environment NLS services, not the Language Environment locale callable services.

Tip: You can set the country value using the COUNTRY run-time option or the CEE3CTY callable service.

Non-CICS default: COUNTRY(US)

CICS default: COUNTRY(US)

Syntax

```
►►──COUNTRy──(──┬──────────────┬──)──────────────────────────────────►◄
                └─country_code─┘
```

country_code
: A 2-character code that indicates to Language Environment the country on which to base the default settings. Table 27 on page 513 contains a list of valid country codes.

Usage notes

- If you specify an unsupported *country_code* , Language Environment accepts the value and issues an informational message.

  If an unsupported *country_code* is specified on the COUNTRY run-time option and one of the services listed in “National Language Support callable services” on page 8 is called with the optional *country_code* parameter omitted, the called service returns its specified default value.
- Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. The COUNTRY setting does not affect these locale-sensitive functions and locale callable services.

  To change the locale, you can use the `setlocale()` library function or the CEESETL callable service. These affect only C/C++ locale-sensitive functions and Language Environment locale callable services, not the COUNTRY run-time option.

  To ensure that all settings are correct for your country, use COUNTRY and either CEESETL or `setlocale()`.

  The settings of CEESETL or `setlocale()` do not affect the setting of the COUNTRY run-time option. COUNTRY affects only Language Environment NLS and date and time services. `setlocale()` and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.
- The COUNTRY setting affects the format of the date and time in the reports generated by the RPTOPTS and RPTSTG run-time options

For more information

- For more information about the CEE3CTY callable service, see “CEE3CTY—Set default country” on page 122.
- For more information about the RPTOPTS run-time option, see “RPTOPTS” on page 59.
- For more information about the RPTSTG run-time option, see “RPTSTG” on page 62.
- For a list of countries and their codes, see Appendix A, “IBM-supplied country code defaults” on page 513.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 444.
- For more information on `setlocale()`, see *z/OS C/C++ Programming Guide*.

DEBUG (COBOL only)

DEBUG activates the COBOL batch debugging features specified by the USE FOR DEBUGGING declarative.

Non-CICS default: NODEBUG

Syntax

```
                ┌─NODEBUG─┐
►►──────────────┤         ├──────────────────────────────────────────►◄
                └─DEBUG───┘
```

NODEBUG
Suppresses the COBOL batch debugging features.

DEBUG
Activates the COBOL batch debugging features.

You must have the WITH DEBUGGING MODE clause in the environment division of your application in order to compile the debugging sections.

CICS consideration

- The under CICS is DEBUG=(OFF).

Usage notes

- When specifying this option in CEEDOPT (CEECOPT), CEEROPT or CEEUOPT, use the syntax DEBUG(ON) or DEBUG(OFF). Use DEBUG and NODEBUG only on the command line.

Performance consideration

Because DEBUG(ON) gives worse run-time performance than DEBUG(OFF), you should use it only during application development or debugging.

For more information

- See *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for more details on the USE FOR DEBUGGING declarative.

DEPTHCONDLMT

Derivation
DEPTH of nested CONDition LiMiT

DEPTHCONDLMT specifies the extent to which conditions can be nested. Figure 1 on page 25 illustrates the effect of DEPTHCONDLMT(3) on condition handling. The initial condition and two nested conditions are handled in this example. The third nested condition is not handled.

```
                Error
            (level 1)
                 ↓
     User-written → Another error
condition handler        (level 2)
                              ↓
                     User-written → Another error
                condition handler        (level 3)
                                              ↓
                                     User-written → Another error
                                condition handler        (level 4)
                                                          ↓
                                                     Not handled
```

Figure 1. Effect of DEPTHCONDLMT(3) on Condition Handling

Non-CICS default: DEPTHCONDLMT(10)

Syntax

```
►►─DEPthcondlmt─(──┬──────┬──)──────────────────────────────────►◄
                   └─limit─┘
```

limit An integer of 0 or greater value. It is the depth of condition handling allowed. An unlimited depth of condition handling is allowed if you specify 0.

A 1 value specifies handling of the initial condition, but does not allow handling of nested conditions that occur while handling a condition. With a 5 value, for example, the initial condition and four nested conditions are processed, but there can be no further nesting of conditions.

If the number of nested conditions exceeds the limit, the application terminates with abend 4087.

CICS consideration

- The default under CICS is DEPTHCONDLMT=(10).

Usage notes

- PL/I consideration—DEPTHCONDLMT(0) provides PL/I compatibility.
- PL/I MTF consideration—In a PL/I MTF application, DEPTHCONDLMT sets the limit for how many nested synchronous conditions are allowed for a PL/I task. If the number of nested conditions exceeds the limit, the application terminates abnormally.
- z/OS UNIX consideration—The DEPTHCONDLMT option sets the limit for how many nested synchronous conditions are allowed for a thread. Asynchronous signals do not affect DEPTHCONDLMT.

For more information

- For more information on nested conditions, see *z/OS Language Environment Programming Guide*.

ENV (C only)

Derivation

ENVironment

ENV

ENV specifies the operating system for your C application. This option does not apply to non-C languages and can be specified only with the C `#pragma runopts` directive. (You cannot set ENV during Language Environment installation.) C++ users can get the same behavior by using the z/OS C++ compiler option TARGET(IMS) to specify ENV(IMS).

The ENV option differs from other run-time options in that it does not have a standard default. The default depends on the system (CMS, IMS, or MVS) in which compilation occurs.

Syntax

```
►►──ENV──(──┬─CMS─┬──)──────────────────────────────────────────►◄
            ├─IMS─┤
            └─MVS─┘
```

CMS Specifies the environment that C applications runs in.

IMS Specifies that the C application runs in an IMS environment. (However, you do not need to specify the ENV option if your application is invoked under IMS but does not actually use IMS facilities.)

MVS Specifies that the C application runs in an MVS environment.

Usage notes

- CICS consideration—This option is ignored under CICS.
- z/OS UNIX consideration—The ENV option applies to the enclave.

ENVAR

Derivation

ENvironmental VARiables

ENVAR sets the initial values for the environment variables specified in *string*. With ENVAR, you can pass into the application switches or tagged information that can then be accessed using the C functions `getenv`, `setenv`, and `clearenv`.

When the run-time options are merged, ENVAR strings are appended in the order encountered during the merge. Thus, the set of environment variables established by the end of run-time option processing reflects all the various sources where environment variables are specified (rather than just the one source with the highest precedence). However, if a setting for the same environment variable is specified in more than one source, the last setting is used.

Environment variables in effect at the time of the `system` function are copied to the new environment. The copied environment variables are treated the same as those found in the ENVAR run-time option on the command level, with respect to the merge of the run-time options from their various sources.

When you have specified the RPTOPTS run-time option, you receive a list of the merged ENVAR run-time options. The output for the ENVAR run-time options contains a separate entry for each source where ENVAR was specified with the environment variables from that source.

Non-CICS default: ENVAR(")

Syntax

```
                  ┌─,──────────┐
                  ▼            │
►►──ENVAR──(──┬──────────┬──┴──)──────────────────────────────────►◄
              └─string───┘
```

string Is of the form *name=value*, where *name* and *value* are sequences of characters that do not contain null bytes or equal signs. The string *name* is an environment variable, and *value* is its value.

Blanks are significant in both the *name=* and the *value* characters.

You can enclose the *string* in either single or double quotation marks to distinguish it from other strings. The *string* cannot contain DBCS characters. It can have a maximum of 250 characters.

You can specify multiple environment variables, separating the *name=value* pairs with commas. Quotation marks are required when specifying multiple variables.

CICS consideration

- The default under CICS is ENVAR=(").

Usage notes

- The ENVAR option functions independently of the POSIX run-time option setting.
- C consideration—An application can access the environment variables using C function `getenv` or the POSIX variable *environ*, which is defined as:

  ```
  extern char **environ;
  ```

  Access through `getenv` is recommended, especially in a multithread environment.

  HLLs can access the environment variables through standard C functions at enclave initialization and throughout the application's run. Access remains until the HLL returns from enclave termination. Environment variables that are propagated across the EXEC override those established by the ENVAR option. `getenv` serializes access to the environment variables.
- C++ consideration—An application can access the environment variables using C function `getenv`.

  HLLs can access the environment variables through standard C functions at enclave initialization and throughout the application's run.
- z/OS UNIX consideration—The environment variables apply to the enclave.

For more information

- For more information about the RPTOPTS run-time option, see "RPTOPTS" on page 59.

ERRCOUNT

Derivation

ERRor COUNTer

ERRCOUNT specifies how many conditions of severity 2, 3, or 4 can occur per thread before the enclave terminates abnormally. After the number specified in ERRCOUNT is reached, no further Language Environment condition management, including CEEHDLR management, is honored.

Non-CICS default: ERRCOUNT(0)

Syntax

```
►►──ERrcount──(──┬──────────┬──)──────────────────────────────────────►◄
                 └─number───┘
```

number

The number of severity 2, 3, and 4 conditions per individual thread that can occur while this enclave is running. If the number of conditions exceeds *number*, the thread and enclave terminate abnormally.

CICS consideration

- The default under CICS is ERRCOUNT=(0).

Usage notes

- ERRCOUNT(0) means that the Language Environment condition handler will not terminate the task regardless of the severity 2, 3, or 4 conditions that are generated.
- ERRCOUNT only applies when conditions are handled by a user condition handler, signal catcher, PL/I on-units, or a language-specific condition handler.

  Language Environment does not count severity 0 or 1 messages. However, the COBOL specific run-time library does count its severity 1 (warning) messages. When the limit of 256 IGZnnnnW messages is reached, the COBOL library will issue message IGZ0041W, which indicates that the limit of warning messages has been exceeded. Any further COBOL warning messages are suppressed.
- PL/I consideration—The use of ERRCOUNT(0) is recommended as the default setting in a PL/I environment. Some conditions, such as ENDPAGE, can occur many times in an application. Use ERRCOUNT(0) to avoid unnecessary termination of your application.
- PL/I MTF consideration—In a PL/I MTF application, ERRCOUNT sets the threshold for the total number severity 2, 3, and 4 synchronous conditions that can occur for each task. If the number of conditions exceeds the threshold, the application terminates normally.
- z/OS UNIX consideration—Synchronous signals that are associated with a condition of severity 2, 3, and 4 do not affect ERRCOUNT. Asynchronous signals do not affect ERRCOUNT.

- C++ consideration—The ERRCOUNT option sets the threshold for the total number of severity 2, 3, and 4 synchronous conditions that can occur. Note that each thrown object is considered a severity 3 condition. However, this condition does not affect ERRCOUNT.

For more information

- For a description of condition severities, see the *z/OS Language Environment Programming Guide*.
- For more information about the CEESGL callable service, see “CEESGL—Signal a condition” on page 450.
- See *z/OS Language Environment Programming Guide* for more information about the facility ID part of messages.

ERRUNIT (Fortran only)

Derivation
ERRor UNIT

ERRUNIT identifies the unit number to which run-time error information is to be directed. This option is provided for compatibility with the VS Fortran version 2 runtime.

Non-CICS default: ERRUNIT(6)

Syntax

```
►►──ERRUnit──(──┬──────────┬──)──────────────────────────────────►◄
                └─number───┘
```

number
A valid unit number in the range 0-99. You can establish your own default number at installation time. The Language Environment message file and the file connected to the Fortran error message unit are the same.

CICS consideration

- ERRUNIT is ignored under CICS.

EXECOPS | NOEXECOPS (C only)

EXECOPS specifies whether you can enter run-time options on the command line. This option does not apply to non-C languages and can be specified only with the C `#pragma runopts` directive. (You cannot set EXECOPS during Language Environment installation.)

EXECOPS | NOEXECOPS can affect the format of the inbound argument list passed to your application. If you specify NOEXECOPS, the slash (/) that usually separates arguments from run-time options (along with the entire command string) is passed as an argument to the application.

Non-CICS default: EXECOPS

Syntax

```
      ┌─EXECOPS──┐
►►────┴─NOEXECOPS─┴──────────────────────────────────────────────────►◄
```

EXECOPS
Specifies that you can enter run-time options on the command line.

NOEXECOPS
Specifies that you cannot enter run-time options on the command line. Language Environment interprets any options on the command line as arguments to the application.

Usage notes

- CICS consideration—This option is ignored under CICS.
- z/OS UNIX consideration—The EXECOPS option applies only to the main routine of the initial thread.

For more information

- See *z/OS Language Environment Programming Guide* for more information about the argument list format.

FILEHIST (Fortran only)

Derivation
FILE HISTory

FILEHIST specifies whether to allow the file definition of a file referred to by a ddname to be changed during run time. This option is intended for use with applications called by Fortran that reallocate Fortran's supplied DD names.

Non-CICS default: FILEHIST

Syntax

```
      ┌─FIlehist──┐
►►────┴─NOFIlehist─┴──────────────────────────────────────────────────►◄
```

FILEHIST
Causes the history of a file to be used in determining its existence. It checks to see whether:
- The file was ever internally opened (in which case it exists)
- The file was deleted by a CLOSE statement (in which case it does not exist).

NOFILEHIST
Causes the history of a file to be disregarded in determining its existence.

If you specify NOFILEHIST, you should consider:

- **If you change file definitions during run-time,** the file is treated as if it were being opened for the first time. Before the file definition can be changed, the existing file must be closed.
- **If you do not change file definitions during run-time,** you must use STATUS='NEW' to re-open an empty file that has been closed with STATUS='KEEP', because the file does not appear to exist to Fortran.

CICS consideration

- FILEHIST is ignored under CICS.

Usage notes

- When specifying this option in CEEDOPT, CEEUOPT or CEEROPT, use the syntax FILEHIST(ON) or FILEHIST(OFF).
- Use FILEHIST and NOFILEHIST only on the command line.

FILETAG (C/C++ only)

Derivation
FILE TAGging

FILETAG run-time option ensures a more granular control of the manner in which untagged HFS files and standard streams opened as terminal files are set up for conversion. It also determines whether certain open functions will tag new or empty HFS files.

Recommendation: You should be familiar with the concept of file tagging, autoconversion, and the CCSID to use the run-time option properly. See *z/OS C/C++ Programming Guide* for more information.

Non-CICS default: FILETAG(NOAUTOCVT,NOAUTOTAG)

CICS default: FILETAG is ignored under CICS.

Syntax

```
►►──FILETAG──(──┬─NOAUTOCVT─┬──,──┬─NOAUTOTAG─┬──)──────────────────────►◄
                └─AUTOCVT───┘       └─AUTOTAG───┘
```

NOAUTOCVT
Disables behavior indicated below.

AUTOCVT
Enables automatic text conversion for untagged HFS files opened using `fopen()` or `freopen()` in text mode. The assumed CCSID for an untagged file will be the EBCDIC CCSID from the CCSID pair specified by the _BPXK_CCSIDS environment variable. If the environment variable is `unset`, a default CCSID pair is used. See the usage notes for more information. See *z/OS C/C++ Programming Guide* for more information on the _BPXK_CCSIDS environment variable.

This option also indicates that the standard streams should be enabled for automatic text conversion to the EBCDIC IBM-1047 codepage when they refer to a terminal file (tty). See the usage notes for more information.

This option does not affect untagged HFS files that are automatically tagged by using the AUTOTAG suboption. This is because an HFS file that is tagged is already enabled for automatic text conversion.

Requirement: The automatic text conversion is performed only if one of the following is also true:
- The _BPXK_AUTOCVT environment variable value is equal to ON.
- The _BPXK_AUTOCVT environment variable is not set and AUTOCVT(ON) has been specified in the active BPXPRM*xx* member on your system. See *z/OS C/C++ Programming Guide* for more information on the _BPXK_AUTOCVT environment variable.

NOAUTOTAG
Deactivates the automatic tagging of new or empty HFS files.

AUTOTAG
Activates the automatic file tagging, on the first write, of new or empty HFS files open with `fopen()`, `freopen()`, or `popen()`. See the usage notes for more information.

z/OS UNIX consideration

- FILETAG applies to the enclave. Nested enclaves do not inherit the setting of this run-time option. HFS files that are opened in the nested enclave are not affected.

Usage notes

- **Recommendations:**
  - You should avoid the following:
    - Setting this run-time option in the installation-wide defaults (CEEDOPT).
    - Setting this run-time option using _CEE_RUNOPTS in a default profile for the UNIX shell users.
    - Exporting _CEE_RUNOPTS that specifies this run-time option. It can cause unexpected behaviors for the unknowing user or application.
  - The application programmer should define this run-time option with the assumption that the application is coded to behave based upon the option's setting.
  - The application programmer should specify this run-time option at compile time using #pragma runopts or at bind using a CEEUOPT CSECT that has been previously created.
  - The application user should not override this run-time option because it can change the expected behavior of the application.
- The default CCSID pair is (1047,819), where 1047 indicates the EBCDIC IBM-1047 codepage and 819 indicates the ASCII ISO8859-1 codepage.
- Automatic text conversion is enabled for the standard streams only when the application has been `exec()`ed, for example, when the UNIX shell gives control to a program entered on the command line, and the standard stream file descriptors are already open, untagged and associated with a tty.
- For the UNIX shell-owned standard streams that are redirected at program execution time, the shell includes added environment variables that control whether the redirected streams are tagged. See *z/OS UNIX System Services Command Reference* for more information.

- Automatic tagging for an HFS file is done at first write by the LFS. The CCSID used for the tag is the program CCSID of the current thread. Both text and binary files are tagged.
- When FILETAG(,AUTOTAG) is in effect, `fopoen()` or `freopen()` of an HFS file fails if it cannot determine whether the file exists or if it cannot determine the size.

FLOW (COBOL only)

FLOW controls the FLOW output produced by OS/VS COBOL programs. You can specify it only on application invocation. (You cannot set FLOW during Language Environment installation.)

Non-CICS default: NOFLOW

Syntax

```
      ┌─NOFLOW──┐
►►────┼─FLOW────┼──────────────────────────────────────────►◄
      ├─FLOW(n)─┤
      ├─FLOW=n──┤
      └─FLOWn───┘
```

NOFLOW
Suppresses the OS/VS COBOL FLOW output.

FLOW Does not suppress the OS/VS COBOL FLOW output.

n Specifies the number of procedures traced; this can be any integer from 1 to 99, inclusive.

HEAP

HEAP controls the allocation of the initial heap, controls allocation of additional heaps created with the CEECRHP callable service, and specifies how that storage is managed.

Heaps are storage areas where you allocate memory for user-controlled dynamically allocated variables such as:

- C variables allocated as a result of the `malloc()`, `calloc()`, and `realloc()` functions
- COBOL WORKING-STORAGE data items
- PL/I variables with the storage class CONTROLLED, or the storage class BASED

The HEAP option is always in effect. If you do not specify HEAP, Language Environment allocates the default value of heap storage when a call is made to get heap storage.

Language Environment does not allocate heap storage until the first call to get heap storage is made. You can get heap storage by using language constructs or by making a call to CEEGTST.

Non-CICS default: HEAP(32K,32K,ANYWHERE,KEEP,8K,4K)

Syntax

```
►►─HEAP─(─┬──────────┬─,─┬──────────┬─,─┬─ANYWHERE─┬─,──────────►
          └─init_size─┘   └─incr_size─┘   ├─ANY─────┤
                                          └─BELOW───┘

►─┬─KEEP─┬─,─┬──────────┬─,─┬──────────┬─)──────────────────────►◄
  └─FREE─┘   └─initsz24──┘   └─incrsz24──┘
```

init_size
: Determines the minimum initial allocation of heap storage. Specify this value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr_size
: Determines the minimum size of any subsequent increment to the heap storage. Specify this value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

ANYWHERE|ANY
: Specifies that you can allocate heap storage anywhere in storage. On systems that support bimodal addressing, you can allocate storage either above or below the 16M line. If there is no available storage above the line, storage is acquired below the 16 MB line.

  The only valid abbreviation of ANYWHERE is ANY.

BELOW
: Specifies that you must allocate heap storage below the 16M line in storage that is accessible to 24-bit addressing. The BELOW suboption causes the HEAPPOOLS option to be ignored since HEAPPOOLS can only run above the line.

KEEP
: Specifies that storage allocated to HEAP increments is not released when the last of the storage is freed.

FREE
: Specifies that storage allocated to HEAP increments is released when the last of the storage is freed. The FREE suboption has no affect on heap increments containing a HEAPPOOLS cell pool.

initsz24
: Determines the minimum initial size of the heap storage that is obtained below the 16M line for applications running with ALL31(OFF) when these applications specify ANYWHERE in the HEAP run-time option. Specify *initsz24* as *n*, *n*K, or *n*M number of bytes. The amount of storage is rounded up to the nearest multiple of 8 bytes.

  initsz24 applies to the initial heap and other heaps created with the CEECRHP callable service that are not allocated strictly below the 16M line.

incrsz24
: Determines the minimum size of any subsequent increment to the heap area that is obtained below the 16M line for applications running with ALL31(OFF) when these applications specify ANYWHERE in the HEAP

run-time option. Specify *incrsz24* as *n*, *n*K, or *n*M number of bytes. The amount of storage is rounded up to the nearest multiple of 8 bytes.

The *incrsz24* applies to the initial heap and other heaps created with the CEECRHP callable service that are not allocated strictly below the 16M line.

CICS consideration

- The default under CICS is HEAP=(4K,4080,ANYWHERE,KEEP,4K,4080).
- Both the initial HEAP allocation and HEAP increments are rounded to the next higher multiple of 8 bytes (not 4K bytes). If HEAP(0) is specified the initial HEAP is obtained on the first use and will be based on the increment size.
- If HEAP(,,ANYWHERE,,,) is in effect, the maximum size of a heap segment is 1 gigabyte (1024 MB). These restrictions are subject to change from one release of CICS to another.
- The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16 bytes CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line).

Usage notes

- Applications running in AMODE 24 that request heap storage get the storage below the 16M line regardless of the setting of ANYWHERE | BELOW.
- COBOL consideration—You can use the HEAP option to provide function similar to the VS COBOL II space management tuning table.
- The ANYWHERE | BELOW and KEEP | FREE suboptions are positional. ANYWHERE | BELOW must be in the third position, and KEEP | FREE must be in the fourth position. If you want to omit *init_size* and *incr_size*, you must specify: HEAP(,,ANY,KEEP,,).

  For PL/I, the only case in which storage is allocated above the line is when all of the following conditions exist:
  - The user routine requesting the storage is running in 31-bit addressing mode.
  - HEAP(,,ANY,,,) is in effect.
  - The main routine runs in AMODE 31.

  In pre-Language Environment-conforming PL/I, the ANYWHERE | BELOW and KEEP | FREE suboptions were not positional. They could be in any order respective to each other. If *init_size* and/or *incr_size* was not specified, the suboptions could be in the first or second position as well.
- PL/I MTF consideration—In a PL/I MTF application, HEAP specifies the heap storage allocation and management for a PL/I main task.
- z/OS UNIX considerations—The HEAP option applies to the enclave.

  Under z/OS UNIX, heap storage is managed at the thread level using `pthread_key_create`, `pthread_setspecific`, and `pthread_getspecific`.

Performance consideration

To improve performance, use the storage report numbers generated by the RPTSTG run-time option as an aid in setting the initial and increment size for HEAP.

For more information

- See *z/OS Language Environment Programming Guide* for more information about Language Environment heap storage or about specifying run-time options at application invocation.

- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 216.
- For more information about the CEEGTST callable service, see “CEEGTST—Get heap storage” on page 321.
- See “RPTSTG” on page 62 for more information about the RPTSTG run-time option.

HEAPCHK

Derivation

HEAP storage CHecKing

HEAPCHK allows the user to run the additional heap check tests.

Non-CICS default: HEAPCHK(OFF,1,0,0)

Syntax

```
                   ┌OFF┐
►►─HEAPChk─(─┬──────┬─,──────────────────────────────────────►
             └ON────┘

►─┬─────────┬─,─┬───────┬─,─┬──────────┬─)──────────────────►◄
  └frequency┘   └delay──┘   └call level┘
```

OFF Indicates that heap checking is inactive.

ON Indicates that heap checking is active.

frequency
The frequency at which heap checks are performed, and is specified in n, nK or nM. A value of one (1) is the default which causes the heap to be checked at each call to a Language Environment heap storage management service. A value of n causes the heap to be checked at every nth call to a Language Environment heap storage management service. A value of zero causes HEAPCHK to produce only a heap storage diagnostics report. The fourth sub-option (call level) must be set to a value greater than 1.

delay A value that causes a delay before heap checks are performed, and is specified in n, nK or nM. A value of zero (0) is the default which causes the heap to be checked from the first call to a Language Environment heap storage management service. A value of n causes the heap to be checked following the nth call to a Language Environment heap storage management service.

call level
This is the number of calls that will be displayed in the traceback for the heap storage diagnostics report and is specified in *n*. A value of zero is the default which turns heap storage diagnostics reporting off. A value of 10 is recommended.

CICS consideration

- The default under CICS is HEAPCHK(OFF,1,0,0).

Usage notes

- If HEAPCHK(ON) is used with STORAGE(,heap_free_value), the free areas of the heap will also be checked.
- If HEAPCHK(ON) is specified, this will result in a performance degradation due to the additional error checking that is performed.
- A U4042 abend dump will be generated when an error is detected, but no CEEDUMP will be produced.
- To request only a heap storage diagnostics report, you must specify a zero for frequency and a number *n* greater than zero for call level. For example (HEAPCHK(ON,0,0,10)).
- Under normal termination conditions, if the call level is greater than zero and the frequency is set to zero, the heap storage diagnostics report is written to the CEEDUMP report, independent of the TERMTHDACT setting.
- If a heap storage diagnostics report is generated from calling CEE3DMP, you must specify the BLOCKS option.

For More Information:

- See *z/OS Language Environment Debugging Guide* for more information about creating and using the heap storage diagnostics report.

HEAPPOOLS (C/C++ only)

Derivation

HEAP storage POOLS

The HEAPPOOLS run-time option is used to control an optional heap storage management algorithm, known as heap pools. This algorithm is designed to improve performance of multi-threaded C/C++ applications with high usage of malloc(), calloc(), realloc() and free(). When active, heap pools virtually eliminates contention for heap storage.

Non-CICS default: HEAPPOOLS(OFF,8,10,32,10,128,10,256,10,1024,10,2048,10)

Syntax

```
                    ┌─OFF─┐                  ┌──────────────────────────────┐
                    │     │                  │                              │
                    │ ON  │                  ▼                              ▼
►►─HEAPPools─(──────┴─────┴──────,──────────────────────,──────────────────────)──────►◄
                                   └─ cell size ─┘        └─percentage─┘
```

OFF Specifies that Language Environment does not use the Heap Pool Manager.

ON Specifies that Language Environment does use the (Quick) Heap Pool Manager to manage heap storage requests against the initial heap.

cell size
The size of cells in a heap pool. The cell size must be a multiple of 8 within a range from 8 to 2048. Cell sizes 1K and 2K are also allowed.

percentage
Percentage of HEAP run-time option init size value to be used as the size for the heap pool and any extents. The percentage must be in a range from 1 to 90.

CICS consideration

- The default under CICS is HEAPPOOLS=(OFF,8,10,32,10,128,256,10,1024,10,2048,10).

Usage notes

- Use of a vendor heap manager (VHM) overrides the use of the HEAPPOOLS run-time option.
- To use less than six heap pools, specify 0 for the cell size after the last heap pool to be used. For example if four heap pools are desired, use 0 for the fifth cell size when setting the HEAPPOOLS run-time option.
- If the percentage of the HEAP run-time option init size values does not allow for at least one cell, then the system will automatically adjust the percentage to enable one cell to be allocated.
- The sum of the percentages may be more or less than 100 percent. This can cause the allocation of a heap pool to require the allocation of a heap increment to satisfy the request if it is greater than 100 percent.
- Each heap pool is allocated on an as needed basis. The allocation of a heap pool can result in the allocation of a heap increment to satisfy the request.
- Tuning tips are specified in *z/OS Language Environment Programming Guide* to help avoid wasting storage. Heap pools and extents are not released back to the heap and cell sizes are fixed so care should be taken when specifying the HEAPPOOLS run-time options to avoid wasting storage.
- The HEAPPOOLS run-time option has no effect when the initial heap is allocated below the 16M line. This would be the case when BELOW is specified as the location on the HEAP run-time option.
- The FREE sub-option on the HEAP run-time option has no effect on the initial heap or any extents in which a heap pool reside. Each cell in a heap pool can be freed, but the heap pool itself is only released back to the system at enclave termination time.
- Mixing of the storage management AWIs (CEEGTST(), CEEFRST() and CEECZST()) and the C/C++ intrinsic functions (malloc(), calloc(), realloc() and free()) are not supported when operating on the same storage address. For example, if you request storage using CEEGTST(), then you may not use free() to release the storage.
- The HEAPPOOLS run-time option applies to the enclave.
- The RPTSTG run-time option will indicate HEAPPOOLS as one of the run-time options which can be adjusted.
- The HEAPCHK run-time option will indicate that individual cells in the cell pools controlled by the HEAPPOOLS run-time option are not validated. It is the heap pool itself which is validated, as it is the actual storage managed by the regularstorage manager.

Performance consideration

To improve the effectiveness of the (Quick) Heap Pool Manager, use the storage report numbers generated by the storage report run-time option as an aid in determining optimum cell sizes and the initial heap size.

INFOMSGFILTER

Derivation

INFOrmational MeSsaGe FILTER

During normal operations, there are times when long lists of informational messages are written to the Language Environment MSGFILE. These may not be Language Environment messages. If these messages are routed to the users terminal, then they have to be constantly cleared. If the messages are saved to a dataset, they will take up disk space and may interfere with a user browsing the output looking for a specific message. INFOMSGFILTER allows the user to activate a filter that eliminates the unwanted and unnecessary informational messages.

These messages are not limited to Language Environment (CEE) messages. Informational messages may also be written, using the CEEMSG interface, by other IBM program products or user-written applications.

Non-CICS default: INFOMSGFILTER(OFF,,,,)

Syntax

```
                        ┌OFF┐
►►─INFOMsgfilter─(──┬───┼───┬──,──┬──────────┬──,──┬──────────┬──,──►
                    └ON─┘       └Foreground┘     └Background┘

►─┬─────┬─)──────────────────────────────────────────────────────►◄
  └CICS─┘
```

OFF Turns off the filtering of messages for all environments.

ON Turns on the filtering of messages for the specified environments.

Foreground
Selecting this keyword will cause message filtering to be turned on for the following environments:

- TSO
- CMS
- z/OS UNIX Shells

Background
Selecting this keyword will cause message filtering to be turned on for the following environments:

- MVS Batch
- CMS Batch

CICS Selecting this keyword will cause message filtering to be turned on in the CICS environment.

CICS consideration

- The default under CICS is INFOMSGFILTER=(OFF,,,,).

INQPCOPN (Fortran only)

Derivation
INQuire the Pre-Connected units that are OPeNed

INQPCOPN controls whether the OPENed specifier on an INQUIRE by unit statement can be used to determine whether a preconnected unit has had any I/O statements directed to it.

Non-CICS default: INQPCOPN

Syntax

```
      ┌─INQpcopn──┐
►►────┤           ├──────────────────────────────────────────────────►◄
      └─NOINQpcopn┘
```

INQPCOPN
Causes the running of an INQUIRE by unit statement to provide the value *true* in the variable or array element given in the OPENED specifier if the unit is connected to a file. This includes the case of a preconnected unit, which can be used in an I/O statement without running an OPEN statement, even if no I/O statements have been run for that unit.

NOINQPCOPN
Causes the running of an INQUIRE by unit statement to provide the value *false* for the case of a preconnected unit for which no I/O statements other than INQUIRE have been run.

INTERRUPT

INTERRUPT causes attention interrupts recognized by the host system to be recognized by Language Environment after the Language Environment environment has been initialized. The way you request an attention interrupt varies from operating system to operating system. When you request the interrupt, you can give control to your application or to a debug tool.

Non-CICS default: INTERRUPT(OFF)

Syntax

```
                  ┌─OFF─┐
►►──INTerrupt──(──┤     ├──)──────────────────────────────────────────►◄
                  └─ON──┘
```

OFF Specifies that Language Environment does not recognize attention interrupts.

ON Specifies that Language Environment recognizes attention interrupts. In addition, if you have specified the TEST(ERROR) or TEST(ALL) run-time option, the interrupt causes the debug tool to gain control.

CICS consideration

- INTERRUPT is ignored under CICS.

Usage notes

- PL/I consideration—Language Environment supports the PL/I method of polling code. Note that the PL/I routine must be compiled with the INTERRUPT compiler option in order for the INTERRUPT run-time option to have an effect.
- PL/I MTF consideration—To receive the attention interrupt, the PL/I program must be compiled with the INTERRUPT compiler option, and the INTERRUPT run-time option must be in effect.
- CICS consideration—INTERRUPT is ignored under CICS.
- PL/I MTF consideration—The INTERRUPT option applies to the enclave. However, only one thread in the enclave is affected for a particular attention interrupt.
- z/OS UNIX consideration—The INTERRUPT option applies to the enclave. However, only one thread in the enclave is affected for a particular attention interrupt.

For more information

- See “TEST | NOTEST” on page 88 for more information about the TEST run-time option.
- For more information about the POSIX run-time option, see “POSIX” on page 55.

LIBRARY

This option specifies the name of the logical library used for finding RTLS version-controlled modules. The lib_name must be defined as a logical library in the CSVRTLxx PARMLIB member.

Non-CICS default: LIBRARY(SYSCEE)

Syntax

```
►►──LIBRary──(──┬──────────────┬──)──────────────────────────────────►◄
                └─lib_name─────┘
```

lib_name

The name of the library token that matches the name specified in the CSVRTLxx member of PARMLIB. The LIBRARY name must be a string from 1 to 8 characters long. The only valid characters are A-Z, 0-9, #, $, @, ., -, +, or _ . The code points for the variant characters (#, $, and @) are assumed to be in code pages 01047 or 00037.

CICS consideration

- LIBRARY is ignored under CICS.

Usage notes

- The LIBRARY option is ignored when RTLS(OFF) is in effect.
- If CEEGINIT is not available in the LNKLST, LPA, JOBLIB, STEPLIB, or TASKLIB when Language Environment is invoked, the LIBRARY option has no effect. RTLS will not be used, but the LIBRARY option value will appear in the options report.

- CICS consideration—The LIBRARY option is ignored under CICS.
- The specification of the LIBRARY option is ignored for nested enclaves. The value is always inherited for the main enclave.

LIBSTACK

Derivation

LIBrary STACK storage

LIBSTACK controls the allocation of the thread's library stack storage. This stack is used by Language Environment and HLL library routines that require save areas below the 16M line.

Language Environment does not acquire the initial library stack segment until the first program that requires LIBSTACK runs.

Non-CICS default: LIBSTACK(4K,4K,FREE)

Syntax

```
►►─LIBStack─(─┬──────────┬─,─┬──────────┬─,─┬─FREE─┬──────────────►◄
              └─init_size─┘   └─incr_size─┘   └─KEEP─┘
```

init_size

Determines the minimum size of the initial library stack segment. The storage is contiguous.

Specify *init_size* as *n*, *n*K, or *n*M bytes of storage. *init_size* can be preceded by a minus sign. In environments other than CICS, if you specify a negative number, all available storage minus the amount specified is used for the initial stack segment.

In all supported systems except CICS, an *init_size* of 0 or −0 requests half of the largest block of contiguous storage below the 16M line.

Language Environment allocates the storage rounded up to the nearest multiple of 8 bytes.

incr_size

Determines the minimum size of any subsequent increment to the library stack area. Specify this value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is the larger of 2 values— *incr_size* or the requested size—rounded up to the nearest multiple of 8 bytes.

If you do not specify *incr_size*, Language Environment uses the IBM-supplied default setting of 4K. If *incr_size*=0, Language Environment gets only the amount of storage needed at the time of the request, rounded up to the nearest multiple of 8 bytes.

The requested size is the amount of storage a routine needs for a stack frame. For example, if the requested size is 9000 bytes, *incr_size* is specified as 8K, and the initial stack segment is full, then Language Environment gets a 9000 byte stack increment from the operating system to

satisfy the request. If the requested size is smaller than 8K, Language Environment gets an 8K stack increment from the operating system.

FREE Specifies that Language Environment releases storage allocated to LIBSTACK increments when the last of the storage in the library stack is freed. The initial library stack segment is not released until the enclave terminates.

KEEP Specifies that Language Environment does not release storage allocated to LIBSTACK increments when the last of the storage is freed.

CICS consideration

- The default under CICS is LIBSTACK=(32,4080,FREE).
- The initial and increment sizes for LIBSTACK are rounded to the next higher multiple of 8 bytes.
- The minimum initial size is 32 bytes; the minimum increment size is 4080.
- The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16 bytes CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line).

Usage notes

- z/OS UNIX consideration—The LIBSTACK option sets the library stack characteristics on each thread.
- The recommended setting for LIBSTACK under z/OS UNIX is LIBSTACK(4K,4K,FREE).

Performance consideration

To improve performance, use the storage report numbers generated by the RPTSTG run-time option as an aid in setting the initial and increment size for LIBSTACK.

For more information

- See “RPTSTG” on page 62 for more information about the RPTSTG run-time option.
- For more information about using the storage reports generated by the RPTSTG run-time option to tune the stacks, see *z/OS Language Environment Programming Guide*.

MSGFILE

Derivation
MeSsaGe FILE

MSGFILE specifies the *ddname* of the file where all run-time diagnostics and reports generated by the RPTOPTS and RPTSTG run-time options are written. MSGFILE also specifies the *ddname* for CEEMSG and CEEMOUT callable services.

Non-CICS default: MSGFILE(SYSOUT,FBA,121,0,NOENQ)

Syntax

```
►►─MSGFile─(─┬──────────┬─,─┬────────┬─,─┬───────┬─,─┬─────────┬──────►
             └─ddname───┘   └─recfm───┘   └─lrecl──┘   └─blksize──┘

►─,─┬─NOENQ─┬─)──────────────────────────────────────────────────────►◄
    └─ENQ───┘
```

ddname
The ddname of the run-time diagnostics file.

recfm The default record format (RECFM) value for the message file. *recfm* is used when this information is not available either in a file definition or in the label of an existing file. The following values are acceptable: F, FA, FB, FBA, FBS, FBSA, U, UA, V, VA, VB, and VBA.

lrecl The default record length (LRECL) value for the message file. *lrecl* is used when this information is not available either in a file definition or in the label of an existing file. *lrecl* is expressed as bytes of storage.

The *lrecl* value (whether from MSGFILE or from another source) cannot exceed the *blksize* value, whose maximum value is 32760. For variable-length record formats, the *lrecl* value is limited to the *blksize* value minus 4.

blksize
The default block size (BLKSIZE) value for the message file. *blksize* is used when this information is not available either in a file definition or in the label of an existing file. *blksize* is expressed as bytes of storage.

blksize (whether from MSGFILE or from another source) cannot exceed 32760.

NOENQ
Serialization around writes to the Message File destination specified *ddname* are not performed.

ENQ Specifies that serialization is performed around writes to the *ddname* specified.

CICS consideration

- MSGFILE is ignored under CICS.
- Run-time output under CICS is directed instead to a transient data queue named CESE.

Usage notes

- The ENQ sub-option should only be used where multiple Language Environment environments are running in the same address space and are sharing the same MSGFILE destination. An example would be a batch job which uses ATTACH to create some number of sub-tasks. Each of these tasks is potentially a distinct Language Environment environment all running with the same default MSGFILE parameters. In this example, each of these environments will share the same MSGFILE destination. To avoid conflicts while writing to the shared MSGFILE destination, it is recommended that the ENQ sub-option be used for each

MSGFILE destination that will be shared. Using different *ddname* for each environment would remove the need to use the ENQ sub-option.

- HLL compiler options, such as the COBOL OUTDD compiler option, can affect whether your run-time output goes to MSGFILE *ddname*.
- Use commas to separate suboptions of the MSGFILE run-time option. If you do not specify a suboption but do specify a subsequent one, you must still code the comma to indicate its omission. However, trailing commas are not required.

  If you do not specify any suboptions, either of the following is valid: MSGFILE or MSGFILE().
- If one of the suboptions of the MSGFILE run-time option is not present in any source, including CEEDOPT, then an IBM-supplied default value is used. The default values for *ddname*, *recfm*, *lrecl*, and *blksize* are SYSOUT, FBA, 121, and 0, respectively.
- If there is no block size in the MSGFILE run-time option, in a file definition, or in the label of an existing file, block size is determined as follows:
  - For a *recfm* value that specifies unblocked fixed-length format records (F or FA) or undefined-format records (U or UA), the *blksize* value is the same as the *lrecl* value.
  - For a *recfm* value that specifies unblocked variable-length format records (V or VA), the *blksize* value is the *lrecl* value plus 4.
  - For a DASD device on MVS and a *recfm* value that specifies blocked records (FB, FBA, FBS, FBSA, VB, or VBA), the *blksize* value is left at 0 by Language Environment so that the system can determine the optimum *blksize* value.
  - For a terminal and a *recfm* value that specifies blocked fixed-length format records (FB, FBA, FBS, or FBSA), the *blksize* value is the same as the *lrecl* value.
  - For a terminal and a *recfm* value that specifies blocked variable-length format records (VB or VBA), the *blksize* value is the *lrecl* value plus 4.
  - For all other cases, *blksize* has a value which gives 100 records per block if the *blksize* value wouldn't exceed 32760, otherwise, a value giving the largest number of records per block such that the *blksize* value that doesn't exceed 32760.

    Or, to put it another way:
    - For a *recfm* value that specifies blocked fixed-length format records (FB, FBA, FBS, or FBSA), the *blksize* value is *lrecl* $\times$ *bfact* where *bfact* is the largest integer not exceeding 100 such that the *blksize* value does not exceed 32760.
    - For a *recfm* value that specifies blocked variable-length format records (VB or VBA), the *blksize* value is (*lrecl* $\times$ *bfact*) plus 4 where *bfact* is the largest integer not exceeding 100 such that the *blksize* value does not exceed 32760.
- Language Environment detects certain invalid values for the MSGFILE suboptions, namely an invalid value for *recfm* and a value of *lrecl* or *blksize* that exceeds 32760. A message is printed, and any incorrect values are ignored.
- Invalid combinations of *recfm*, *lrecl*, and *blksize* values are not diagnosed by Language Environment but can cause an error condition to be detected by the system on the first attempt to write to the message file.
- Language Environment does not check the validity of the MSGFILE *ddname*. An invalid *ddname* generates an error condition on the first attempt to issue a message.

- C/C++ consideration—C `perror()` messages and output directed to `stderr` go to the MSGFILE destination.
- PL/I consideration—Run-time messages in PL/I programs are directed to the file specified by MSGFILE, instead of to the PL/I SYSPRINT STREAM PRINT file.

  User-specified output is still directed to the PL/I SYSPRINT STREAM PRINT file. To direct this output to the Language Environment MSGFILE file, specify MSGFILE(SYSPRINT).
- Fortran consideration—To get the same message file function as with VS Fortran, specify MSGFILE(FTnnF001,UA,133) where *nn* is the unit number of the error unit. For more information, see Fortran Run-Time Migration Guide.
- z/OS UNIX considerations—The MSGFILE option specifies the *ddname* of the diagnostic file for the enclave. When multiple threads write to the message file, the output is interwoven by line. To group lines of output, serialize MSGFILE access (by using a mutex, for example).

  When z/OS UNIX is available and the MSGFILE option specifies a *ddname* nominating a POSIX file, Language Environment uses POSIX services to write the message file. A *ddname* nominates a POSIX file using the keyword *PATH=*.

  z/OS UNIX must be available on the underlying operating system for the MSGFILE option to write to a POSIX file. If the *ddname* nominates a POSIX file and z/OS UNIX is not present, then Language Environment tries to dynamically allocate an MVS file to be used as the message file.

  If the message file is allocated (whether POSIX or z/OS), Language Environment directs the output to this file. If the current message file is not allocated, and the application carries out a `fork()/exec`, `spawn()`, or `spawnp()`, Language Environment checks whether File Descriptor 2 exists. If it does exist, then Language Environment uses it; otherwise, Language Environment dynamically allocates the message file to the POSIX file system and attempts to open the file SYSOUT in the current working directory; or, if there is no current directory, then in the directory /tmp.
- If your application is running under the z/OS UNIX shells or any environment that has file descriptor 2 (FD2) open, MSGFILE output is directed to whatever FD2 points to. Under the z/OS UNIX shells, this is typically your terminal. If FD2 is closed when your application is invoked (via `spawn()` or `exec()`), no message file is created.

For more information

- For more information about the RPTOPTS and RPTSTG run-time options, see “RPTOPTS” on page 59 and “RPTSTG” on page 62.
- For more information about the CEEMSG and CEEMOUT callable services, see “CEEMSG—Get, format, and dispatch a message” on page 395 and “CEEMOUT—Dispatch a message” on page 372.
- For details on how HLL compiler options affect messages, see information on HLL I/O statements and message handling in *z/OS Language Environment Programming Guide*.
- For examples of getting and formatting messages, including HLL run-time output, see “CEEMSG—Get, format, and dispatch a message” on page 395.
- For more information about `perror()` and `stderr` see C message output information in *z/OS Language Environment Programming Guide*.
- For more information about the CESE transient data queue, see *z/OS Language Environment Programming Guide*.

MSGQ

Derivation
MeSsaGe Queue

MSGQ specifies the number of ISI blocks that Language Environment allocates on a per thread basis for use by the application. The ISI contains information for Language Environment to use when identifying and reacting to conditions, providing access to q_data tokens, and assigning space for message inserts used with user-created messages. When an ISI is needed and one is not available, Language Environment uses the least recently used ISI. CEECMI allocates storage for the ISI, if necessary.

Non-CICS default: MSGQ(15)

Syntax

```
►►──MSGQ──(──┬──────────┬──)──────────────────────────────────────►◄
             └─number───┘
```

number
An integer that specifies the number of ISIs to be maintained per thread within an enclave.

CICS consideration

- MSGQ is ignored under CICS.

Usage notes

- PL/I MTF consideration—In a PL/I MTF application, MSGQ sets the number of message queues allowed for each task.

For more information

- For more information about the CEECMI callable service, see “CEECMI—Store and load message insert data” on page 209.
- For more information about the ISI, see *z/OS Language Environment Programming Guide*.

NATLANG

Derivation
NATional LANGuage

NATLANG specifies the initial national language to be used for the run-time environment, including error messages, month names, and day of the week names. Message translations are provided for Japanese and for uppercase and mixed-case U.S. English. NATLANG also determines how the message facility formats messages.

NATLANG affects only the Language Environment NLS and date and time services, not the Language Environment locale callable services.

NATLANG

You can set the national language by using the NATLANG run-time option or the SET function of the CEE3LNG callable service Language Environment maintains one current language at the enclave level. The current language remains in effect until one of the above changes it. For example, if you specify JPN in the NATLANG run-time option, but subsequently specify ENU using the CEE3LNG callable service, ENU becomes the current national language.

Language Environment writes storage and options reports and dump output only in mixed-case U.S. English.

Non-CICS default: NATLANG(ENU)

Syntax

```
                  ┌─ENU─┐
►►─NATlang─(──────┼─────┼──)──────────────────────────────────────────►◄
                  ├─UEN─┤
                  └─JPN─┘
```

ENU A 3-character ID specifying mixed-case U.S. English.

Message text consists of SBCS characters and includes both uppercase and lowercase letters.

UEN A 3-character ID specifying uppercase U.S. English.

Message text consists of SBCS characters and includes only uppercase letters.

JPN A 3-character ID specifying Japanese.

Message text can contain a mixture of SBCS and DBCS characters.

CICS consideration

- The default under CICS is NATLANG=(ENU).

Usage notes

- If you specify a national language that is not available on your system, Language Environment uses the IBM-supplied default ENU (mixed-case U.S. English).

  CEEUOPT, CEEROPT and CEEDOPT (CEECOPT) can specify an unknown national language code, but give a return code of 4 and a warning message.
- C/C++ consideration—Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. To change the locale, you can use the `setlocale()` library function or the CEESETL callable service.

  The settings of CEESETL or `setlocale()` do not affect the setting of the NATLANG run-time option. NATLANG affects only Language Environment NLS and date and time services. `setlocale()` and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.

  To ensure that all settings are correct for your country, use NATLANG and either CEESETL or `setlocale()`.
- PL/I MTF consideration—NATLANG affects every task in the application. The SET function of CEE3LNG is supported for the relinked OS PL/I or PL/I for MVS & VM MTF applications only.

- z/OS UNIX consideration—The NATLANG option specifies the initial value for the enclave.

For more information

- For more information about the CEE3LNG callable service, see “CEE3LNG—Set national language” on page 164.
- See “MSGQ” on page 47 for more information about the MSGQ run-time option.
- For more information on `setlocale()`, see *z/OS C/C++ Programming Guide*.

NONIPTSTACK | NONONIPTSTACK

Derivation

NON Initial Process Thread STACK

Note

NONIPTSTACK has been deprecated but remains for compatibility. The THREADSTACK run-time option should be used instead, which allows the same suboptions plus an ON/OFF suboption and support for the XPLINK downward-growing stack.

NONIPTSTACK controls stack allocation for each thread, except the initial thread, in a multithread environment. If the thread attribute object does not provide an explicit stack size, then the allocation values can be inherited from the STACK option or specified explicitly on the NONIPTSTACK option. NONONIPTSTACK causes the values specified in the STACK option to be used.

In PL/I MTF applications, NONIPTSTACK specifies stack storage for every subtask. If you use the IBM-supplied default NONONIPTSTACK, the STACK option specifies stack storage for both the main task and subtasks.

Non-CICS default: NONONIPTSTACK(4K,4K,BELOW,KEEP)

Syntax

```
                 ┌NONOniptstack┐
►►──────────────┤             ├──────(──────────────,──────────────,──────────────►
                 └NONIptstack──┘       └init_size──┘   └incr_size─┘

►──┬─BELOW────────┬──,──┬─KEEP─┬──)──────────────────────────────────────────►◄
   ├─ANYWHERE─────┤     └─FREE─┘
   └─ANY──────────┘
```

NONONIPTSTACK

Indicates that the allocation options of the STACK option are used for thread stack allocation. Any suboption specified with NONONIPTSTACK is ignored.

NONIPTSTACK

Controls the stack allocation for each thread, except the initial thread, in a multithread environment.

init_size
The length of each noninitial thread initial stack storage area. This is an unsigned integer, n, nK, or nM. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

A value of zero (0) causes an allocation of 4K.

incr_size
The minimum amount by which the stack storage for any noninitial thread is incremented, and is specified in n, nK, or nM. The actual amount of allocated storage is the larger of two values, *incr_size* or the requested size, rounded up to the nearest multiple of 8 bytes.

If you specify *incr_size* as 0, only the amount of the storage needed at the time of the request (rounded up to the nearest 8 bytes) is obtained.

BELOW
Specifies that the stack storage must be allocated below the 16M line. Applications running with ALL31(OFF) must specify NONIPTSTACK(,,BELOW) to ensure that stack storage is addressable by the application.

ANYWHERE|ANY
Specifies that the stack storage can be allocated anywhere in storage either above or below the 16M line.

The only valid abbreviation of ANYWHERE is ANY.

KEEP Specifies that storage allocated to NONIPTSTACK increments is not released when the last of the storage in the thread stack increment is freed.

FREE Specifies that storage allocated to NONIPTSTACK increments is released when the last of the storage in the thread stack increment is freed.

Usage notes

- All storage allocated to NONIPTSTACK segments is freed when the thread terminates.
- The initial stack segment of the thread is never released until the thread terminates, regardless of the KEEP/FREE state.
- You can specify sub-options with NONONIPTSTACK, but they are ignored. If you override the NONONIPTSTACK option with NONIPTSTACK and you omit suboptions, then the suboptions you specified with NONONIPTSTACK remain in effect. If you respecify NONONIPTSTACK with different suboptions, they override the defaults.
- PL/I MTF consideration—NONIPTSTACK(4K, 4K, BELOW, KEEP) provides PL/I compatibility for stack storage allocation and management for each subtask in the application.
- PL/I considerations—For multitasking or multithreaded environments, the stack size for a subtask or non-Initial Process Thread (IPT) is taken from the NONIPTSTACK option unless NONONIPTSTACK is specified. NONONIPTSTACK specifies that the values in the STACK option be used.

  In the multithreaded environment, you can explicitly specify the stack size in the thread attribute object; it will be used instead of the value specified with NONIPTSTACK or STACK.
- CICS consideration—This option is ignored under CICS.

For more information

- For more information about the STACK run-time option, see “STACK” on page 76.
- For more information about the ALL31 run-time option, see “ALL31” on page 15.

OCSTATUS (Fortran only)

Derivation

Open Close STATUS

OCSTATUS controls the verification of file existence and whether a file is actually deleted based on the STATUS specifier on the OPEN and CLOSE statement, respectively.

Non-CICS default: OCSTATUS

Syntax

```
      ┌─OCstatus──┐
►►────┴─NOOCstatus─┴──────────────────────────────────────────►◄
```

OCSTATUS

Specifies that file existence is checked with each OPEN statement to verify that the status of the file is consistent with STATUS='OLD' and STATUS='NEW'. It also specifies that file deletion occurs with each CLOSE statement with STATUS='DELETE' for those devices which support file deletion. Preconnected files are included in these verifications. OCSTATUS consistency checking applies to DASD files, PDS members, VSAM files, MVS labeled tape files, and dummy files only. For dummy files, the consistency checking occurs only if the file was previously opened successfully in the current program.

In addition, when a preconnected file is disconnected by a CLOSE statement, an OPEN statement is required to reconnect the file under OCSTATUS. Following the CLOSE statement, the INQUIRE statement parameter OPENED indicates that the unit is disconnected.

NOOCSTATUS

Bypasses file existence checking with each OPEN statement and bypasses file deletion with each CLOSE statement.

If STATUS='NEW', a new file is created; if STATUS='OLD', the existing file is connected.

If STATUS='UNKNOWN' or 'SCRATCH', and the file exists, it is connected; if the file does not exist, a new file is created.

In addition, when a preconnected file is disconnected by a CLOSE statement, an OPEN statement is *not* required to reestablish the connection under NOOCSTATUS. A sequential READ, WRITE, BACKSPACE, REWIND, or ENDFILE will reconnect the file to a unit. Before the file is reconnected, the INQUIRE statement parameter OPENED will indicate that the unit is disconnected; after the connection is reestablished, the INQUIRE statement parameter OPENED will indicate that the unit is connected.

CICS consideration

- OCSTATUS is ignored under CICS.

Usage notes

- When specifying this option in CEEDOPT, CEEUOPT or CEEROPT, use the syntax OCSTATUS(ON) or OCSTATUS(OFF).
- Use OCSTATUS and NOOCSTATUS only on the command line.

PC (Fortran only)

Derivation

Private Common blocks

PC controls whether Fortran status common blocks are shared among load modules.

Non-CICS default: NOPC

Syntax

```
►►──┬─NOPC─┬──────────────────────────────────────────────────────────►◄
    └─PC───┘
```

NOPC Specifies that Fortran static common blocks with the same name but in different load modules all refer to the same storage. NOPC applies only to static common blocks referenced by compiled code produced by any of the following compilers and that were **not** compiled with the PC compiler option:

- VS FORTRAN Version 2 Release 5
- VS FORTRAN Version 2 Release 6

PC Specifies that Fortran static common blocks with the same name but in different load modules do not refer to the same storage.

CICS consideration

- PC is ignored under CICS.

Usage notes

- When specifying this option in CEEDOPT, CEEUOPT or CEEROPT, use the syntax PC(ON) or PC(OFF).
- Use PC and NOPC only on the command line.

PLIST (C only)

Derivation

Parameter LIST

PLIST specifies the format of the invocation parameters your C application receives when you invoke it. Although the CICS, CMS, IMS, MVS, and TSO suboptions of PLIST are supported for compatibility, it is strongly recommended that you use the HOST or OS suboptions of PLIST.

This option does not apply to non-C languages and can be specified only with the C `#pragma runopts` directive. (You cannot set PLIST during Language Environment installation.) The behavior of C applications with PLIST(HOST) in effect is the same for C++.

Non-CICS default: PLIST(HOST)

Syntax

```
                 ┌─HOST─┐
►►─PLIST─(──┬────┼─CICS─┼──)──────────────────────────────────►◄
            │    ├─CMS──┤
            │    ├─IMS──┤
            │    ├─MVS──┤
            │    ├─OS───┤
            │    └─TSO──┘
```

HOST The parameter list is a character string. The string is located differently under various systems as follows:

- CMS

  If invoked by OSRUN, use the string presented in an MVS-like format located by the pointer held in R1.

  If not invoked by OSRUN, use the CMS extended parameter list.
- TSO

  If a command processor parameter list (CPPL) is detected, get the string from the command buffer.

  If a CPPL is not detected, assume a halfword-prefixed string in the MVS format.
- MVS

  Use the halfword-prefixed string.

CICS The parameter list received by your C application is assumed to be in a CICS format.

CMS The parameter list received by your C application is assumed to be in a CMS extended parameter list format.

IMS The parameter list received by your C application is assumed to be in an IMS format.

MVS The parameter list received by your C application is assumed to be in an MVS format.

OS The parameter list received by your C application is assumed to be in an OS style.

TSO The parameter list received by your C application is assumed to be in a CPPL format.

CICS consideration

- PLIST is ignored under CICS.

Usage notes

- When using the pre-Language Environment-conforming C interface for preinitialization, it was necessary to specify PLIST(MVS) in order to flag preinitialized routines. Although PLIST(MVS) is supported for compatibility, you should specify PLIST(OS) instead of PLIST(MVS) when possible, to flag pre-Language Environment-conforming preinitialized routines.
- IMS considerations—If your C application runs under IMS, the suboption of PLIST that you specify depends on the version of the C compiler you used. If you compiled your application with Version 2.1 (or earlier) of the C compiler, specify the PLIST(IMS) suboption. If your C++ application runs under IMS, you should specify the z/OS C++ compiler option PLIST(OS).
- z/OS UNIX consideration—The PLIST option applies only to the main routine of the initial thread.

PLITASKCOUNT (PL/I only)

Derivation

PL/I TASK COUNTer

PLITASKCOUNT controls the maximum number of tasks active at one time while you are running PL/I MTF applications. PLITASKCOUNT(20) provides behavior compatible with the PL/I ISASIZE(,,20) option.

Non-CICS default: PLITASKCOUNT(20)

Syntax

```
►►──PLITaskcount──(──┬──────────┬──)──────────────────────────────────►◄
                     └─tasks────┘
```

tasks A decimal integer that is the maximum number of tasks allowed in a PL/I MTF application at any one time during execution. The total tasks include the main task and subtasks created directly or indirectly from the main task.

Usage notes

- A value of zero (0) assumes the IBM-supplied default of 20.
- PL/I MTF consideration—If *tasks* or the IBM-supplied default of 20 exceeds the z/OS UNIX installation default of the maximum number of threads, Language Environment assumes the z/OS UNIX installation default.
- If a request to create a task would take the number of currently active tasks over the allowable limit, condition IBM0566S is signalled and the task is not created.

POSIX

Derivation

Portable Operating System Interface - X

POSIX specifies whether the enclave can run with the POSIX semantics.

POSIX is an application characteristic that is maintained at the enclave level. After you have established the characteristic during enclave initialization, you cannot change it.

When you set POSIX to ON, you can use functions that are unique to POSIX, such as `pthread_create()`.

One of the effects of POSIX(ON) is the enablement of POSIX signal handling semantics, which interact closely with the Language Environment condition handling semantics.

ANSI C programs can access the z/OS UNIX Hierarchical File System (HFS) on MVS independent of the POSIX setting. Where ambiguities exist between ANSI and POSIX semantics, the POSIX run-time option setting indicates the POSIX semantics to follow.

Non-CICS default: POSIX(OFF)

Syntax

```
►►──POSix──(──┬─────┬──)──────────────────────────────────────────►◄
              ├─OFF─┤
              └─ON──┘
```

OFF Indicates that the application is not POSIX-enabled.

ON Indicates that the application is POSIX-enabled.

CICS consideration

- POSIX is ignored under CICS.

Usage notes

- If you set POSIX to ON and you run non-thread-safe programs in a thread other than the initial thread, the behavior is undefined.
- If you set POSIX to ON when z/OS UNIX is not active, the message file receives a warning, POSIX is set to OFF, but the application continues to run.
- POSIX(ON) applies to z/OS but explicitly excludes CICS. If you set POSIX to ON while an application is running under CICS, you receive a warning message, POSIX is set OFF, and the application continues to run. You can specify POSIX(ON) for both DB2* and IMS applications.
- Within nested enclaves, only one enclave can have the POSIX option set to ON. All other nested enclaves must have the POSIX option set to OFF. When nested enclaves are specifying the run-time option POSIX(ON) within one Language

Environment process, Language Environment will display a severity 3 error message and allow abend 4093 to occur with a reason code of 172.

For more information

- For more information on POSIX functions that have a kernel dependency, or a POSIX ON dependency (especially for a failure where the kernel dependency or the POSIX ON setting is not met), see *z/OS C/C++ Run-Time Library Reference*.
- For more information about the INTERRUPT run-time option, see “INTERRUPT” on page 40.

PROFILE

PROFILE controls the use of an optional PROFILER which collects performance data for the running application.

For a detailed description of the setup and use of the IBM z/OS C/C++ PROFILER, see *z/OS UNIX System Services User’s Guide*.

Non-CICS default: PROFILE(OFF,’’)

Syntax

```
                   ┌OFF┐
►►──PROFile──(──┬──┴───┴──,──┬──────────┬──)──────────────────────────►◄
                └──ON───┘    └─string───┘
```

OFF Indicates that the profile facility is inactive.

ON Indicates that the profile facility is active.

string Profile options that Language Environment will pass to the profiler installed. You can enclose the string in either single or double quotation marks.

The maximum length of the string is 250 bytes when specified on program invocation or via a compiler directive. When establishing installation defaults using CEEDOPT the size is limited to 242 bytes and when using CEEUOPT to establish programmer defaults the size is limited to 248 bytes.

CICS consideration

- The default under CICS is PROFILE=(OFF,’’).

Usage notes

An application cannot run with both the TEST and PROFILE options in effect. If both are specified, an informational message is generated and Language Environment forces the PROFILE option OFF. The string sub-option is required when establishing default settings using CEEDOPT or CEEUOPT. It is optional when passing run-time options to the compiler (#pragma runopts, PLIXOPT) or when specifying run-time options on program invocation. If omitted, the string sub-option will be set to the previously established programmer or installation default.

PRTUNIT (Fortran only)

Derivation
PRinT UNIT

PRTUNIT identifies the unit number used for PRINT and WRITE statements that do not specify a unit number.

Non-CICS default: PRTUNIT(6)

Syntax

```
►►─PRTunit─(──┬──────────┬──)──────────────────────────────────────►◄
              └─number───┘
```

number
A valid unit number in the range 0-99. You can establish your own default number at installation time.

CICS consideration

- PRTUNIT is ignored under CICS.

PUNUNIT (Fortran only)

Derivation
PUNch UNIT

PUNUNIT identifies the unit number used for PUNCH statements that do not specify a unit number.

Non-CICS default: PUNUNIT(7)

Syntax

```
►►─PUNunit─(──┬──────────┬──)──────────────────────────────────────►◄
              └─number───┘
```

number
A valid unit number in the range 0-99. You can establish your own default number at installation time.

CICS consideration

- PUNUNIT is ignored under CICS.

RDRUNIT (Fortran only)

Derivation
ReaDeR UNIT

RDRUNIT identifies the unit number used for READ statements that do not specify a unit number.

Non-CICS default: RDRUNIT(5)

Syntax

```
►►──RDRunit──(──┬──────────┬──)──────────────────────────────────────►◄
                └─number───┘
```

number
A valid unit number in the range 0-99. You can establish your own default number at installation time.

CICS consideration

- RDRUNIT is ignored under CICS.

RECPAD (Fortran only)

Derivation
RECord PADding

RECPAD specifies whether a formatted input record is padded with blanks.

Non-CICS default: RECPAD(OFF)

Syntax

```
      ┌─NORECpad─┐
►►────┤          ├──────────────────────────────────────────────────►◄
      └─RECpad───┘
```

Usage notes

- NORECPAD has the same effect as RECPAD(OFF) and RECPAD(NONE). RECPAD has the same effect as RECPAD(ON) and RECPAD(ALL).
- The PAD specifier of the OPEN statement can be used to indicate padding for individual files.

REDIR | NOREDIR (C Only)

Derivation
REDIRection

REDIR specifies whether you can enter directions for `stdin`, `stderr`, and `stdout` from the command line.

This option does not apply to non-C/C++ languages and can be specified with the `#pragma runopts` directive or the REDIR and NOREDIR compiler options. (You cannot set REDIR during Language Environment installation.)

For ILC applications, REDIR can be used to direct `printf` output (or output from PL/I programs that use the MSGFILE(SYSPRINT) run-time option) from the application to the MSGFILE so it can be interspersed with output from COBOL programs that use the compiler option OUTDD.

Non-CICS default: REDIR

Syntax

```
      ┌─REDIR──┐
►►────┴─NOREDIR─┴──────────────────────────────────────────►◄
```

REDIR
Specifies that you can redirect `stdin`, `stderr`, and `stdout` from the command line.

REDIR applies only if ARGPARSE is also specified or defaulted.

NOREDIR
Specifies that you cannot redirect `stdin`, `stderr`, and `stdout` from the command line.

CICS consideration

- RECPAD is ignored under CICS.

Usage notes

- z/OS UNIX consideration—The REDIR | NOREDIR option applies only to the main routine of the initial thread.

For more information

- For more information about the MSGFILE run-time option, see “MSGFILE” on page 43.
- For details about `printf`, see *z/OS Language Environment Programming Guide*.
- See “ARGPARSE | NOARGPARSE (C only)” on page 18 for a description of ARGPARSE.

RPTOPTS

Derivation
RePorT OPTionS

RPTOPTS

RPTOPTS generates, after an application has run, a report of the run-time options in effect while the application was running. Language Environment writes options reports only in mixed-case U.S. English.

Language Environment directs the report to the *ddname* specified in the MSGFILE run-time option.

RPTOPTS does not generate the options report if Language Environment abends but does generate a report in all other cases.

Figure 2 on page 61 shows the sample output when RPTOPTS is set to ON. RPTOPTS(ON) lists the declared run-time options in alphabetical order. The report lists the option names and shows where each option obtained its current setting. The report heading displayed at the top of the options report is set by CEE3RPH. The date and time formats are affected by the country code set by the COUNTRY run-time option or the CEE3CTY callable service.

The LAST WHERE SET column in the report shows the last place where the options were referenced, even if no suboptions or subsets of the options were changed. ″Override″ in the report indicates that Language Environment forced the setting of this specific option, based on either knowledge of the application or a side effect of another run-time option. “Default setting” in the report indicates that you cannot specify the option in CEEDOPT (CEECOPT) or CEEUOPT. “Programmer default” includes any options specified with C/C++ `#pragma runopts`, PL/I PLIXOPT, and CEEUOPT.

Non-CICS default: RPTOPTS(OFF)

Syntax

```
                  ┌OFF┐
►►──RPTOpts──(──┤   ├──)──────────────────────────────────────────►◄
                  └ON─┘
```

OFF Does not generate a report of the run-time options in effect while the application was running.

ON Generates a report of the run-time options in effect while the application was running.

Options report example

```
Options Report for Enclave main 04/08/02 3:28:53 PM
Language Environment V01 R04.00

 LAST WHERE SET                OPTION
 ---------------------------------------------------------------------------
 Installation default            ABPERC(NONE)
 Installation default            ABTERMENC(ABEND)
 Installation default          NOAIXBLD
 Programmer default              ALL31(ON)
 Assembler user exit             ANYHEAP(32768,16384,ANYWHERE,FREE)
 Installation default          NOAUTOTASK
 Assembler user exit             BELOWHEAP(8192,8192,FREE)
 Installation default            CBLOPTS(ON)
 Installation default            CBLPSHPOP(ON)
 Installation default            CBLQDA(OFF)
 Installation default            CHECK(ON)
 Installation default            COUNTRY(US)
 Installation default          NODEBUG
 Installation default            DEPTHCONDLMT(10)
 Installation default            ENVAR("")
 Installation default            ERRCOUNT(0)
 Installation default            ERRUNIT(6)
 Installation default            FILEHIST
 Installation default            FILETAG(NOAUTOCVT,NOAUTOTAG)
 Default setting               NOFLOW
 Assembler user exit             HEAP(49152,16384,ANYWHERE,KEEP,8192,4096)
 Installation default            HEAPCHK(OFF,1,0,0)
 Invocation command              HEAPPOOLS(ON,8,10,32,10,128,10,256,10,1024,10,2048,10)
 Installation default            INFOMSGFILTER(OFF,,,,)
 Installation default            INQPCOPN
 Installation default            INTERRUPT(OFF)
 Installation default            LIBRARY(SYSCEE)
 Programmer default              LIBSTACK(4096,4096,FREE)
 Invocation command              MSGFILE(MSGFILE,FBA,121,0,NOENQ)
 Installation default            MSGQ(15)
 Installation default            NATLANG(ENU)
 Mapped                          NONIPTSTACK(See THREADSTACK)
 Installation default            OCSTATUS
 Installation default          NOPC
 Installation default            PLITASKCOUNT(20)
 Programmer default              POSIX(ON)
 Installation default            PROFILE(OFF,"")
 Installation default            PRTUNIT(6)
 Installation default            PUNUNIT(7)
 Installation default            RDRUNIT(5)
 Installation default            RECPAD(OFF)
 Programmer default              RPTOPTS(ON)
 Programmer default              RPTSTG(ON)
 Installation default          NORTEREUS
 Installation default            RTLS(OFF)
 Installation default          NOSIMVRD
 Programmer default              STACK(4096,4096,ANYWHERE,FREE,524288,131072)
 Programmer default              STORAGE(NONE,NONE,NONE,1024)
 Installation default            TERMTHDACT(TRACE,,96)
 Installation default          NOTEST(ALL,"*","PROMPT","INSPPREF")
 Installation default            THREADHEAP(4096,4096,ANYWHERE,KEEP)
 Programmer default              THREADSTACK(ON,4096,4096,ANYWHERE,KEEP,131072,131072)
 Installation default            TRACE(OFF,4096,DUMP,LE=0)
 Installation default            TRAP(ON,SPIE)
 Installation default            UPSI(00000000)
 Installation default          NOUSRHDLR(,)
 Installation default            VCTRSAVE(OFF)
 Installation default            VERSION()
 Installation default            XPLINK(OFF)
 Installation default            XUFLOW(AUTO)
```

Figure 2. Options Report Example Produced by Run-Time Option RPTOPTS(ON)

Note: If automatic storage tuning for CICS changes a storage option setting, the LAST WHERE SET value will be "Automatic Tuning".

CICS consideration

- The default under CICS is RPTOPTS=(OFF).
- With RPTOPTS(ON) under CICS, the options report will be written to the CESE queue when the transaction terminates successfully.

Usage notes

- z/OS UNIX consideration—The RPTOPTS option reports run-time options for the enclave.

Performance consideration

This option increases the time it takes for the application to run. Therefore, use it only as an aid to application development.

For more information

- See “MSGFILE” on page 43 for more information about the MSGFILE run-time option.
- For more information about the CEE3RPH callable service, see “CEE3RPH—Set report heading” on page 187.
- See “COUNTRY” on page 22 for more information about the COUNTRY run-time option.
- For more information about the CEE3CTY callable service, see “CEE3CTY—Set default country” on page 122.

RPTSTG

Derivation
RePorT STora Ge

RPTSTG generates, after an application has run, a report of the storage the application used. The report is directed to the *ddname* specified in the MSGFILE run-time option.

Figure 3 on page 64 shows a sample report created with the RPTSTG option set to ON.

The storage report heading is set by CEE3RPH. The date and time formats, in the RPTSTG generated reports, are affected by the country code set by the COUNTRY run-time option or the CEE3CTY callable service.

You can use the storage report information to adjust the ANYHEAP, BELOWHEAP, HEAP, LIBSTACK, NONIPTSTACK, STACK, HEAPPOOLS and THREADHEAP run-time options.

Language Environment writes storage reports only in mixed-case U.S. English.

Non-CICS default: RPTSTG(OFF)

Syntax

```
                  ┌─OFF─┐
►►──RPTStg──(──┬──────┬──)──────────────────────────────────────────►◄
               └─ON──┘
```

OFF Does not generate a report of the storage used while the application was running.

ON Generates a report of the storage used while the application was running.

```
Storage Report for Enclave main 04/08/02 3:28:53 PM
 Language Environment V01 R04.00

     STACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:              7400
       Largest used by any thread:                          7400
       Number of segments allocated:                           2
       Number of segments freed:                               0
     THREADSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:              3616
       Largest used by any thread:                          3616
       Number of segments allocated:                           6
       Number of segments freed:                               0
     LIBSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     THREADHEAP statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Successful Get Heap requests:                           0
       Successful Free Heap requests:                          0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     HEAP statistics:
       Initial size:                                       49152
       Increment size:                                     16384
       Total heap storage used (sugg. initial size):       62784
       Successful Get Heap requests:                          29
       Successful Free Heap requests:                         13
       Number of segments allocated:                           2
       Number of segments freed:                               0
     HEAP24 statistics:
       Initial size:                                        8192
       Increment size:                                      4096
       Total heap storage used (sugg. initial size):           0
       Successful Get Heap requests:                           0
       Successful Free Heap requests:                          0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     ANYHEAP statistics:
       Initial size:                                       32768
       Increment size:                                     16384
       Total heap storage used (sugg. initial size):      104072
       Successful Get Heap requests:                          30
       Successful Free Heap requests:                         15
       Number of segments allocated:                           6
       Number of segments freed:                               5
```

Figure 3. Storage Report Produced by Run-Time Option RPTSTG(ON) (Part 1 of 4)

```
BELOWHEAP statistics:
  Initial size:                                          8192
  Increment size:                                        8192
  Total heap storage used (sugg. initial size):             0
  Successful Get Heap requests:                             0
  Successful Free Heap requests:                            0
  Number of segments allocated:                             0
  Number of segments freed:                                 0
Additional Heap statistics:
  Successful Create Heap requests:                          1
  Successful Discard Heap requests:                         1
  Total heap storage used:                               4912
  Successful Get Heap requests:                             3
  Successful Free Heap requests:                            3
  Number of segments allocated:                             2
  Number of segments freed:                                 2
HeapPools Statistics:
  Pool 1 size:    8
    Successful Get Heap requests:    1-   8                8
  Pool 2 size:   32
    Successful Get Heap requests:    9-  16                3
    Successful Get Heap requests:   17-  24                5
    Successful Get Heap requests:   25-  32                3
  Pool 3 size:  128
    Successful Get Heap requests:   33-  40                3
    Successful Get Heap requests:   41-  48                3
    Successful Get Heap requests:   49-  56               11
    Successful Get Heap requests:   57-  64                4
    Successful Get Heap requests:   65-  72                3
    Successful Get Heap requests:   73-  80                4
    Successful Get Heap requests:   81-  88                5
    Successful Get Heap requests:   89-  96                4
    Successful Get Heap requests:   97- 104                4
    Successful Get Heap requests:  113- 120                5
    Successful Get Heap requests:  121- 128                4
  Pool 4 size:  256
    Successful Get Heap requests:  129- 136                6
    Successful Get Heap requests:  137- 144                3
    Successful Get Heap requests:  145- 152                4
    Successful Get Heap requests:  153- 160                2
    Successful Get Heap requests:  161- 168                8
    Successful Get Heap requests:  169- 176                5
    Successful Get Heap requests:  177- 184                4
    Successful Get Heap requests:  185- 192                6
    Successful Get Heap requests:  193- 200                3
    Successful Get Heap requests:  201- 208                4
    Successful Get Heap requests:  209- 216                2
    Successful Get Heap requests:  217- 224                3
    Successful Get Heap requests:  225- 232                4
    Successful Get Heap requests:  233- 240                2
    Successful Get Heap requests:  241- 248                2
    Successful Get Heap requests:  249- 256                1
```

Figure 3. Storage Report Produced by Run-Time Option RPTSTG(ON) (Part 2 of 4)

```
Pool 5 size: 1024
  Successful Get Heap requests:  257- 264                4
  Successful Get Heap requests:  265- 272                1
  Successful Get Heap requests:  273- 280                3
  Successful Get Heap requests:  281- 288                2
  Successful Get Heap requests:  289- 296                2
  Successful Get Heap requests:  305- 312                6
  Successful Get Heap requests:  313- 320                5
  Successful Get Heap requests:  321- 328                4
  Successful Get Heap requests:  329- 336                2
  Successful Get Heap requests:  337- 344                3
  Successful Get Heap requests:  353- 360                2
  Successful Get Heap requests:  361- 368                4
  Successful Get Heap requests:  369- 376                5
  Successful Get Heap requests:  377- 384                2
  Successful Get Heap requests:  385- 392                2
  Successful Get Heap requests:  393- 400                2
  Successful Get Heap requests:  401- 408                5
  Successful Get Heap requests:  409- 416                3
  Successful Get Heap requests:  417- 424                2
  Successful Get Heap requests:  425- 432                1
  Successful Get Heap requests:  433- 440                2
  Successful Get Heap requests:  441- 448                4
  Successful Get Heap requests:  457- 464                1
  Successful Get Heap requests:  465- 472                1
  Successful Get Heap requests:  473- 480                2
  Successful Get Heap requests:  481- 488                1
  Successful Get Heap requests:  489- 496                2
  Successful Get Heap requests:  497- 504                5
  Successful Get Heap requests:  505- 512                2
  Successful Get Heap requests:  545- 552                1
  Successful Get Heap requests:  577- 584                1
  Successful Get Heap requests:  641- 648                2
  Successful Get Heap requests:  825- 832                1
  Successful Get Heap requests:  913- 920                1
Pool 6 size: 2048
  Successful Get Heap requests: 1089-1096                1
  Successful Get Heap requests: 1169-1176                1
  Successful Get Heap requests: 1185-1192                1
  Successful Get Heap requests: 1217-1224                2
  Successful Get Heap requests: 1257-1264                1
  Successful Get Heap requests: 1377-1384                1
  Successful Get Heap requests: 1401-1408                1
  Successful Get Heap requests: 1521-1528                1
  Successful Get Heap requests: 1537-1544                1
  Successful Get Heap requests: 1545-1552                1
  Successful Get Heap requests: 1569-1576                1
  Successful Get Heap requests: 1665-1672                1
  Successful Get Heap requests: 1761-1768                1
  Successful Get Heap requests: 1785-1792                1
  Successful Get Heap requests: 1929-1936                1
  Successful Get Heap requests: 1937-1944                1
  Successful Get Heap requests: 1953-1960                1
Requests greater than the largest cell size:            19
```

Figure 3. Storage Report Produced by Run-Time Option RPTSTG(ON) (Part 3 of 4)

```
    HeapPools Summary:
      Cell  Extent   Cells Per  Extents    Maximum     Cells In
      Size  Percent  Extent     Allocated  Cells Used  Use
      ---------------------------------------------------------
         8    10         307           1           2           0
        32    10         122           1           3           1
       128    10          36           1          10           7
       256    10          18           1          11           4
      1024    10           4           4          13          12
      2048    10           2           2           4           3
      ---------------------------------------------------------
      Suggested Percentages for current Cell Sizes:
        HEAPP(ON,8,1,32,1,128,3,256,6,1024,28,2048,17)
      Suggested Cell Sizes:
        HEAPP(ON,104,,208,,376,,512,,1264,,1960,)
    Largest number of threads concurrently active:             2
End of Storage Report
```

Figure 3. Storage Report Produced by Run-Time Option RPTSTG(ON) (Part 4 of 4)

The following figure is an example of the Storage Report produced by run-time option RPTSTG(ON) running with XPLINK.

```
Storage Report for Enclave main 04/08/02 3:39:15 PM
 Language Environment V01 R04.00

     STACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:              6864
       Largest used by any thread:                          6864
       Number of segments allocated:                           2
       Number of segments freed:                               0
     THREADSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:             11232
       Largest used by any thread:                          2576
       Number of segments allocated:                           6
       Number of segments freed:                               0
     XPLINK STACK statistics:
       Initial size:                                      524288
       Increment size:                                    131072
       Largest used by any thread:                          2640
       Number of segments allocated:                           1
       Number of segments freed:                               0
     XPLINK THREADSTACK statistics:
       Initial size:                                      131072
       Increment size:                                    131072
       Largest used by any thread:                          2752
       Number of segments allocated:                           6
       Number of segments freed:                               0
     LIBSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     THREADHEAP statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Successful Get Heap requests:                           0
       Successful Free Heap requests:                          0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     HEAP statistics:
       Initial size:                                       49152
       Increment size:                                     16384
       Total heap storage used (sugg. initial size):       64640
       Successful Get Heap requests:                          30
       Successful Free Heap requests:                         13
       Number of segments allocated:                           2
       Number of segments freed:                               0
```

Figure 4. Storage Report Produced by RPTSTG(ON) with XPLINK (Part 1 of 4)

```
HEAP24 statistics:
  Initial size:                                          8192
  Increment size:                                        4096
  Total heap storage used (sugg. initial size):             0
  Successful Get Heap requests:                             0
  Successful Free Heap requests:                            0
  Number of segments allocated:                             0
  Number of segments freed:                                 0
ANYHEAP statistics:
  Initial size:                                         32768
  Increment size:                                       16384
  Total heap storage used (sugg. initial size):        125392
  Successful Get Heap requests:                            31
  Successful Free Heap requests:                           15
  Number of segments allocated:                             7
  Number of segments freed:                                 6
BELOWHEAP statistics:
  Initial size:                                          8192
  Increment size:                                        8192
  Total heap storage used (sugg. initial size):             0
  Successful Get Heap requests:                             0
  Successful Free Heap requests:                            0
  Number of segments allocated:                             0
  Number of segments freed:                                 0
Additional Heap statistics:
  Successful Create Heap requests:                          1
  Successful Discard Heap requests:                         1
  Total heap storage used:                               4912
  Successful Get Heap requests:                             3
  Successful Free Heap requests:                            3
  Number of segments allocated:                             2
  Number of segments freed:                                 2
HeapPools Statistics:
  Pool 1 size:    8
    Successful Get Heap requests:    1-   8                8
  Pool 2 size:   32
    Successful Get Heap requests:    9-  16                3
    Successful Get Heap requests:   17-  24                5
    Successful Get Heap requests:   25-  32                3
  Pool 3 size:  128
    Successful Get Heap requests:   33-  40                9
    Successful Get Heap requests:   41-  48                3
    Successful Get Heap requests:   49-  56               11
    Successful Get Heap requests:   57-  64                4
    Successful Get Heap requests:   65-  72                3
    Successful Get Heap requests:   73-  80                4
    Successful Get Heap requests:   81-  88                5
    Successful Get Heap requests:   89-  96                4
    Successful Get Heap requests:   97- 104                4
    Successful Get Heap requests:  113- 120                5
    Successful Get Heap requests:  121- 128                4
```

Figure 4. Storage Report Produced by RPTSTG(ON) with XPLINK (Part 2 of 4)

```
Pool 4 size:  256
  Successful Get Heap requests:  129- 136                6
  Successful Get Heap requests:  137- 144                3
  Successful Get Heap requests:  145- 152                4
  Successful Get Heap requests:  153- 160                2
  Successful Get Heap requests:  161- 168                8
  Successful Get Heap requests:  169- 176                5
  Successful Get Heap requests:  177- 184                4
  Successful Get Heap requests:  185- 192                6
  Successful Get Heap requests:  193- 200                3
  Successful Get Heap requests:  201- 208                4
  Successful Get Heap requests:  209- 216                2
  Successful Get Heap requests:  217- 224                3
  Successful Get Heap requests:  225- 232                4
  Successful Get Heap requests:  233- 240                2
  Successful Get Heap requests:  241- 248                2
  Successful Get Heap requests:  249- 256                1
Pool 5 size: 1024
  Successful Get Heap requests:  257- 264                4
  Successful Get Heap requests:  265- 272                1
  Successful Get Heap requests:  273- 280                3
  Successful Get Heap requests:  281- 288                2
  Successful Get Heap requests:  289- 296                2
  Successful Get Heap requests:  305- 312                6
  Successful Get Heap requests:  313- 320                5
  Successful Get Heap requests:  321- 328                4
  Successful Get Heap requests:  329- 336                2
  Successful Get Heap requests:  337- 344                3
  Successful Get Heap requests:  353- 360                2
  Successful Get Heap requests:  361- 368                4
  Successful Get Heap requests:  369- 376                5
  Successful Get Heap requests:  377- 384                2
  Successful Get Heap requests:  385- 392                2
  Successful Get Heap requests:  393- 400                2
  Successful Get Heap requests:  401- 408                5
  Successful Get Heap requests:  409- 416                3
  Successful Get Heap requests:  417- 424                2
  Successful Get Heap requests:  425- 432                1
  Successful Get Heap requests:  433- 440                2
  Successful Get Heap requests:  441- 448                4
  Successful Get Heap requests:  457- 464                1
  Successful Get Heap requests:  465- 472                1
  Successful Get Heap requests:  473- 480                2
  Successful Get Heap requests:  481- 488                1
  Successful Get Heap requests:  489- 496                2
  Successful Get Heap requests:  497- 504                5
  Successful Get Heap requests:  505- 512                2
  Successful Get Heap requests:  545- 552                1
  Successful Get Heap requests:  577- 584                1
  Successful Get Heap requests:  641- 648                2
  Successful Get Heap requests:  825- 832                1
  Successful Get Heap requests:  913- 920                1
```

Figure 4. Storage Report Produced by RPTSTG(ON) with XPLINK (Part 3 of 4)

```
      Pool 6 size: 2048
        Successful Get Heap requests: 1089-1096                1
        Successful Get Heap requests: 1169-1176                1
        Successful Get Heap requests: 1185-1192                1
        Successful Get Heap requests: 1217-1224                2
        Successful Get Heap requests: 1257-1264                1
        Successful Get Heap requests: 1377-1384                1
        Successful Get Heap requests: 1401-1408                1
        Successful Get Heap requests: 1521-1528                1
        Successful Get Heap requests: 1537-1544                1
        Successful Get Heap requests: 1545-1552                1
        Successful Get Heap requests: 1569-1576                1
        Successful Get Heap requests: 1665-1672                1
        Successful Get Heap requests: 1761-1768                1
        Successful Get Heap requests: 1785-1792                1
        Successful Get Heap requests: 1929-1936                1
        Successful Get Heap requests: 1937-1944                1
        Successful Get Heap requests: 1953-1960                1
      Requests greater than the largest cell size:            19
    HeapPools Summary:
      Cell  Extent   Cells Per  Extents    Maximum     Cells In
      Size  Percent  Extent     Allocated  Cells Used  Use
      ----------------------------------------------------------
         8    10         307           1           6           0
        32    10         122           1           4           1
       128    10          36           1          26          13
       256    10          18           2          19           4
      1024    10           4           4          13          12
      2048    10           2           2           4           3
      ----------------------------------------------------------
      Suggested Percentages for current Cell Sizes:
        HEAPP(ON,8,1,32,1,128,8,256,11,1024,28,2048,17)
      Suggested Cell Sizes:
        HEAPP(ON,96,,208,,376,,512,,1264,,1960,)
    Largest number of threads concurrently active:             7
End of Storage Report
```

Figure 4. Storage Report Produced by RPTSTG(ON) with XPLINK (Part 4 of 4)

CICS consideration

- The default under CICS is RPTSTG=(OFF).
- With RPTSTG(ON) under CICS, the storage report will be written to the CESE queue when the transaction terminates successfully.
- The phrases “Number of segments allocated” and “Number of segments freed” represent, on CICS, the number of EXEC CICS GETMAIN and EXEC CICS FREEMAIN requests, respectively.

Usage notes

- When a vendor heap manager (VHM) is active, the Language Environment Storage Report will have a text line indicating that the user heap for C/C++ part of the enclave is managed separately. The VHM is expected to write its own storage report to the `stderr` stream.
- RPTSTG does not generate a storage report if your application terminates abnormally.
- RPTSTG includes PL/I task-level information on stack and heap utilization.

- z/OS UNIX consideration—The RPTSTG option applies to storage utilization for the enclave, including thread-level information on stack utilization, and stack storage used by multiple threads.

Performance consideration

This option increases the time it takes for an application to run. Therefore, use it only as an aid to application development.

The storage report generated by RPTSTG(ON) shows the number of system-level get storage calls that were required while the application was running. To improve performance, use the storage report numbers generated by the RPTSTG option as an aid in setting the initial and increment size for STACK and HEAP. This reduces the number of times that the Language Environment storage manager makes requests to acquire storage. For example, you can use the storage report numbers to set appropriate values in the HEAP and STACK *init_size* and *incr_size* fields for allocating storage.

For more information

- For more information about the MSGFILE run-time option, see “MSGFILE” on page 43.
- For more information about the CEE3RPH callable service, see “CEE3RPH—Set report heading” on page 187.
- See “COUNTRY” on page 22 for more information about the COUNTRY run-time option.
- For more information about the CEE3CTY callable service, see “CEE3CTY—Set default country” on page 122.
- For more information about the ANYHEAP run-time option, see “ANYHEAP” on page 16.
- For more information about the BELOWHEAP run-time option, see “BELOWHEAP” on page 19.
- For more information about the HEAP run-time option, see “HEAP” on page 33.
- For more information about the LIBSTACK run-time option, see “LIBSTACK” on page 42.
- For more information about the STACK run-time option, see “STACK” on page 76.
- For more information about tuning your application with storage numbers, see *z/OS Language Environment Programming Guide*.

RTEREUS (COBOL only)

Derivation
Run Time Environment REUSe

RTEREUS implicitly initializes the run-time environment to be reusable when the main program for the thread is a COBOL program. This option is valid only when used with CEEDOPT, CEEUOPT, CEEROPT or the assembler user exit.

Non-CICS default: NORTEREUS

Syntax

```
      ┌─NORTEREUS─┐
►►────┴─RTEREUS───┴──────────────────────────────────────────►◄
```

NORTEREUS
Does not initialize the run-time environment to be reusable when the first COBOL program is invoked.

RTEREUS
Initializes the run-time environment to be reusable when the first COBOL program is invoked.

CICS consideration

- RTEREUS is ignored under CICS.

Usage notes

- Avoid using RTEREUS(ON) as an installation default. If you do use RTEREUS, use it for specific applications only.
- If you do use RTEREUS, use it for specific applications only.
- Enterprise COBOL programs compiled with the THREAD compiler option will not run with RTEREUS(ON).
- Under Language Environment, RTEREUS(ON) is only supported in a single enclave environment unless you modify the behavior using the IGZERREO CSECT. With the IBM supplied default setting for COBOL's reusable environment, applications that create multiple enclaves will terminate with error message IGZ0168S. Multiple enclaves can be created by applications that use SVC LINK or CMSCALL to invoke application programs. One example is when an SVC LINK is used to invoke an application program under ISPF that is using ISPF services (such as CALL 'ISPLINK' and ISPF SELECT).
- If a Language Environment reusable environment is established (using RTEREUS), attempts to run a C or PL/I main program under Language Environment will fail. For example, when running on ISPF with RTEREUS(ON):
  - The first program invoked by ISPF is a COBOL program. A Language Environment reusable environment is established.
  - At some other point, ISPF invokes a PL/I or C program. The initialization of the PL/I or C program will fail.
- If a large number of COBOL programs are run (using RTEREUS) under the same MVS task, you can encounter out-of-region abends. This is because all storage acquired by Language Environment to run COBOL programs is kept in storage until the MVS task ends or the Language Environment environment is terminated.
- Language Environment storage and run-time options reports are not produced by Language Environment (using RTEREUS) unless a STOP RUN is issued to end the enclave.
- When you specify RTEREUS in CEEDOPT, CEEROPT or CEEUOPT, the only accepted syntax is RTEREUS(ON) or RTEREUS(OFF).
- Use RTEREUS and NORTEREUS only on the command line.
- IMS consideration—RTEREUS is not recommended for use under IMS.

- The IGZERREO CSECT affects the handling of program checks in the non-Language Environment-enabled driver that repeatedly invokes COBOL programs. It also affects the behavior of running COBOL programs in a nested enclave when a reusable environment is active.

Performance consideration

You must change STOP RUN statements to GOBACK statements in order to gain the benefits of RTEREUS. STOP RUN terminates the reusable environment. If you specify RTEREUS and use STOP RUN, Language Environment recreates the reusable environment on the next invocation of COBOL. Doing this repeatedly degrades performance, because a reusable environment takes longer to create than does a normal environment.

The IGZERREO CSECT affects the performance of running with RTEREUS.

Language Environment also offers preinitialization support in addition to RTEREUS.

For more information

- For more information about CEEUOPT, CEEROPT or CEEDOPT, see *z/OS Language Environment Customization*.
- For more information about IGZERREO, see *z/OS Language Environment Customization*.
- See *z/OS Language Environment Programming Guide* for more information about preinitialization.

RTLS

Derivation

Run Time Library Services

RTLS allows you to LOAD and DELETE Language Environment modules and any dynamically-loaded user modules using the z/OS module search order or using the active RTLS logical library.

Non-CICS default: RTLS(OFF)

Syntax

```
►►──RTLS──(──┬─OFF─┬──)──────────────────────────────────────────►◄
             └─ON──┘
```

OFF When RTLS(OFF) is in effect, Language Environment modules and any dynamically-loaded user modules are loaded using the z/OS module search order.

ON When RTLS(ON) is in effect, most Language Environment modules and dynamically-loaded user modules are first loaded from the active RTLS logical library. If they are not found in the RTLS logical library, they are LOADed using the z/OS module search order.

CICS consideration

- RTLS is ignored under CICS.

Usage notes

- If CEEGINIT is not available in the LNKLST, LPA, JOBLIB, STEPLIB, or TASKLIB when Language Environment is invoked, the RTLS(ON|OFF) option has no effect. RTLS will not be used, but the RTLS(ON|OFF) option setting will appear in the options report. Load module CEEGINIT can be found in the SCEERTLS data set and must be placed in the z/OS search order in order for this option to take effect. This option is also meaningless under CICS, CEEPIPI, and with C and PL/I preinitialization.
- The RTLS option is ignored for the following environments:
  - CEEPIPI (Language Environment Preinitialization)
  - Pre-Language Environment preinitialization for C and PL/I
- The specification of the LIBRARY option is ignored for nested enclaves. The value is always inherited for the main enclave.
- For restrictions that apply to RTLS, see *z/OS Language Environment Customization*.

For more information

- See “LIBRARY” on page 41 and “VERSION” on page 100.

SIMVRD (COBOL only)

Derivation

SIMulate Variable length Relative organization Data sets

SIMVRD specifies whether your COBOL programs use a VSAM KSDS to simulate variable-length relative organization data sets.

Non-CICS default: NOSIMVRD

Syntax

```
      ┌─NOSIMVRD─┐
►►────┴─SIMVRD───┴──────────────────────────────────────────►◄
```

NOSIMVRD
Do not use a VSAM KSDS to simulate variable-length relative organization.

SIMVRD
Use a VSAM KSDS to simulate variable-length relative organization.

CICS consideration

- SIMVRD is ignored under CICS.

Usage notes

- When you specify SIMVRD in CEEDOPT, CEEROPT or CEEUOPT, the only accepted syntax is SIMVRD(ON) or SIMVRD(OFF).
- Use SIMVRD and NOSIMVRD only on the command line.

For more information

- See *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for more details.
- For more information about CEEUOPT, CEEROPT or CEEDOPT, see the *z/OS Language Environment Customization*.

STACK

STACK controls the allocation of the thread's stack storage for both the upward and downward- growing stacks. Typical items residing in the upward-growing stack are C or PL/I automatic variables, COBOL LOCAL-STORAGE data items, and work areas for COBOL library routines.

The downward-growing stack will be allocated only when an application has been built with XPLINK.

Storage required for the common anchor area (CAA) and other control blocks is allocated separately from, and prior to, the allocation of the initial stack segment and the initial heap.

Non-CICS default: STACK(128K,128K,ANYWHERE,KEEP,512K,128K)

Syntax

```
►►──STAck──(──┬──────────────┬──,──┬──────────────┬──,──┬─ANYWHERE─┬──,──►
              └─usinit_size──┘     └─usincr_size──┘     ├─ANY─────┤
                                                        └─BELOW───┘

►──┬─KEEP─┬──,──┬──────────────┬──,──┬──────────────┬──)──────────────►◄
   └─FREE─┘     └─dsinit_size──┘     └─dsincr_size──┘
```

usinit_size

Determines the size of the initial upward-growing stack segment. The storage is contiguous. You specify the *usinit_size* value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

usinit_size can be preceded by a minus sign. In environments other than CICS, if you specify a negative number Language Environment uses all available storage minus the amount specified for the initial stack segment.

A size of "0" or "−0" requests half of the largest block of contiguous storage in the region below the 16 MB line.

usincr_size

Determines the minimum size of any subsequent increment to the upward-growing stack area. You can specify this value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is the larger of two values— *usincr_size* or the requested size—rounded up to the nearest multiple of 8 bytes

If you specify *usincr_size* as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 8 bytes, is obtained.

The requested size is the amount of storage a routine needs for a stack frame. For example, if the requested size is 9000 bytes, *usincr_size* is specified as 8K, and the initial stack segment is full, Language Environment gets a 9000 byte stack increment from the operating system to satisfy the request. If the requested size is smaller than 8K, Language Environment gets an 8K stack increment from the operating system.

ANYWHERE|ANY
Specifies the stack storage can be allocated anywhere in storage. If there is no storage available above the line, Language Environment acquires storage below the 16 MB line. On systems that do not support bimodal addressing, Language Environment ignores this option and places the stack storage below 16M.

BELOW
Specifies that the stack storage must be allocated below the 16M line in storage that is accessible to 24-bit addressing.

KEEP Specifies that storage allocated to stack increments is not released when the last of the storage in the stack increment is freed.

FREE Specifies that storage allocated to stack increments is released when the last of the storage in the stack is freed. The initial stack segment is never released until the enclave terminates.

dsinit_size
Determines the size of the initial downward growing stack segment. The storage is contiguous. You specify the *dsinit_size* value as n, nK, or nM bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 16 bytes.

dsincr_size
Determines the minimum size of any subsequent increment to the downward growing stack area. You can specify this value as n, nK, or nM bytes of storage. The actual amount of allocated storage is the larger of two values-- *dsincr_size* or the requested size--rounded up to the nearest multiple of 16 bytes.

CICS consideration

- The default under CICS is STACK=(4K,4080,ANYWHERE,KEEP,4K,4080).
- **dsinit_size** and **dsincr_size** sub-options are ignored under CICS.
- The maximum initial and increment size for CICS above 16 MB is 1 gigabyte (1024 MB). This restriction is subject to change from one release of CICS to another.
- Both the initial size and the increment size are rounded up to the nearest multiple of 8 bytes. The initial size minimum is 4K.
- If you do not specify STACK, Language Environment assumes the default value of 4K. Under CICS, STACK(0), STACK (−0), and STACK (−n) are all interpreted as STACK(4K).
- The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16 bytes CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line).

Usage notes

- When an application is running in an XPLINK environment (that is, either the XPLINK(ON) run-time option was specified, or the initial program contained at least one XPLINK-compiled part), the STACK run-time option will be forced to

STACK(,,ANY,,,). Only the third suboption of the STACK run-time option is changed by this action, to indicate that stack storage can be allocated anywhere in storage. No message will be issued to indicate this action. In this case, if a Language Environment run-time options report is generated using the RPTOPTS run-time option, the STACK option will be reported as ″Override″ under the LAST WHERE SET column.

- The *dsinit_size* and *dsincr_size* values are the amounts of storage that can be used for downward growing stack frames (plus the stack header, approximately 20 bytes). The actual size of the storage getmained will be 4K (8K if a 4K page alignment cannot be guaranteed) larger to accommodate the guard page.
- The downward growing stack is only initialized in a XPLINK supported environment, that is, batch, TSO, z/OS UNIX, and only when a XPLINK application is active in the enclave. Otherwise the suboptions for the downward growing stack are ignored.
- Applications running with ALL31(OFF) must specify STACK(,,BELOW,,,) to ensure that stack storage is addressable by the application.
- PL/I consideration—PL/I automatic storage above the 16 MB line is supported under control of the Language Environment STACK option. When the Language Environment stack is above, PL/I temporaries (dummy arguments) and parameter lists (for reentrant/recursive blocks) also reside above.

  The stack frame size for an individual block is constrained to 16 MB. Stack frame extensions are also constrained to 16 MB. Therefore, the size of an automatic aggregate, temporary variable, or dummy argument cannot exceed 16 MB. Violation of this constraint might have unpredictable results.

  If an OS PL/I application does not contain any edited stream I/O and if it is running with AMODE 31, you can relink it with Language Environment to use STACK(,,ANY,,,). Doing so is particularly useful under CICS to help relieve below-the-line storage constraints.
- PL/I MTF consideration—The STACK option allocates and manages stack storage for the PL/I main task only. For information about stack storage management in the subtasks, see “NONIPTSTACK | NONONIPTSTACK” on page 49.
- z/OS UNIX consideration—The STACK option specifies the characteristics of the user stack for the initial thread. In particular, it gets the initial size of the user stack for the initial thread.

  The characteristics that indicate *incr_size*, ANYWHERE, and KEEP | FREE apply to any thread created using `pthread_create`. Language Environment gets the initial stack size from the threads attribute object specified in the `pthread_create` function. The default size to be set in the thread’s attribute object is obtained from the STACK run-time option’s initial size.

  The recommended default setting for STACK under z/OS UNIX is STACK=(12K,12K,ANYWHERE,KEEP,512K,128K).

Performance consideration

To improve performance, use the storage report numbers generated by the RPTSTG run-time option as an aid in setting the initial and increment size for STACK.

For more information

- See “ALL31” on page 15 for more information about the ALL31 run-time option.
- See “RPTSTG” on page 62 for more information about the RPTSTG run-time option.

- For more information about using the storage reports generated by the RPTSTG run-time option to tune the stacks, see *z/OS Language Environment Programming Guide*.

STORAGE

STORAGE controls the initial content of storage when allocated and freed. It also controls the amount of storage that is reserved for the out-of-storage condition. If you specify one of the parameters in the STORAGE run-time option, all allocated storage processed by that parameter is initialized to the specified value. Otherwise, it is left uninitialized.

You can use the STORAGE option to identify uninitialized application variables, or prevent the accidental use of previously freed storage. STORAGE is also useful in data security. For example, storage containing sensitive data can be cleared when it is freed.

Non-CICS default: STORAGE(NONE,NONE,NONE,0K)

Syntax

```
►►─STOrage─(─┬──────────────────┬─,─┬──────────────────┬─,──────────►
             └─heap_alloc_value─┘   └─heap_free_value──┘

►─┬──────────────────┬─,─┬──────────────────┬─)──────────────────────►◄
  └─dsa_alloc_value──┘   └─reserve_size─────┘
```

heap_alloc_value
The initialized value of any heap storage allocated by the storage manager. You can specify *heap_alloc_value* as:

- A single character enclosed in quotes. If you specify a single character, every byte of heap storage allocated by the storage manager is initialized to that character's EBCDIC equivalent. For example, if you specify 'a' as the *heap_alloc_value*, heap storage is initialized to X'818181...81' or 'aaa...a'.
- Two hex digits without quotes. If you specify two hex digits, every byte of the allocated heap storage is initialized to that value. For example, if you specify FE as the *heap_alloc_value*, heap storage is initialized to X'FEFEFE...FE'. A *heap_alloc_value* of 00 initializes heap storage to X'0000...00'.
- **NONE** If you specify **NONE**, the allocated heap storage is not initialized.

heap_free_value
The value of any heap storage freed by the storage manager is overwritten. You can specify *heap_free_value* as:

- A single character enclosed in quotes. For example, a *heap_free_value* of 'f' overwrites freed heap storage to X'868686...86'; 'B' overwrites freed heap storage to X'C2C2C2...C2'.
- Two hex digits without quotes. A *heap_free_value* of FE overwrites freed heap storage with X'FEFEFE...FE'.
- **NONE** If you specify **NONE**, the freed heap storage is not initialized.

dsa_alloc_value
The initialized value of stack frames from the Language Environment stack.

A stack frame is dynamically-acquired storage that is composed of a standard register save area and the area available for automatic storage.

If specified, all Language Environment stack storage, including automatic variable storage, is initialized to *dsa_alloc_value*. Stack frames allocated outside the Language Environment stack are never initialized.

You can specify *dsa_alloc_value* as:

- A single character enclosed in quotes. If you specify a single character, any dynamically acquired stack storage allocated by the storage manager is initialized to that character's EBCDIC equivalent. For example, if you specify 'A' as the *dsa_alloc_value*, stack storage is initialized to X'C1C1C1...C1'. A *dsa_alloc_value* of 'F' initializes stack storage to X'C6C6C6...C6', 'd' to X'848484...84'.
- Two hex digits without quotes. If you specify two hex digits, any dynamically-acquired stack storage is initialized to that value. For example, if you specify FE as the *dsa_alloc_value*, stack storage is initialized to X'FEFEFE...FE'. A *dsa_alloc_value* of 00 initializes stack storage to X'00', FF to X'FFFFFF...FF'.
- **NONE** If you specify **NONE**, the stack storage is not initialized.

reserve_size

The amount of storage for the Language Environment storage manager to reserve in the event of an out-of-storage condition. You can specify the *reserve_size* value as *n*, *n*K, or *n*M bytes of storage. The amount of storage is rounded to the nearest multiple of 8 bytes.

If you specify *reserve_size* as 0, no reserve segment is allocated.

The default reserve_size is 0, so no reserve segment is allocated. If you do not specify a reserve segment and your application exhausts storage, the application terminates with abend 4088 and a reason code of 1024.

If you specify a *reserve_size* that is greater than 0 on a non-CICS system, Language Environment does not immediately abend when your application runs out of storage. Instead, when the stack overflows, Language Environment uses the reserve stack as the new segment and signals a CEEOPD out of storage condition. This allows a user-written condition handler to gain control for this signal and release storage. If the reserve stack segment overflows while this is happening, Language Environment terminates with abend 4088 and reason code of 1004. The reserve stack segment is not freed until thread termination. It is acquired from 31-bit storage if the STACK(,,ANY,,,) runtime option is set or 24-bit storage when STACK(,,BELOW,,,) is requested. If a determination is made to activate the reserve stack, the reserve size should be set to a minimum of 32K to support LE condition handling and messaging internal routines as well as the user condition handler. When using the reserve stack in a multi-threaded environment, it is recommended that the ALL31(ON) and STACK(,,ANY,,,) options also be in effect.

To avoid such an overflow, increase the size of the reserve stack segment with the STORAGE(,,,*reserve_size*) run-time option. The reserve stack segment is not freed until thread termination.

CICS consideration

- The default under CICS is STORAGE=(NONE,NONE,NONE,0K).
- The out-of-storage condition is not raised under CICS.

Usage notes

- *heap_alloc_value*, *heap_free_value*, and *dsa_alloc_value* can all be enclosed in quotes. To initialize heap storage to the EBCDIC equivalent of a single quote, double it within the string delimited by single quotes or surround it with a pair of double quotes. Both of the following are correct ways to specify a single quote:

  ```
  STORAGE('''')
  STORAGE("'")
  ```

  Similarly, double quotes must be doubled within a string delimited by double quotes, or surrounded by a pair of single quotes. The following are correct ways to specify a double quote:

  ```
  STORAGE("""")
  STORAGE('"')
  ```

- CICS consideration—The IBM-supplied default setting for STORAGE under CICS is STORAGE(NONE,NONE,NONE,0K).

  The out-of-storage condition is not raised under CICS.
- z/OS UNIX consideration—A reserve stack of the size specified by the *reserve_size* suboption of STORAGE is allocated for each thread.
- COBOL consideration—If using WSCLEAR in VS COBOL II, STORAGE(00,NONE,NONE,8K) is recommended.

Performance consideration

Using STORAGE to control initial values can increase program run-time. If you specify a *dsa_alloc_value*, performance is likely to be poor. Therefore, use the *dsa_alloc_value* option only for debugging, not to initialize automatic variables or data structures.

Use STORAGE(NONE,NONE,NONE) when you are not debugging.

TERMTHDACT

Derivation
TERMinating THreaD ACTions

TERMTHDACT sets the level of information that is produced when Language Environment percolates a condition of severity 2 or greater beyond the first routine's stack frame.

The Language Environment service CEE3DMP is called for the TRACE, UATRACE, DUMP, and UADUMP suboptions of TERMTHDACT.

The following CEE3DMP options are passed for TRACE:
NOENTRY CONDITION TRACEBACK THREAD(ALL) NOBLOCK NOSTORAGE NOVARIABLES NOFILES STACKFRAME(ALL) PAGESIZE(60) FNAME(CEEDUMP) GENOPTS

The following options are passed for DUMP and UADUMP:
THREAD(ALL) NOENTRY TRACEBACK FILES VARIABLES BLOCK STORAGE STACKFRAME(ALL) PAGESIZE(60) FNAME(CEEDUMP) CONDITION GENOPTS

If a message is printed, based upon the TERMTHDACT(MSG) run-time option, the message is for the active condition immediately prior to the termination imminent

step. In addition, if that active condition is a promoted condition (was not the original condition), the original condition's message is printed.

If the TRACE run-time option is specified with the DUMP suboption, a dump containing the trace table, at a minimum, is produced. The contents of the dump depend on the values set in the TERMTHDACT run-time option.

Under abnormal termination, the following dump contents are generated:

- TERMTHDACT(TRACE)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination and a trace of the active routines on the activation stack as well as an options report.
- TERMTHDACT(QUIET)—Specifies that Language Environment does not generate a message when a thread terminates due to an unhandled condition of severity 2 or greater.
- TERMTHDACT(MSG)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination.
- TERMTHDACT(DUMP)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, a Language Environment dump and an options report.
- TERMTHDACT(UATRACE)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, an options report, and generates a U4039 abend which allows a system dump of the user address space to be generated.
- TERMTHDACT(UADUMP)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, an options report, a Language Environment dump, and generates a U4039 abend which allows a system dump of the user address space to be generated. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.
- TERMTHDACT(UAONLY)—When a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.
- TERMTHDACT(UAIMM)—Specifies to Language Environment that prior to condition management processing, for abends and program interrupts that are conditions of Severity 2 or higher, Language Environment will immediately request the operating system to generate a system dump of the original abend/program interrupt of the user address space. Due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. After the dump is taken by the operating system, Language Environment condition manager can continue processing. If the thread terminates due to an unhandled condition of Severity 2 or higher, then Language Environment will terminate as if TERMTHDACT(QUIET) was specified.

Under normal termination, the following dump contents are generated:

- Independent of the TERMTHDACT setting, Language Environment may generate a CEEDUMP containing the trace table only, based on the TRACE run-time option.

Non-CICS default: TERMTHDACT(TRACE,CESE,96)

Syntax

```
                    ┌─TRACE──────┐       ┌─CESE───────┐
►►─TERmthdact─(─────┼────────────┼──,────┼────────────┼──,──┬──────────────────┬──►
                    ├─QUIET──────┤       └─CICSDDS────┘     └─reg_stor_amount─┘
                    ├─MSG────────┤
                    ├─DUMP───────┤
                    ├─UATRACE────┤
                    ├─UADUMP─────┤
                    ├─UAONLY─────┤
                    └─UAIMM──────┘

►─)──────────────────────────────────────────────────────────────────────────►◄
```

TRACE
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination and a trace of the active routines on the activation stack.

QUIET
Specifies that Language Environment does not generate a message when a thread terminates due to an unhandled condition of severity 2 or greater.

MSG Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination.

DUMP Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, and a Language Environment dump.

UATRACE
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, and a U4039 system dump of the user address space. Under CICS, you will get a CICS transaction dump. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space.

UADUMP
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, a Language Environment dump, and a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.

UAONLY
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.

UAIMM
Specifies to Language Environment that prior to condition management processing, for abends and program interrupts that are conditions of severity 2 or higher, Language Environment will immediately request the operating system to generate a system dump of the original abend/program interrupt of the user address space. Due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. After the dump is taken by the operating system, Language Environment condition manager can continue processing. If the thread terminates due to an unhandled condition of Severity 2 or higher, then Language Environment will terminate as if TERMTHDACT(QUIET) was specified.

Note: For software-raised conditions or signals, UAIMM behaves the same as UAONLY.

CESE Specifies that Language Environment dump output will be written to the CESE QUEUE as it has always been.

CICSDDS
Specifies that Language Environment dump output will be written to the new CICS transaction dump that contains both CICS and CEEDUMP data.

reg_stor_amount
Controls the amount of storage to be dumped around registers. This amount can be in the range from 0 to 256 bytes. The amount specified will be rounded up to the nearest multiple of 32. The default amount is 96 bytes.

CICS consideration

- The default under CICS is TERMTHDACT=(TRACE,CESE,96).
- All TERMTHDACT output is written to the data queue based on the setting of CESE or CICSDDS.

Table 14 on page 85 for help in understanding the results of the different options that are available.

Table 14. Condition Handling of 0Cx ABENDS

Options	**TERMTHDACT(option,CESE,)**	**TERMTHDACT(option,CICSDDS,)**
QUIET	• No output. • ASRA or user ABEND issued.	• No output. • ASRA or user ABEND issued.
MSG	• Message written to CESE queue or MSGFILE. • ASRA or user ABEND issued.	• Message written to CESE queue or MSGFILE. • ASRA or user ABEND issued.
TRACE	• Message written to CESE queue. • Traceback written to CESE queue. • ASRA or user ABEND issued.	• Message written to CESE or MSGFILE. • Traceback included in CICS transaction dump for this ABEND. • ASRA or user ABEND issued.
DUMP	• Message written to CESE queue. • Traceback written to CESE queue. • CEEDUMP to CESE queue. • ASRA or user ABEND issued.	• Invalid sub-option combination. Not supported.
UATRACE	• Message written to CESE queue. • Traceback included in CICS transaction dump for this ABEND. • U4039 transaction dump in CICS dump data set. • ASRA or user ABEND issued.	• Message written to CESE queue. • Traceback written to CESE queue. • U4039 transaction dump in CICS dump data set. • ASRA or user ABEND issued.
UADUMP	• Message written to CESE queue. • Traceback written to CESE queue. • CEEDUMP written to CESE queue. • U4039 transaction dump in CICS dump data set. • ASRA or user ABEND issued.	• Invalid sub-option combination. Not supported.
UAONLY	• U4039 transaction dump in CICS dump data set.	• No changes in behavior for CICSDDS.
UAIMM	• U4039 transaction dump in CICS dump data set.	• No changes in behavior for CICSDDS.

Note: Program checks end in ASRx (most commonly ASRA) CICS abend with a CICS dump in the dump data set. Abends end with the abend code provided on the EXEC CICS ABEND command with a CICS dump in the dump data set if the NODUMP option was NOT specified.

Table 15. Handling of Software Raised Conditions

Options	**TERMTHDACT(option,CESE,)**	**TERMTHDACT(option,CICSDDS,)**
QUIET	• No output. • U4038 abend issued with CANCEL and NODUMP options.	• No output. • U4038 abend issued with CANCEL and NODUMP options.
MSG	• Message written to CESE queue or MSGFILE. • U4038 abend issued.	• Message written to CESE queue or MSGFILE. • U4038 abend issued.
TRACE	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • U4038 abend issued.	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • U4038 abend issued.

TERMTHDACT

Table 15. Handling of Software Raised Conditions (continued)

Options	**TERMTHDACT(option,CESE,)**	**TERMTHDACT(option,CICSDDS,)**
DUMP	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • CEEDUMP written to CESE queue. • U4038 abend issued.	• Invalide sub-option combination. Not supported.
UATRACE	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • U4039 transaction dump in CICS dump data set. • U4038 abend issued.	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • U4039 transaction dump in CICS dump data set. • U4038 abend issued.
UADUMP	• Message written to CESE queue or MSGFILE. • Traceback written to CESE queue. • CEEDUMP written to CESE queue. • U4039 transaction dump in CICS dump data set. • U4038 abend issued.	• Invalid sub-option combination. Not supported.
UAONLY	• U4039 transaction dump in CICS dump data set. • U4038 abend issued.	• No changes in behavior for CICSDDS.
UAIMM	• U4039 transaction dump in CICS dump data set. • U4038 abend issued.	• Invalid sub-option combination. Not supported.

Note:

- CICS will be told about software raised erro conditions for DUMP and TRACE.
- When assembling a CEECOPT, CEEROPT, or CEEUOPT, the CICSDDS option cannot be issued with DUMP, or UADUMP. Doing this results in a RC=8 and the following message from CEEXOPT is issued and the setting is forced to TRACE:

```
8,The TERMTHDACT level setting of DUMP
8,conflicts with the CICSDDS suboption.
8,A level of TRACE or less must be used with CICSDDS.
8,The TERMTHDACT level suboption
8,was set to TRACE.
```

- Language Environment will request a CICS transaction dump via the U4039 abend.
- See *z/OS Language Environment Run-Time Messages* for more complete details regarding the U4039 abend.
- Running with something like TERMTHDACT(TRACE,CICSDDS) in the CEECOPT or CEEROPT and then creating a CEEUOPT without specifying the second operand (for example, TERMTHDACT(DUMP)) results in the CICS dump data set as the output destination and the following message occurs in the CESE queue:

```
CEE3627I The following messages pertain to the programmer default
run-time options.
CEE3775W A conflict was detected between the TERMTHDACT suboptions
CICSDDS and DUMP.
The TERMTHDACT level setting has been set to TRACE.
```

and the traceback is written to the CICS transaction dump data set.

Usage notes

- A run-time options report will be generated and placed at the end of the enclave information whenever the TRACE, UATRACE, DUMP and UADUMP options are invoked.
- PL/I considerations—After a normal return from a PL/I ERROR ON-unit or from a PL/I FINISH ON-unit, Language Environment considers the condition unhandled. If a GOTO is not performed and the resume cursor is not moved, the thread terminates. The TERMTHDACT setting guides the amount of information that is produced. The message is not presented twice.
- PL/I MTF considerations—TERMTHDACT applies to a task when the task terminates abnormally due to an unhandled condition of severity 2 or higher that is percolated beyond the initial routine's stack frame. All active subtasks created from the incurring task also terminate abnormally, but the enclave can continue to run.
- z/OS UNIX consideration—The TERMTHDACT option applies when a thread terminates abnormally. Abnormal termination of a single thread causes termination of the entire enclave. If an unhandled condition of severity 2 or higher percolates beyond the first routine's stack frame, the enclave terminates abnormally.

  If an enclave terminates due to a POSIX default signal action, TERMTHDACT applies only to conditions that result from program checks or abends.

  If running under an z/OS UNIX shell and Language Environment generates a system dump, a core dump is generated to a file based on the kernel environment variable, _BPXKDUMP.
- _CEE_DMPTARG

  The environment variable _CEE_DMPTARG will be used to allow a sysout class for a dynamically allocated CEEDUMP.

  You can set the _CEE_DMPTARG value string from an z/OS UNIX shell by:

  using the export command
  using the C functions setenv() or putenv()
  using the ENVAR run-time option.

  Format of the environment variable is:

  _CEE_DMPTARG=value

  where value is a null-terminated character string defined as one of the following values:

  SYSOUT(x)—where x defines a sysout class that Language Environment will set dynamically allocating the CEEDUMP.
  For example you could specify: _CEE_DMPTARG=SYSOUT(A)

  To set the _CEE_DMPTARG value from an z/OS UNIX shell, you could issue the export command and specify the following run-options, for example:

  ```
  export _CEE_DMPTARG=SYSOUT(A).
  ```

WHEN _CEE_DMPTARG is not set, then the sysout class will default to SYSOUT(*) for the dynamically allocated CEEDUMP. If the dynamic allocation for the specified SYSOUT class specified by _CEE_DMPTARG should fail, the default, SYSOUT(*) will be used.

For more information

- See “TRACE” on page 94, for more information about the TRACE run-time option.
- For more information about the CEE3DMP service and its parameters, see “CEE3DMP—Generate dump” on page 129.
- See *z/OS Language Environment Programming Guide* for more information about the TERMTHDACT run-time option and condition message.
- For More Information about CESE, see *z/OS Language Environment Programming Guide*.

TEST | NOTEST

TEST specifies the conditions under which a debug tool (such as the Debug Tool supplied with z/OS) assumes control when the user application is being initialized. Parameters of the TEST and NOTEST run-time options are merged as one set of parameters.

Non-CICS default: NOTEST(ALL,*,PROMPT,INSPPREF)

Syntax

```
                   ┌─ALL───────┐                          ┌─PROMPT───────┐
►►──┬─NOTest─┬──(─┼───────────┼──,──┬─────────────────┬──,─┼──────────────┼──,──────►
   └─TESt───┘    ├─ERROR──────┤     ├─commands_file───┤    ├─NOPROMPT────┤
                 └─NONE───────┘     └─*───────────────┘    ├─*───────────┤
                                                           ├─;───────────┤
                                                           └─command─────┘

►──┬──────────────────────┬──)──────────────────────────────────────────────────►◄
   ├─preference_file──────┤
   └─*────────────────────┘
```

ALL Specifies that any of the following causes the debug tool to gain control even without a defined AT OCCURRENCE for a particular condition or AT TERMINATION:
- The ATTENTION function
- Any Language Environment condition of severity 1 or above
- Application termination

ERROR
Specifies that only one of the following causes the debug tool to gain control without a defined AT OCCURRENCE for a particular condition or AT TERMINATION:
- The ATTENTION function
- Any Language Environment-defined error condition of severity 2 or higher
- Application termination

NONE Specifies that no condition causes the debug tool to gain control without a defined AT OCCURRENCE for a particular condition or AT TERMINATION.

commands_file
A valid *ddname*, data set name (MVS), or file name (CMS), specifying the primary commands file for this run. If you do not specify this parameter all requests for commands go to the user terminal.

You can enclose *commands_file* in single or double quotes to distinguish it from the rest of the TEST | NOTEST suboption list. It can have a maximum length of 80 characters. If the data set name provided could be interpreted as a ddname, it must be preceded by a slash (/). The slash and data set name must be enclosed in quotes.

A primary commands file is required when running in a batch environment.

***** (asterisk—in place of *commands_file*)
Specifies that no *commands_file* is supplied. The terminal, if available, is used as the source of the debug tool commands.

PROMPT
Specifies that the debug tool is invoked at Language Environment initialization.

NOPROMPT
Specifies that the debug tool is not invoked at Language Environment initialization.

***** (asterisk—in place of PROMPT/NOPROMPT)
Specifies that the debug tool is not invoked at Language Environment initialization; equivalent to NOPROMPT.

; (semicolon—in place of PROMPT/NOPROMPT)
Specifies that the debug tool is invoked at Language Environment initialization; equivalent to PROMPT.

command
A character string that specifies a valid debug tool command. The command list can be enclosed in single or double quotes to distinguish it from the rest of the TEST parameter list; it cannot contain DBCS characters. Quotes are needed whenever the command list contains embedded blanks, commas, semicolons, or parentheses. The list can have a maximum of 250 characters.

preference_file
A valid *ddname*, data set name (MVS), or file name (CMS), specifying the preference file to be used. A preference file is a type of commands file that you can use to specify settings for your debugging environment. It is analogous to creating a profile for a text editor, or initializing a terminal session.

You can enclose *preference_file* in single or double quotes to distinguish it from the rest of the TEST parameter list. It can have a maximum of 80 characters.

If a specified data set name could be interpreted as a *ddname*, it must be preceded by a slash (/). The slash and data set name must be enclosed in quotes.

The IBM-supplied default setting for *preference_file* is INSPPREF.

***** (asterisk—in place of *preference_file*)
Specifies that no *preference_file* is supplied.

CICS consideration

- The default under CICS is NOTEST=(ALL,*,PROMPT,INSPPREF).

Usage notes

- You can specify parameters on the NOTEST option. If NOTEST is in effect when the application gains control, it is interpreted as TEST(NONE,,*,). If Debug Tool is initialized using a CALL CEETEST or equivalent, the initial test level, the initial *commands_file*, and the initial *preference_file* are taken from the NOTEST run-time option setting.
- z/OS UNIX consideration—Language Environment honors the initial command string before the main routine runs on the initial thread.

  The test level (ALL, ERROR, NONE) applies to the enclave.

  Language Environment honors the preference file when the debug tool is initialized, regardless of which thread first requests the debug tool services.

Performance consideration

To improve performance, use this option only while debugging.

For more information

- See *Debug Tool User's Guide and Reference* for details and for examples of the TEST run-time option as it relates to Debug Tool.

THREADHEAP

Derivation

THREAD level HEAP storage

THREADHEAP controls the allocation and management of thread-level heap storage. Separate heap segments are allocated and freed for each thread based on the THREADHEAP specification.

For PL/I MTF applications, controlled and based variables declared in a subtask are allocated from heap storage specified by THREADHEAP. Variables in the main task are allocated from heap storage specified by HEAP.

Library use of heap storage in a substack is allocated from the enclave-level heap storage specified by the ANYHEAP and BELOWHEAP options.

Non-CICS default: THREADHEAP(4K,4K,ANY,KEEP)

Syntax

```
►►─THREADHeap─(─┬──────────┬─,─┬──────────┬─,─┬─ANYWHERE─┬─,──►
                └init_size─┘   └incr_size─┘   ├─ANY──────┤
                                              └─BELOW────┘

►─┬─KEEP─┬─)──────────────────────────────────────────────────►◄
  └─FREE─┘
```

init_size
The minimum initial size of thread heap storage, and is specified in n, nK, or nM. Storage is acquired in multiples of 8 bytes.

A value of zero (0) causes an allocation of 4K.

incr_size
The minimum size of any subsequent increment to the noninitial heap storage is specified in n, nK, or nM. The actual amount of allocated storage is the larger of two values, *incr_size* or the requested size, rounded up to the nearest multiple of 8 bytes.

If you specify *incr_size* as 0, only the amount of the storage needed at the time of the request (rounded up to the nearest 8 bytes) is obtained.

ANYWHERE|ANY
Specifies that the heap storage can be allocated anywhere in storage. If there is no available storage above the line, storage is acquired below the 16 MB line.

The only valid abbreviation of ANYWHERE is ANY.

BELOW
Specifies that the heap storage must be allocated below the 16M line.

KEEP Specifies that storage allocated to THREADHEAP increments is not released when the last of the storage in the thread heap increment is freed.

FREE Specifies that storage allocated to THREADHEAP increments is released when the last of the storage in the thread heap increment is freed.

CICS consideration

- THREADHEAP is ignored under CICS.
- Even though this option is ignored under CICS, the default increment size under CICS has changed from 4K (4096 bytes) to 4080 bytes, to accommodate the 16 bytes CICS storage check zone.

Usage notes

- If the requesting routine is running in 24-bit addressing mode and THREADHEAP(,,ANY,) is in effect, THREADHEAP storage is allocated below the 16M line based upon the HEAP(,,,,initsz24,incrsz24) settings.
- PL/I MTF considerations—The thread-level heap is allocated only in applications that use the PL/I MTF. For PL/I MTF applications, controlled and based variables specified in subtasks are located in the thread-level heap.

  If the main program is running in 24-bit addressing mode and THREADHEAP(,,ANY,) is in effect, heap storage is allocated below the 16M line. The only case in which storage is allocated above the line is when all of the following conditions exist:
  – The user routine requesting the storage is running in 31-bit addressing mode.
  – HEAP(,,ANY,,,) is in effect.
  – The main routine is running in 31-bit addressing mode.
- When running PL/I with POSIX(ON) in effect, THREADHEAP is used for allocating heap storage for PL/I base variables declared in non-IPTs. Storage allocated to all THREADHEAP segments is freed when the thread terminates.
- THREADHEAP(4K,4K,ANYWHERE,KEEP) provides behavior compatible with the PL/I TASKHEAP option.
- The initial thread heap segment is never released until the thread terminates.
- THREADHEAP has no effect on C/C++ or Fortran for z/OS MTF applications.

THREADSTACK

Derivation

THREAD level STACK storage

THREADSTACK controls the allocation of the thread's stack storage for both the upward and downward-growing stacks, except the initial thread in a multi-threaded application.

If the thread attribute object does not provide an explicit stack size, then the allocation values can be inherited from the STACK option or specified explicitly on the THREADSTACK option.

Non-CICS default: THREADSTACK(OFF,4K,4K,ANYWHERE,KEEP,128K,128K)

Syntax

```
►►──THREADSTack──(──┬─OFF─┬──,──┬──────────────┬──,──┬──────────────┬──,──────►
                    └─ON──┘     └usinit_size────┘     └usincr_size───┘

►──┬─ANYWHERE─┬──,──┬─KEEP─┬──,──┬──────────────┬──,──┬──────────────┬──)──────►◄
   ├─ANY──────┤     └─FREE─┘     └dsinit_size───┘     └dsincr_size───┘
   └─BELOW────┘
```

OFF Indicates that the allocation suboptions of the STACK run-time option are used for thread stack allocation. Any other suboption specified with THREADSTACK is ignored.

ON Controls the stack allocation for each thread, except the initial thread, in a multithread environment.

usinit_size
Determines the size of the initial upward-growing stack segment. The storage is contiguous. You specify the *usinit_size* value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

usinit_size can be preceded by a minus sign. In environments other than CICS, if you specify a negative number Language Environment uses all available storage minus the amount specified for the initial stack segment.

A size of "0" or "−0" requests half of the largest block of contiguous storage in the region below the 16 MB line.

usincr_size
Determines the minimum size of any subsequent increment to the upward-growing stack area. You can specify this value as *n*, *n*K, or *n*M bytes of storage. The actual amount of allocated storage is the larger of two values— *usincr_size* or the requested size—rounded up to the nearest multiple of 8 bytes

If you specify *usincr_size* as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 8 bytes, is obtained.

The requested size is the amount of storage a routine needs for a stack frame. For example, if the requested size is 9000 bytes, *usincr_size* is specified as 8K, and the initial stack segment is full, Language Environment gets a 9000 byte stack increment from the operating system to satisfy the request. If the requested size is smaller than 8K, Language Environment gets an 8K stack increment from the operating system.

ANYWHERE | ANY
Specifies that stack storage can be allocated anywhere in storage. On systems that support bimodal addressing, storage can be allocated either above or below the 16M line. If there is no storage available above the line, Language Environment acquires storage below the line. On systems that do not support bimodal addressing (for example, when VM/ESA is initial program loaded in 370 mode) Language Environment ignores this option and places the stack storage below 16M.

BELOW
Specifies that the stack storage must be allocated below the 16M line in storage that is accessiable to 24–bit addressing.

KEEP Specifies that storage allocated to stack increments is not released when the last of the storage in the stack increment is freed.

FREE Specifies that storage allocated to stack increments is released when the last of the storage in the stack is freed. The initial stack segment is never released until the enclave terminates.

dsinit_size
Determines the size of the initial downward-growing stack segment. The storage is contiguous. You specify the init_size value as n, nK, or nM bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 16 bytes.

dsincr_size
Determines the minimum size of any subsequent increment to the downward-growing stack area. You can specify this value as n, nK, or nM bytes of storage. The actual amount of allocated storage is the larger of two values-- incr_size or the requested size--rounded up to the nearest multiple of 16 bytes.

CICS consideration

- THREADSTACK is ignored under CICS.

Usage notes

- The *dsinit_size* and *dsincr_size* values are the amounts of storage that can be used for downward-growing stack frames (plus the stack header, approximately 20 bytes). The actual size of the storage getmained will be 4K (8K if a 4K page alignment cannot be guaranteed) larger to accommodate the guard page.
- The downward-growing stack is only initialized in a XPLINK supported environment, that is, batch, TSO, z/OS UNIX, and only when a XPLINK application is active in the enclave. Otherwise the suboptions for the downward-growing stack are ignored.
- All storage allocated to THREADSTACK segments are freed when the thread terminates.
- The initial stack segment of the thread is never released until the thread terminates, regardless of the KEEP/FREE state.
- You can specify sub-options with THREADSTACK(OFF,...), but they are ignored. If you override the THREADSTACK(OFF,...) suboption with THREADSTACK(ON)

and you omit suboptions, then the suboptions you specified with THREADSTACK(OFF,...) remain in effect. If you respecify THREADSTACK(OFF,...) with different suboptions, they override the defaults.

- PL/I MTF consideration—THREADSTACK(ON,4K, 4K, BELOW, KEEP,,) provides PL/I compatibility for stack storage allocation and management for each subtask in the application.
- PL/I considerations—For multitasking or multithreaded environments, the stack size for a subtask or non-Initial Process Thread (non-IPT) is taken from the THREADSTACK option unless THREADSTACK(OFF) is specified. THREADSTACK(OFF) specifies that the values in the STACK option be used.
- In the multithreaded environment, you can explicitly specify the stack size in the thread attribute object; it will be used instead of the value specified with THREADSTACK or STACK.
- The THREADSTACK option replaces the **NONIPTSTACK** and **NONONIPTSTACK** options.

TRACE

TRACE controls run-time library tracing activity, the size of the in-storage trace table, the type of trace events to record, and it determines whether a dump containing, at a minimum, the trace table should be unconditionally taken when the application terminates. When you specify TRACE(ON), user-requested trace entries are intermixed with Language Environment trace entries in the trace table.

Under normal termination conditions, if TRACE is active and you specify DUMP, only the trace table is written to the dump report, independent of the TERMTHDACT setting. Only one dump is taken for each termination. Under abnormal termination conditions, the type of dump taken (if one is taken) depends on the value of the TERMTHDACT run-time option and whether TRACE is active and the DUMP suboption is specified.

Non-CICS default: TRACE(OFF,4K,DUMP,LE=0)

Syntax

```
                   ┌OFF┐                          ┌DUMP───┐        ┌LE=0──┐
►►──TRACe──(──┬────┼───┼──,──┬──────────────┼──,──┼───────┼──,──┼──────┼──)──────►◄
              └ON───┘          └table_size────┘        └NODUMP─┘        ├LE=1──┤
                                                                        ├LE=2──┤
                                                                        └LE=3──┘
```

OFF Indicates that the tracing facility is inactive.

ON Indicates that the tracing facility is active.

table_size
Determines the size of the tracing table as specified in bytes (*n*K or *n*M). The upper limit is 16M.

DUMP Requests that a Language Environment-formatted dump (containing the trace table) be taken at program termination regardless of the setting of the TERMTHDACT run-time option.

NODUMP
Requests that a Language Environment-formatted dump not be taken at program termination.

LE=0 Specifies that no trace events be recorded.

LE=1 Specifies that entry to and exit from Language Environment member libraries be recorded (such as, in the case of C, entry and exit of the `printf()` library function).

LE=2 Specifies that mutex init/destroy and locks/unlocks from Language Environment member libraries be recorded.

LE=3 Activates both the entry/exit trace and the mutex trace.

CICS consideration

- The default under CICS is TRACE=(OFF,4K,DUMP,LE=0).

Usage notes

- PL/I MTF consideration—The TRACE(ON,,,LE=2) setting provides the following trace table entries for PL/I MTF support:
  - Trace entry 100 occurs when a task is created.
  - Trace entry 101 occurs when a task that contains the tasking CALL statements is terminated.
  - Trace entry 102 occurs when a task that does not contain the tasking CALL statements is terminated.
- When running PL/I with POSIX(ON) in effect, no PL/I-specific trace information is provided.

COBOL does not provide any Trace Table Entries.

For more information

- For more information about the dump contents, see “TERMTHDACT” on page 81.
- For more information about using the tracing facility, see *z/OS Language Environment Debugging Guide*.

TRAP

TRAP specifies how Language Environment programs handle abends and program interrupts.

TRAP(ON) must be in effect for the ABTERMENC run-time option to have effect.

This option is similar to the STAE | NOSTAE run-time option currently offered by COBOL, C, and PL/I, and the SPIE | NOSPIE option offered by C and PL/I:

Table 16. TRAP Run-Time Option Settings

If...	then...
a single option is specified in input,	TRAP is set according to that option, TRAP(OFF) for NOSTAE or NOSPIE, TRAP(ON) for STAE or SPIE.
both options are specified in input,	TRAP is set ON unless both options are negative. TRAP is set OFF if both options are negative.
STAE is specified in one `#pragma runopts` statement, and NOSPIE in another,	the option in the last `#pragma runopts` determines the setting of TRAP.

Table 16. TRAP Run-Time Option Settings (continued)

If...	then...
multiple instances of STAE | NOSTAE are specified,	TRAP is set according to the last instance only. All others are ignored.
multiple instances of SPIE | NOSPIE are specified,	TRAP is set according to the last instance only. All others are ignored.
an options string has TRAP(ON) or TRAP(OFF) together with SPIE | NOSPIE, and/or STAE | NOSTAE,	the TRAP setting takes preference over all others.

CEESGL is unaffected by this option.

Non-CICS default: TRAP(ON,SPIE)

Syntax

```
                  ┌─ON──┐       ┌─SPIE───┐
►►──TRAP──(──┬────┼──,──┬───────┼──)──────────────────────────►◄
             └─OFF─┘       └─NOSPIE─┘
```

ON Fully enables the Language Environment condition handler.

OFF Prevents language condition handlers or handlers registered by CEEHDLR from being notified of abends or program checks; prevents application of POSIX signal handling semantics for abends and program checks.

SPIE SPIE specifies that Language Environment issue an ESPIE macro to handle program interrupts. The SPIE sub-option is ignored when specified with the OFF sub-option.

NOSPIE
NOSPIE specifies that Language Environment will NOT issue the ESPIE macro. When you specify the ON sub-option, Language Environment will handle program interrupts and abends via an ESTAE. The NOSPIE sub-option is ignored when specified with the OFF sub-option.

Due to the restrictions and side-effects when running TRAP(OFF) stated in the usage notes below, IBM highly recommends running TRAP(ON,SPIE) in all environments.

CICS consideration

- The default under CICS is TRAP=(ON,SPIE).
- Since Language Environment never sets a SPIE or STAE, the SPIE|NOSPIE sub-option is ignored on CICS.

Usage notes

- Use TRAP(OFF) only when you need to analyze a program exception before Language Environment handles it.
- When you specify TRAP(OFF) in a non-CICS environment, an ESPIE is not issued, but an ESTAE is issued. Language Environment does not handle conditions raised by program interrupts or abends initiated by SVC 13 as Language Environment conditions, and does not print messages for such conditions.

- Running with TRAP(OFF) (for exception diagnosis purposes) can cause many side effects, because Language Environment uses condition handling internally and requires TRAP(ON). When you run with TRAP(OFF), you can get side effects even if you do not encounter a software-raised condition, program check, or abend. If you do encounter a program check or an abend with TRAP(OFF) in effect, the following side effects can occur:
  - The ABTERMENC run-time option has no effect.
  - The ABPERC run-time option has no effect.
  - Resources acquired by Language Environment are not freed.
  - Files opened by HLLs are not closed by Language Environment, so records might be lost.
  - The abnormal termination exit is not driven for enclave termination.
  - The assembler user exit is not driven for enclave termination.
  - User condition handlers are not enabled.
  - The debugger is not notified of the error.
  - No storage report or run-time options report is generated.
  - No Language Environment messages or Language Environment dump output is generated.
  - In z/OS UNIX, POSIX signal handling semantics are not enabled for the abend.
  - The enclave terminates abnormally if such conditions are raised.
  - The COBOL ON SIZE error clause may be disabled for COMPUTE statements.
- TRAP(ON) must be in effect when you use the CEEBXITA assembler user exit for enclave initialization to specify a list of abend codes that Language Environment percolates.
- C++ consideration—TRAP(ON) must be in effect in order for the z/OS C++ `try`/`throw`/`catch` condition handling mechanisms to work.
- When TRAP(ON) is in effect, and the abend code is in the CEEAUE_CODES list in CEEBXITA, Language Environment percolates the abend. Normal Language Environment condition handling is never invoked to handle these abends. This feature is useful when you do not want Language Environment condition handling to intervene for certain abends or when you want to prevent invocation of the abnormal termination exit for certain abends, such as when IMS issues a user ABEND code 777.
- When TRAP(ON,NOSPIE) is specified in a non-CICS environment, Language Environment will handle program interrupts and abends via an ESTAE. This feature is useful when you do not want Language Environment to issue an ESPIE macro.

  When TRAP(OFF), (TRAP(OFF,SPIE) or TRAP(OFF,NOSPIE) is specified and there is a program interrupt, the user exit for termination is not driven.
- z/OS UNIX consideration—The TRAP option applies to the entire enclave and all threads within.

For more information

- See “ABTERMENC” on page 13 for more information about the ABTERMENC run-time option.
- See “CEESGL—Signal a condition” on page 450 for more information about the CEESGL callable service.
- For more information about the CEEHDLR callable service, see “CEEHDLR—Register User-written condition handler” on page 326.

- See *z/OS Language Environment Programming Guide*, for more information about the CEEBXITA assembler user exit.

UPSI (COBOL only)

Derivation
User Programmable Status Indicator

UPSI sets the eight UPSI switches on or off for applications that use COBOL programs.

Non-CICS default: UPSI(00000000)

Syntax

```
►►──UPSI──(──┬──────────┬──)──────────────────────────────────────►◄
             └─nnnnnnnn─┘
```

nnnnnnnn
n represents one UPSI switch between 0 and 7, the leftmost *n* representing the first switch. Each *n* can either be 0 (off) or 1 (on).

CICS consideration

- The default under CICS is UPSI=(00000000).

Usage notes

- Specify this option in CEEDOPT(CEECOPT), CEEROPT or CEEUOPT with a string of eight binary flags; for example: UPSI(00000000). Use UPSI, not followed by a string, only on the command line.

For more information

- For more information on how COBOL programs access the UPSI switches, see *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide*.

USRHDLR | NOUSRHDLR

Derivation
USeR condition HanDLeR

USRHDLR registers a user condition handler at stack frame 0, allowing you to register a user condition handler without having to include a call to CEEHDLR in your application and then recompile the application.

Non-CICS default: NOUSRHDLR

Syntax

```
      ┌─NOUsrhdlr─┐
►►────┴─USrhdlr───┴──(──┬──────────┬──,──┬──────────┬──)──────────────────────►◄
                        └─lmname───┘     └─lmname2──┘
```

NOUSRHDLR
Does not register a user condition handler without recompiling an application to include a call to CEEHDLR.

USRHDLR
Registers a user condition handler without recompiling an application to include a call to CEEHDLR.

lmname
The name of a load module (or an alias name of a load module) that contains the user condition handler that is to be registered at stack frame 0.

lmname2
The name of a load module (or an alias name of a load module) that contains the user condition handler that is to be registered to get control after the enablement phase and before any other user condition handler.

CICS consideration

- The default under CICS is NOUSRHDLR=()
- When specifying USRHDLR under CICS, *lmname* and *lmname2* must be defined in the CICS PPT.

Usage notes

- **Restriction:** If user condition handler *lmname* is in effect, it is unsupported to resume execution in the program in which the condition occurs. This includes calls in the condition handler to CEEMRCR and CEEMRCE. This restriction does not apply to user condition handler *lmname2*.
- The user condition handler specified by the USRHDLR run-time option must be in a separate load module rather than be link-edited with the rest of the application.
- The user condition handler *lmname* is invoked for conditions that are still unhandled after being presented to condition handlers for the main program.
- The user condition handler *lmname2* is invoked for each condition after the condition completes the enablement phase but before any other registered user condition handler is given control.
- You can use a user condition handler registered with the USRHDLR run-time option to return any of the result codes allowed for a user condition handler registered with the CEEHDLR callable service.
- A condition that is percolated or promoted by a user condition handler registered to handle conditions at stack frame 0 using the USRHDLR run-time option is not presented to any other user condition handler.
- The loading of the user condition handlers *lmname* and *lmname2* occurs only when that user condition handler needs to be invoked the first time.
- If the load of either *lmname* or *lmname2* fails, an error message is issued.

- Modules specified as user handlers that contain one of the fenced languages for the environment will cause a condition to be signaled on the z/OS.e operatin system. The condition token is CEE38V.

For more information

- For information on registering a user condition handler and its interfaces, see “CEEHDLR—Register User-written condition handler” on page 326.

VCTRSAVE

Derivation
VeCToR environment to be SAVEd

VCTRSAVE specifies whether any language in the application uses the vector facility when user-written condition handlers are called.

Non-CICS default: VCTRSAVE(OFF)

Syntax

```
                  ┌OFF┐
►►─Vctrsave─(─────┼───┼─)──────────────────────────────────────►◄
                  └ON─┘
```

OFF No language in the application uses the vector facility when user-provided condition handlers are called.

ON A language in the application uses the vector facility when user-provided condition handlers are called.

CICS consideration

- VCTRSAVE is ignored under CICS.

Usage notes

- z/OS UNIX consideration—The VCTRSAVE option applies to the entire enclave and all threads within the enclave.

Performance consideration

When a condition handler plans to use the vector facility (that is, run any vector instructions), the entire vector environment has to be saved on every condition and restored on return to the application code. You can avoid this extra work by specifying VCTRSAVE(OFF) when you are not running an application under vector hardware.

VERSION

The VERSION option specifies the version of the RTLS logical library used for finding RTLS version-controlled modules. If the VERSION is specified, it must be defined as a version of the logical library in the CSVRTLxx PARMLIB member.

Non-CICS default: VERSION(’’)

Syntax

```
►►──VERSion──(──┬──────────┬──)──────────────────────────────────►◄
                └─ver_name─┘
```

ver_name

The VERSION name must be a string from 1 to 8 characters long. The only valid characters are A-Z, 0-9, #, $, @, ., -, +, or _ . The code points for the variant characters (#, $, and @) are assumed to be in code pages 01047 or 00037.

If this option is not specified, the default version of the logical library is used. This default version is defined in the CSVRTLxx PARMLIB member.

CICS consideration

- VERSION is ignored under CICS.

Usage notes

- This option is ignored when RTLS(OFF) is in effect.
- If CEEGINIT is not available in the LNKLST, LPA, JOBLIB, STEPLIB, or TASKLIB when the Language Environment is invoked, the VERSION option has no effect. RTLS will not be used, but the VERSION option value will appear in the options report.

For more information

- See “LIBRARY” on page 41 and “RTLS” on page 74.

XPLINK

Derivation

eXtra Performance LINKage

The XPLINK run-time option controls the initialization of the XPLINK environment. XPLINK resources such as the downward-growing stack and the XPLINK C/C++ Run Time Library are committed only when it is known that an XPLINK program will receive control. If the initial program in the enclave contains at least one function that was compiled using XPLINK conventions, then XPLINK resources will be committed during Language Environment initialization as if XPLINK(ON) had been specified. If the initial program is purely non-XPLINK, then no XPLINK resources will be committed. If it is known that an XPLINK function will be called at some point during the execution of the application, (for example, by calling a DLL function that has been compiled XPLINK), then XPLINK(ON) must be specified so the necessary XPLINK resources are available.

You cannot set XPLINK during Language Environment installation (CEEDOPT/CEEROPT) or from the CEEBXITA Assembler User Exit Interface. You can only specify XPLINK on application invocation (command line interface or _CEE_RUNOPTS environment variable), or as an application default (CEEUOPT, C/C++ #pragma runopts, or PLIXOPT).

Non-CICS default: XPLINK(OFF)

Syntax

```
                  ┌─OFF─┐
►►──XPLink──(──┼─────┼──)──────────────────────────────────────────►◄
                  └─ON──┘
```

OFF Specifies that no programs containing XPLINK-compiled functions will be run. XPLINK resources will not be committed.

ON Specifies that at some time during the execution of an application, an XPLINK-compiled function may be called. XPLINK resources will be committed so that when this occurs, the XPLINK function can properly execute.

Usage notes

The XPLINK(ON) run-time option is provided for application compatibility. It should be specified only for applications that:

- have a non-XPLINK main(),
- use XPLINK resources during their execution (for example, calls to an XPLINK function in a DLL), and have been tested to run in an XPLINK environment (that is, they don't use any resources or subsystems that are restricted in an XPLINK environment) Blindly running a non-XPLINK application in an XPLINK environment by specifying the XPLINK(ON) run-time option could result in performance degration or application abends.

For these reasons, the XPLINK(ON) application should only be specified for individual applications that require it. That is why you cannot set XPLINK(ON) as the installation default (eg. in CEEDOPT), and why you should not export_CEE_RUNOPTS from the UNIX System Services shell containing the XPLINK(ON) run-time option.

- If the XPLINK run-time option is not specified and the initial program contains at least one XPLINK-compiled part, then the XPLINK run-time option will be forced to (ON). No message will be issued to indicate this action.
- When an application is running in an XPLINK environment (that is, either the XPLINK(ON) run-time option was specified, or the initial program contained at least one XPLINK compiled part), the ALL31 run-time option will be forced to ON. No AMODE 24 routines are allowed in an enclave that uses XPLINK. No message will be issued to indicate this action. If a Language Environment run-time options report is generated using the RPTOPTS run-time option, the ALL31 option will be reported as ″Override″ under the LAST WHERE SET column.
- When an application is running in an XPLINK environment (that is, either the XPLINK(ON) run-time option was specified, or the initial program contained at least one XPLINK compiled part), the STACK run-time option will be forced to STACK(,,ANY). Only the third suboption is changed by this action to indicate that STACK storage can be allocated anywhere in storage. No message will be issued to indicate this action. If a Language Environment run-time options report is generated using the RPTOPTS run-time option, the STACK option will be reported as ″Override″ under the LAST WHERE SET column.

Performance Considerations:

- When XPLINK(ON) is in affect, resources required for the execution of an XPLINK-compiled function are committed. This includes, for example, allocation of a downward-growing stack segment. If no XPLINK functions are invoked, then these are resources that are not available to an XPLINK function.
- If the application contains C or C ++ and XPLINK(ON) is specified, then the XPLINK-compiled version of the C Run-Time Library is loaded, which will run on the downward-growing stack. When non-XPLINK functions call C RTL functions in this environment, a swap from the upward-growing stack to the downward-growing stack will occur. This results in additional overhead that could cause performance degradation. Applications that make heavy use of the C RTL from non-XPLINK callers should be aware of this, and if necessary for performance reasons, either run in a pure non-XPLINK environment with XPLINK(OFF), or convert as much of the application to XPLINK as possible and run with XPLINK(ON).
- Applications that consist only of non-XPLINK functions (ex. COBOL, PL/I) should not specify the XPLINK(ON) run-time option, as just turning this on in these applications will result in a performance degradation.

XUFLOW

Derivation

eXponent Under FLOW

XUFLOW specifies whether an exponent underflow causes a program interrupt. An exponent underflow occurs when a floating point number becomes too small to be represented.

The underflow setting is determined at enclave initialization and is updated when new languages are introduced into the application (via fetch or dynamic call, for example). Otherwise, it does not vary while the application is running.

Language Environment preserves the language semantics for C/C++ and COBOL regardless of the XUFLOW setting. Language Environment preserves the language semantics for PL/I only when XUFLOW is set to AUTO or ON. Language Environment does not preserve the language semantics for PL/I when XUFLOW is set to OFF.

An exponent underflow caused by a C/C++ or COBOL program does not cause a condition to be raised.

Non-CICS default: XUFLOW(AUTO)

Syntax

```
►►──Xuflow──(──┬─AUTO─┬──)──────────────────────────────────────────►◄
               ├──────┤
               ├─ON───┤
               └─OFF──┘
```

AUTO An exponent underflow causes or does not cause a program interrupt

dynamically, based upon the HLLs that make up the application. Enablement is determined without user intervention.

XUFLOW(AUTO) causes condition management to process underflows only in those applications where the semantics of the application languages require it. Normally, XUFLOW(AUTO) provides the best efficiency while meeting language semantics.

ON An exponent underflow causes a program interrupt.

XUFLOW(ON) causes condition management to process underflows regardless of the mix of languages; therefore, this setting might be less efficient in applications that consist of languages not requiring underflows to be processed by condition management.

OFF An exponent underflow does not cause a program interrupt; the hardware takes care of the underflow.

When you set XUFLOW to OFF, the hardware processes exponent underflows. This is more efficient than condition handling to process the underflow.

CICS consideration

- The default under CICS is XUFLOW=(AUTO).

Usage notes

- PL/I consideration—When setting XUFLOW to OFF, be aware that the semantics of PL/I require the underflow to be signaled.
- z/OS UNIX consideration—The XUFLOW option applies to the entire enclave and all threads within.

Language run-time option mapping

Language Environment provides one set of run-time options for applications. These options are processed at the enclave level and allow you to control many aspects of the Language Environment environment.

Most options are applicable to all Language Environment-conforming languages. In addition, although Language Environment assists migration by mapping current HLL options to Language Environment's options, the run-time options of a particular HLL product might change in the Language Environment-enabled version. However, Language Environment has attempted to maintain run-time options consistently across language products while minimizing required changes within each product.

Tables of pre-Language Environment, HLL-specific options and their Language Environment equivalents are provided in the *z/OS Language Environment Run-Time Migration Guide*. The mapping is performed automatically by Language Environment except where noted.

Chapter 3. Language Environment callable services

This chapter provides syntax and examples of Language Environment callable services, which you can invoke from applications generated with the following IBM compiler products:

- IBM z/OS C/C++
- IBM OS/390 C/C++
- C/C++ for MVS/ESA
- IBM SAA AD/Cycle C/370
- Enterprise COBOL for z/OS and OS/390
- Enterprise PL/I for z/OS and OS/390
- IBM COBOL for OS/390 & VM
- IBM COBOL for MVS & VM
- IBM PL/I for MVS & VM
- VisualAge PL/I for OS/390

You can invoke Language Environment callable services from assembler programs using the CEEENTRY and associated macros. While you cannot call these services directly from Fortran programs, you can use the Fortran routines AFHCEEN and AFHCEEF to invoke most of these services. (See *Fortran Run-time Migration Guide.)* You can use the other languages to perform these services on behalf of a Fortran program.

Notes:

1. Customers using this book may not have pre-Language Environment run-time libraries.
2. You can use DYNAMIC calls from VS COBOL II programs to Language Environment Date/Time callable services. You can not use DYNAMIC calls from VS COBOL II programs to other Language Environment callable services. You can not use STATIC calls from VS COBOL II programs to any Language Environment callable services.
3. A Language Environment callable service used by application programmers can also be called an application writer interface (AWI).

Language Environment callable services provide functions that pre-Language Environment run-time libraries might not provide. You can use these services alone or with Language Environment run-time options, which customize your run-time environment.

For guidelines about writing your own callable services, see *z/OS Language Environment Programming Guide*.

Locating callable service information

This chapter contains the following sections to help you use the Language Environment callable services:

- “General usage notes for callable services” on page 106
- “Invoking callable services” on page 107
- “Data type definitions” on page 112
- “Callable services” on page 115

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NOTE

For a list of Language Environment callable services, see Chapter 1, “Language Environment quick reference tables” on page 1.

General usage notes for callable services

- You can invoke callable services from any Language Environment-conforming HLL except where otherwise noted.
- You might receive feedback codes from services other than the one you are invoking. This is because the callable services invoke other callable services that might return a feedback code.
- Callable services that are intended to be available on any platform that Language Environment supports are prefixed with CEE. Callable services defined only for S/370 are prefixed with CEE3.
- Routines that invoke callable services do not need to be in 31-bit addressing mode. 31-bit addressing mode switching is performed implicitly without any action required by the calling routine, if you specify the ALL31(OFF) run-time option (see “ALL31” on page 15).

  However, if AMODE switching occurs and your program makes many calls to Language Environment callable services, the switching time can slow down your application. Run with AMODE(31), if possible, to avoid unnecessary mode switching.
- Under Language Environment, all parms are passed by reference, indirectly. The code in Figure 5 and Figure 6 might cause unpredictable results:

```
CALL CEEDATE USING X,Y,Z.  **Invalid**
```

Figure 5. An Invalid COBOL CALL that Omits the fc Parameter

```
DCL CEEDATE ENTRY OPTIONS(ASM);
CALL CEEDATE(x,y,z);      /* invalid */
```

Figure 6. An Invalid PL/I CALL that Omits the fc Parameter

Figure 7 and Figure 8 on page 107 illustrate valid calls. The COBOL examples are valid only for COBOL for MVS & VM Release 2 or later.

```
CALL CEEDATE USING X,Y,Z,OMITTED.
CALL CEEDATE USING X,Y,Z,FC.
```

Figure 7. Valid COBOL CALLs that Use the Optional fc Parameter

```
DCL CEEDATE ENTRY(*,*,*,* OPTIONAL) OPTIONS(ASM);
CALL CEEDATE(x,y,z,*);    /* valid   */
CALL CEEDATE(x,y,z,fc);   /* valid   */
```

Figure 8. Valid PL/I CALLs that Use the Optional fc Parameter

Invoking callable services

You can invoke Language Environment callable services from assembler routines, HLL-generated object code, HLL library routines, other Language Environment library routines, and user-written HLL calls. When you want to access Language Environment library routines, you can use the same type of user-written HLL calls and functions you currently use for your HLL applications.

This section provides syntax and examples to help you request callable services from C/C++, COBOL, and PL/I.

Header, copy, or include files

Many of the programming examples in this chapter imbed header, copy, or include files. (Whether you call the files header files, copy files, or include files depends on the language you are using.) These files can save you time by providing declarations for symbolic feedback codes and Language Environment callable services that you would otherwise need to code in your program. They can also help you reduce errors by verifying correct usage of Language Environment callable services at compile time.

The names and descriptions of the files imbedded in the callable service examples in this chapter are provided in Table 17.

Table 17. Files Used in C/C++, COBOL, and PL/I Examples

File Name	Description
CEEEDCCT	C declarations for Language Environment symbolic feedback codes
leawi.h	Declarations of Language Environment callable services and OMIT_FC, which is used to explicitly omit the *fc* parm, for routines written in C/C++
CEEIGZCI	COBOL declarations for condition information block
CEEIGZCT	COBOL declarations for Language Environment symbolic feedback codes
CEEIGZLC	Locale category constants LC_ALL, LC_COLLATE, LC_CTYPE, LC_MESSAGES, LC_MONETARY, LC_NUMERIC, and LC_TIME.
CEEIGZTD	TD_STRUCT structure needed for CEEFTDS calls
CEEIGZNM	NM_STRUCT structure needed for CEELCNV calls

Table 17. Files Used in C/C++, COBOL, and PL/I Examples (continued)

File Name	Description
CEEIGZDT	DTCONV structure needed for CEEQDTC calls
CEEIBMAW	Language Environment callable service declarations for routines written in PL/I
CEEIBMCI	PL/I declarations for condition information block
CEEIBMCT	PL/I declarations for Language Environment symbolic feedback codes
CEEIBMLC	Locale category constants LC_ALL, LC_COLLATE, LC_CTYPE, LC_MESSAGES, LC_MONETARY, LC_NUMERIC, and LC_TIME.
CEEIBMTD	TD_STRUCT structure needed for CEEFTDS calls
CEEIBMNM	NM_STRUCT structure needed for CEELCNV calls
CEEIBMDT	DTCONV structure needed for CEEQDTC calls
CEEFORCT	Fortran declarations for Language Environment symbolic feedback codes

Notes:
- A symbolic feedback code is a symbolic representation of a condition token.
- PL/I routines that imbed CEEIBMAW require the MACRO compiler option.
- COBOL does not require declarations of external programs; therefore, you do not need declarations of Language Environment callable services for programs written in COBOL.

On z/OS, these files are contained in the Language Environment SCEESAMP partitioned data set, except for `leawi.h`, which is contained in the SCEEH.H partitioned data set.

You can imbed these files using the statement appropriate for the language your routine is written in, as shown in Table 18:

Table 18. Imbedding Files in Your Routines

To imbed a file in a...	Use...
C/C++ routine	`#include` statement
COBOL program	`COPY` statement
PL/I routine	`%include` statement

Examples of these statements are shown in the following sections on syntax.

Sample programs

Sample C/C++, COBOL, and PL/I programs are provided for most of the callable services described in this chapter. No sample Fortran programs are provided because you cannot invoke Language Environment callable services from Fortran programs. However, you can use other languages to perform these services on behalf of a Fortran program. These sample programs are also provided online with

the Language Environment product for your convenience. On MVS, the sample routines are located in the SCEESAMP partitioned data set.

C/C++ syntax

In C or C++, use the following syntax to invoke a Language Environment callable service with a feedback code in effect:

Syntax

```
►►──ceexxxx──(parm1, parm2, ...parmn, fc);──────────────────────────►◄
```

Note: "..." is "and so on," not the C ellipsis operator.

Use the following syntax to invoke callable services with an omitted feedback code parameter:

Syntax

```
►►──CEExxxx──(parm1, parm2, ...parmn, NULL);────────────────────────►◄
```

See “Parameter list for invoking callable services” on page 111 for a description of this syntax.

Language Environment callable services always have a return type of *void* and should be prototyped as such.

Input strings for callable services are **not** NULL terminated in C/C++.

You can use the SCEEH.H file `leawi.h` to declare Language Environment callable services, in conjunction with a C/C++ call to a Language Environment callable service, as shown below:

```
#include <leawi.h>
int main(void)
{
 CEExxxx(parm1, parm2, ... parmn, fc);
 }
```

Figure 9. Sample Callable Services Invocation Syntax for C/C++

To help in checking the success of your applications, Language Environment provides FBCHECK in the `ceeedcct.h` file. FBCHECK compares a feedback code against a condition token you supply to determine whether you receive the feedback code you should.

COBOL syntax

In COBOL, use the following syntax to invoke Language Environment callable services:

Syntax

```
►►──CALL "CEExxxx" USING── parm1, parm2, ...parmn, fc──────────────────────►◄
```

You can call Language Environment services either statically or dynamically from COBOL applications.

The Language Environment callable services are architected as low maintenance stubs that branch to the actual run-time routine that performs the service. Static CALL to these stubs is the preferred choice for best performance. This avoids the overhead of a COBOL dynamic call without the usual maintainability disadvantage of a more robust statically link-edited routine.

See “Parameter list for invoking callable services” on page 111 for a description of this syntax.

You can use the SCEESAMP file CEEIGZCT to declare symbolic Language Environment feedback codes, in conjunction with a COBOL call to a Language Environment callable service to return a feedback code, as shown below:

```
COPY CEEIGZCT.
CALL "CEExxxx" USING parm1, parm2, ... parmn, fc
```

Figure 10. Sample Callable Services Invocation Syntax for COBOL

COBOL for MVS & VM Release 2 or later also allows you to omit arguments. In place of the argument, use the OMITTED parameter, as shown below. See Figure 5 on page 106 and Figure 7 on page 106 for an example of omitting parameters in COBOL.

Syntax

```
►►──CALL "CEExxxx" USING── parm1, parm2, ...parmn, OMITTED──────────────────►◄
```

PL/I syntax

In PL/I, use the following syntax to invoke a Language Environment callable service with a feedback code in effect:

Syntax

```
►►──CALL CEExxxx──(parm1, parm2, ...parmn, *);──────────────────────────────►◄
```

PL/I also allows you to omit arguments. In place of the argument, code an asterisk (*), as shown below:

Syntax

```
►►──CALL CEExxxx──(*, *, ...*, );──────────────────────────────────►◄
```

Note that you cannot invoke callable services as function references.

See “Parameter list for invoking callable services” for a description of this syntax.

The value of register 15 upon return from any Language Environment callable service is undefined. Use of OPTIONS(RETCODE) is not recommended, because a subsequent use of the PLIRETV built-in function returns an undefined value.

If you code your own declarations for the Language Environment callable services, be sure to specify all required arguments in the CALL statement. Figure 6 on page 106 illustrates a call in which the feedback code to CEEDATE has been incorrectly omitted.

You can use the SCEESAMP file CEEIBMAW to declare Language Environment callable services, in conjunction with a PL/I call to a Language Environment callable service, as shown below:

```
%INCLUDE CEEIBMAW;
CALL CEExxxx(parm1, parm2, ... parmn, fc);
```

Figure 11. Sample Callable Services Invocation Syntax for PL/I

Parameter list for invoking callable services

This section describes the syntax and parameters you need to invoke Language Environment callable services.

CEExxxx
The name of the callable service.

By including a reference to a header file in your code, you can avoid declaring each callable service as an external entry. See “Header, copy, or include files” on page 107 for these file names.

*parm1 parm2 ... parm***n**
Optional or required parameters passed to or returned from the called service.

Some callable service parameters are optional in C/C++ and PL/I only. If you do not want to pass the parm or you do not want the return value, you can omit the parm, using the appropriate syntax to indicate the parm is omitted.

fc A feedback code that indicates the result of the service. *fc* can be omitted when you use C/C++, PL/I, and COBOL (COBOL for MVS & VM Release 2 or later).

If you specify *fc* as an argument, feedback information in the form of a condition token is returned to the calling routine. The condition token indicates whether the service completed successfully or whether a condition was encountered while the service was running. In Language Environment you can decode the condition token so that it can be acted on.

If you omit *fc* as an argument, using the appropriate syntax to indicate *fc* is omitted, the condition is signaled if the service was not successful.

Because callable services call other services, these other services might generate feedback codes.

Data type definitions

Parameters in Language Environment are defined as specific data types, such as:

- Fullword binary integer
- Short floating-point hexadecimal
- Long floating-point hexadecimal
- Fixed-length character string with a predefined length
- Entry variable
- Character string with a halfword prefix indicating its current length

Table 19, Table 20 on page 113, and Table 21 on page 114 contain data type definitions and their descriptions for C/C++, COBOL, and PL/I, respectively.

C/C++ data type definitions

The table below includes data type definitions and their descriptions for C/C++:

Table 19. Data Type Definitions for C/C++

Data Type	Description	C/C++
INT2	A 2-byte signed integer	signed short
INT4	A 4-byte signed integer	signed int
FLOAT4	A 4-byte single-precision floating-point number	float
FLOAT8	An 8-byte double-precision floating-point number	double
FLOAT16	A 16-byte extended-precision floating-point number	long double
COMPLEX8	Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers	Not available
COMPLEX16	Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers	Not available
COMPLEX32	Extended floating-point hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers	Not available
POINTER	A platform-dependent address pointer	void *
CHAR*n*	A string (character array) of length *n*	char[n]

VSTRING	A halfword length-prefixed character string (for input); fixed-length 80-character string (for output)	`struct _VSTRING(`
		` _INT2 short length;`
		` char  string[1];`
		` }string-in;`
		`char string_out[80];`

Table 19. Data Type Definitions for C/C++ (continued)

Data Type	Description	C/C++

FEED_BACK	A mapping of the condition token (fc)	`Case 1:`
		`typedef struct {`
		`  short  tok_sev  ;`
		`  short  tok_msgno  ;`
		`  int  tok_case :2,`
		`  tok_sever:3,`
		`  tok_ctrl :3 ;`
		`  char  tok_facid[3];`
		`  int  tok_isi  ;`
		`  }  _FEEDBACK ;`
		
		`Case 2:`
		`typedef struct {`
		`  short  tok_sev  ;`
		`  short  tok_msgno  ;`
		`  int  tok_class_code :2,`
		`  tok_cause_code:3,`
		`  tok_ctrl :3 ;`
		`  char  tok_facid[3];`
		`  int  tok_isi  ;`
		`  }  _FEEDBACK ;`

CEE_ENTRY	An HLL-dependent entry constant	FUNCTION POINTER

COBOL data type definitions

The table below includes data type definitions and their descriptions for COBOL:

Table 20. Data Type Definitions for COBOL

Data Type	Description	COBOL
INT2	A 2-byte signed integer	PIC S9(4) USAGE IS BINARY
INT4	A 4-byte signed integer	PIC S9(9) USAGE IS BINARY
FLOAT4	A 4-byte single-precision floating-point number	COMP-1
FLOAT8	An 8-byte double-precision floating-point number	COMP-2
FLOAT16	A 16-byte extended-precision floating-point number	Not available
COMPLEX8	Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers	Not available
COMPLEX16	Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers	Not available
COMPLEX32	Extended floating-point hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers	Not available
POINTER	A platform-dependent address pointer	USAGE IS POINTER

Table 20. Data Type Definitions for COBOL (continued)

Data Type	Description	COBOL
CHAR*n*	A string (character array) of length *n*	PIC X(n)

VSTRING	A halfword length-prefixed character string (for input); fixed-length 80-character string (for output)	`01 STRING-IN.`
		`  02 LEN  PIC S9(4) USAGE IS BINARY.`
		`  02 TXT  PIC X(N).`
		`01 STRING-OUT PIC X(80).`

FEED_BACK	A mapping of the condition token (fc)	`Case 1:`
		`01 FC`
		`  02 SEV  PIC S9(4) USAGE IS BINARY.`
		`  02 MSGNO  PIC S9(4) USAGE IS BINARY.`
		`  02 FLGS  PIC X(1).`
		`  02 FACID  PIC X(3).`
		`  02 ISI  PIC X(4).`
		`Case 2:`
		`01 FC`
		`  02 CLASS-CODE PIC 9(4) USAGE IS BINARY.`
		`  02 CAUSE-CODE PIC 9(4) USAGE IS BINARY.`
		`  02 FLGS  PIC X(1).`
		`  02 FACID  PIC X(3).`
		`  02 ISI  PIC X(4).`

CEE_ENTRY	An HLL-dependent entry constant	USAGE IS PROCEDURE-POINTER

PL/I data type definitions

The table below includes data type definitions and their descriptions for PL/I:

Table 21. Data Type Definitions for PL/I

Data Type	Description	PL/I
INT2	A 2-byte signed integer	REAL FIXED BINARY (15,0)
INT4	A 4-byte signed integer	REAL FIXED BINARY (31,0)
FLOAT4	A 4-byte single-precision floating-point number	REAL FLOAT BINARY (21) or REAL FLOAT DECIMAL (6)
FLOAT8	An 8-byte double-precision floating-point number	REAL FLOAT BINARY (53) or REAL FLOAT DECIMAL (16)
FLOAT16	A 16-byte extended-precision floating-point number	REAL FLOAT DECIMAL (33) or REAL FLOAT BINARY (109)
COMPLEX8	Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers	COMPLEX FLOAT DECIMAL (6)
COMPLEX16	Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers	COMPLEX FLOAT DECIMAL (16)
COMPLEX32	Extended floating-point hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers	COMPLEX FLOAT DECIMAL (33)
POINTER	A platform-dependent address pointer	POINTER

Table 21. Data Type Definitions for PL/I (continued)

Data Type	Description	PL/I
CHAR*n*	A string (character array) of length *n*	CHAR(n)
VSTRING	A halfword length-prefixed character string (for input); fixed-length 80-character string (for output)	`DCL string_in  CHAR(n) VARYING;` `DCL string_out CHAR(80);`

FEED_BACK	A mapping of the condition token (fc)	`Case 1:`
		`DCL 1 FEEDBACK BASED,`
		`  3 SEVERITY  FIXED BINARY (15),`
		`  3 MSGNO  FIXED BINARY (15),`
		`  3 FLAGS,`
		`  5 CASE  BIT  (2),`
		`  5 SEVERITY BIT  (3),`
		`  5 CONTROL  BIT  (3),`
		`  3 FACID  CHAR (3),`
		`  3 ISI  FIXED BINARY (31);`
		`Case 2:`
		`DCL 1 FEEDBACK BASED,`
		`  3 CLASS_CODE FIXED BINARY (15),`
		`  3 CAUSE_CODE FIXED BINARY (15),`
		`  3 FLAGS,`
		`  5 CASE  BIT (2),`
		`  5 SEVERITY BIT (3),`
		`  5 CONTROL  BIT (3),`
		`  3 FACID  CHAR (3),`
		`  3 ISI  FIXED BINARY (31);`

CEE_ENTRY	An HLL-dependent entry constant	ENTRY

Callable services

Following are the Language Environment callable services and examples of how to use them in C/C++, COBOL, and PL/I.

CEE3ABD—Terminate enclave with an abend

CEE3ABD requests that Language Environment terminate the enclave with an abend. The issuing of the abend can be either with or without clean-up. There is no return from this service, nor is there any condition associated with it.

Syntax

```
►►──CEE3ABD──(──abcode──,──clean-up──)──────────────────────────────►◄
```

abcode
A fullword integer, no greater than 4095, specifying the abend code that is issued. Under CICS, this fullword integer is converted to EBCDIC.

clean-up
Indicates whether the abend should result in clean-up of the enclave's resources. The acceptable values for *clean-up* are as follows:

Value	Meaning
0	Issue the abend without clean-up
1	Issue the abend with normal enclave termination processing

If an illegal value for *clean-up* is passed, the abend is issued without clean-up.

If *clean-up* is 0, no Language Environment dump is generated. A system dump, however, is requested when issuing the abend. Under CICS, a transaction dump is taken. To get a dump under CMS, specify FILEDEF SYSABEND PRINTER or FILEDEF SYSUDUMP PRINTER.

If *clean-up* is 0, Language Environment condition handling is disabled for the current enclave and termination activities are not performed. Event handlers are not driven; Debug Tool is not invoked; user exits are not invoked; and user-written condition handlers are not invoked.

When *clean-up* is 1, the abend is processed in the same manner as if it were a non-Language Environment abend. Its processing is affected by the ABPERC and TRAP options, the filedef abends percolated in the assembler user exit, and other elements of the environment related to abend processing. In particular, the condition handler can intercept the abend and give the application a chance to handle the abend. If the condition remains unhandled, normal termination activities are performed: information such as a Language Environment dump is produced, depending on the setting of the TERMTHDACT option; event handlers are driven; Debug Tool is invoked; and user exits are invoked. Assembler user exit settings control whether the application actually terminates with an abend.

Usage notes

- z/OS UNIX consideration—CEE3ABD applies to the enclave.

For more information

- For more information about the ABPERC run-time option, see “ABPERC” on page 12.
- For more information about the TRAP run-time option, see “TRAP” on page 95.
- For more information about the TERMTHDACT run-time option, see “TERMTHDACT” on page 81.

Examples

```
/*Module/File Name: EDC3ABD   */

#include <leawi.h>

int main(void) {

  _INT4 code, timing;

  code = 0xdead; /* Abend code to issue */
  timing = 0;

  CEE3ABD(&code,&timing);
}
```

Figure 12. C/C++ Example of CEE3ABD

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3ABD
      ***********************************************
      ** CBL3ABD - Call CEE3ABD to terminate the  **
      **           enclave with an abend          **
      ***********************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3ABD.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ABDCODE                PIC S9(9) BINARY.
       01  TIMING                 PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLMGET.

      ***********************************************
      ** 3415 is the abend code to be issued,     **
      ** a timing of zero requests an abend       **
      ** without clean-up                         **
      ***********************************************
                MOVE 3415 TO ABDCODE.
                MOVE 0 TO TIMING.
                CALL "CEE3ABD" USING ABDCODE , TIMING.

                GOBACK.
```

Figure 13. COBOL Example of CEE3ABD

```
*PROCESS MACRO;
 /*Module/File Name: IBM3ABD
 /*****************************************************/
 /**                                                 */
 /** Function: CEE3ABD - terminate enclave with an   */
 /**                     abend                       */
 /**                                                 */
 /** In this example, CEE3ABD is called with a       */
 /** timing value of 1.  This requests an abend that */
 /** is deferred until clean-up takes place.         */
 /**                                                 */
 /*****************************************************/
 PLI3ABD: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL ABDCODE REAL FIXED BINARY(31,0);
    DCL TIMING  REAL FIXED BINARY(31,0);

    ABDCODE = 3333; /* Choose code to abend with     */
    TIMING = 1;     /* Specify 1, for an abend with  */
                    /*    clean-up                   */

    /* Call CEE3ABD to request an abend 3333 with    */
    /*    clean-up                                   */
    CALL CEE3ABD ( ABDCODE, TIMING );

 END PLI3ABD;
```

Figure 14. PL/I Example of CEE3ABD

CEE3CIB—Return pointer to condition information block

CEE3CIB returns a pointer to a condition information block (CIB) associated with a given condition token. Use this service only during condition handling.

For PL/I and COBOL applications, Language Environment provides called header, COPY, or include files (in SCEESAMP) that map the CIB. For C/C++ applications, the macros are in the header file `leawi.h` (in SCEEH.H).

The CIB contains detailed information about the condition and provides input to your application's condition handlers, which can then respond more effectively to a given condition.

Syntax

```
►►──CEE3CIB──(──┬──────────────┬──,──cib_ptr──,──fc──)──────────────────►◄
                └──cond_token──┘
```

cond_token
The condition token passed to a user-written condition handler. If you do not specify this parameter, Language Environment returns the address of the most recently-raised condition.

cib_ptr
The address of the CIB associated with the condition token.

fc
A 12-byte feedback code, optional in some languages, that indicates the results of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE35S	1	3260	No condition was active when a call to a condition management routine was made.
CEE35U	1	3262	An invalid condition token was passed. The condition token did not represent an active condition.

Usage notes

- Because the CIB is used only for synchronous signals, you should not use CEE3CIB in signal catchers that are driven for asynchronous signals.
- After the condition handling functions return control to your application, *cib_ptr* is no longer valid.
- z/OS UNIX consideration—In multithread applications, CEE3CIB returns the CIB associated with the current token on only the current thread.

For more information

- For more information about the CEE3CIB callable service, see *z/OS Language Environment Programming Guide*.

Examples

```
/*Module/File Name: EDC3CIB   */

#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

#ifdef __cplusplus
   extern "C" {
#endif
   void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
   }
#endif

int main(void) {

  _FEEDBACK fc;
  _ENTRY routine;
  _INT4 token;
  int x,y,z;

  /* set the routine structure to point to the handler */
  /* and use CEEHDLR to register the user handler      */

  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;

  CEEHDLR(&routine,&token,&fc);
```

Figure 15. C/C++ Example of EDC3CIB (Part 1 of 2)

```
  /* verify that CEEHDLR was successful */
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEHDLR failed with message number %d\n",
           fc.tok_msgno);
    exit(2999);
  }
  x = 5;
  y = 0;
  z = x / y;
}

/*******************************************************/
/* handler is a user condition handler                 */
/*******************************************************/
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {

   _CEECIB *cib_ptr;
   _FEEDBACK cibfc;

   CEE3CIB(fc, &cib_ptr, &cibfc);

  /* verify that CEE3CIB was successful */
  if ( _FBCHECK ( cibfc , CEE000 ) != 0 ) {
    printf("CEE3CIB failed with message number %d\n",
           cibfc.tok_msgno);
    exit(2999);
  }

   printf("%s \n",(*cib_ptr).cib_eye);
   printf("%d \n",cib_ptr->cib_cond.tok_msgno);
   printf("%s \n",cib_ptr->cib_cond.tok_facid);
   *result = 10;
}
```

Figure 15. C/C++ Example of EDC3CIB (Part 2 of 2)

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3CIB
      ************************************************
      **                                            **
      ** CBL3CIB - Register a condition handler     **
      **           that will call CEE3CIB to get    **
      **           a Condition Information Block    **
      **           (CIB) for the condition.         **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3CIB.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE  PROCEDURE-POINTER.
       01  TOKEN                   PIC S9(9) BINARY.
       01  FC                      PIC X(12).
       PROCEDURE DIVISION.
       PARA-CBL3CIB.
           SET ROUTINE TO ENTRY "HANDLER".
           CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.

           GOBACK.
       END PROGRAM CBL3CIB.

   CBL LIB,QUOTE
       IDENTIFICATION DIVISION.
       PROGRAM-ID. HANDLER.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  CIB-PTR POINTER.
       01  FC                      PIC S9(9) BINARY.
       LINKAGE SECTION.
      ************************************************
      ** Include the mapping of the CIB             **
      ************************************************
       COPY CEEIGZCI.
       01  CURCOND                 PIC X(12).
       01  TOKEN                   PIC S9(9) BINARY.
       01  RESULT                  PIC S9(9) BINARY.
       01  NEWCOND                 PIC X(12).
       PROCEDURE DIVISION USING CURCOND, TOKEN,
                                RESULT, NEWCOND.
       PARA-HANDLER.
           CALL "CEE3CIB" USING CURCOND, CIB-PTR, FC.
           SET ADDRESS OF CEECIB TO CIB-PTR.
           DISPLAY "In Handler".
           DISPLAY CIB-EYE.
           DISPLAY CIB-TOK-MSGNO.
           DISPLAY CIB-TOK-FACID.

           GOBACK.
       END PROGRAM HANDLER.
```

Figure 16. COBOL Example of CEE3CIB

```
*PROCESS OPT(0), MACRO;
 /* Module/File Name: IBM3CIB                        */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3CIB - example of CEE3CIB         **/
 /**                     invoked from PL/I ON-unit  **/
 /**                                                **/
 /****************************************************/

 IBM3CIB:  PROCEDURE  OPTIONS(MAIN);

   %INCLUDE CEEIBMAW;
   %INCLUDE CEEIBMCT;
   %INCLUDE CEEIBMCI;

   DECLARE
      CIB_PTR     POINTER,
      01 FC,                       /* Feedback token */
         03 MsgSev    REAL FIXED BINARY(15,0),
         03 MsgNo     REAL FIXED BINARY(15,0),
         03 Flags,
            05 Case      BIT(2),
            05 Severity  BIT(3),
            05 Control   BIT(3),
         03 FacID     CHAR(3),        /* Facility ID */
         03 ISI     /* Instance-Specific Information */
                REAL FIXED BINARY(31,0),
      divisor     FIXED BINARY(31) INITIAL(0);

   ON  ZERODIVIDE  BEGIN;

      CALL CEE3CIB(*, CIB_PTR, FC);
      IF  FBCHECK( FC, CEE000 )  THEN  DO;
         PUT SKIP LIST('Found ' || CIB_PTR->CIB_EYE ||
            ' for message #' || CIB_PTR->CIB_TOK_MSGNO
            || ' from ' || CIB_PTR->CIB_TOK_FACID );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3CIB failed with msg '
            || FC.MsgNo );
         END;

      END /* ON ZeroDivide */;


   divisor = 15 / divisor  /* signals ZERODIVIDE */;

 END IBM3CIB;
```

Figure 17. PL/I Example of CEE3CIB

CEE3CTY—Set default country

CEE3CTY sets the default country. A calling routine can change or query the current national country setting. The country setting affects the date format, the time format, the currency symbol, the decimal separator, and the thousands separator.

The current national country setting also affects the format of the date and time in the reports generated by the RPTOPTS and RPTSTG run-time options.

CEE3CTY also affects the default symbols for the NLS and date and time callable services.

CEE3CTY affects only the Language Environment NLS and date and time services, not the Language Environment locale callable services or C locale-sensitive functions.

The current default country setting, as well as previous default settings that have not been discarded, are stored on the stack on a LIFO (last in, first out) basis. The current default country setting is always on the top of the stack.

There are two methods of changing the default country setting with CEE3CTY:

- Specify the new default country setting and place it on top of the stack using a *function* value of 1 (SET). This discards the previous default setting.
- Specify the new default country setting and place it on top of the stack using a *function* value of 3 (PUSH). This pushes the previous default setting down on the stack so that you can later retrieve it by discarding the current setting.

To illustrate the second method, suppose you live in the United States and the code for the United States is specified as the default at installation. If you want to use the French defaults for a certain application, you can use CEE3CTY to PUSH France as the default country setting; then when you want the defaults for the United States, you can POP France from the top of the stack, making the United States the default setting.

Syntax

```
►►──CEE3CTY──(──function──,──country_code──,──fc──)──────────────────────►◄
```

function (input)
A fullword binary integer specifying the service to be performed.

The possible values for *function* are:

1—SET Establishes the *country_code* parameter as the current country. The top of the stack is, in effect, replaced with *country_code*.

2—QUERY Returns the current country code on the top of the stack to the calling routine. The current code is returned in the *country_code* parameter.

3—PUSH Pushes the *country_code* parameter onto the top of the country code stack, making it the current country code. Previous country codes on the stack are retained on a LIFO basis, which makes it possible to return to a prior country code at a later time.

4—POP Pops the current country code. The last country code that was affected by a PUSH now becomes the current *country_code*. On return to the calling routine, the *country_code* parameter contains the discarded country code. If the stack contains only one country code, the code cannot be popped because the stack would be empty after the call. Therefore, no action is taken and a feedback code indicating such is returned to the calling routine.

country_code (input/output)

A 2-character fixed-length string. *country_code* is not case-sensitive. Table 27 on page 513 contains a list of valid country codes. It is used in the following ways for the different *functions:*

If *function* **is specified as:**	**then** *country_code***:**
1 or 3	Contains the desired 2-character country code. In this case, it is an input parameter. Table 27 on page 513 contains a list of valid country codes.
2	Returns the current 2-character country code on top of the stack. In this case, it is an output parameter.
4	Returns the discarded 2-character country code. In this case, it is an output parameter.

fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	**Severity**	**Message Number**	**Message Text**
CEE000	0	—	The service completed successfully.
CEE3BV	2	3455	Only one country code was on the stack when a POP request was made to CEE3CTY. The current country code was returned in the
CEE3C0	3	3456	The country code *country-code* for the PUSH or SET function for CEE3CTY was invalid. No operation was performed.
CEE3C1	3	3457	The function *function* specified for CEE3CTY was not recognized. No operation was performed.

Usage notes

- The default setting for *country_code* is already on the stack when you start a program. You do not have to PUSH it there.
- The bytes X'0E' and X'0F' representing shift-out and shift-in codes are not affected by any *country_code* setting.
- C/C++ consideration—Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. To change the locale, you can use the `setlocale()` library function or the CEESETL callable service.

  The settings of CEESETL or `setlocale()` do not affect the setting of the CEE3CTY callable service. CEE3CTY affects only Language Environment NLS and date and time services. `setlocale()` and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.

  To ensure that all settings are correct for your country, use CEE3CTY and either CEESETL or `setlocale()`.
- z/OS UNIX consideration—CEE3CTY applies to the enclave. Every thread in the enclave has the same country setting.

For more information

- For more information about the RPTOPTS and RPTSTG run-time options, see “RPTOPTS” on page 59 and “RPTSTG” on page 62.
- For a list of the default settings for a specified country, see Table 27 on page 513.
- For more information about the COUNTRY run-time option, refer to “COUNTRY” on page 22.
- For more information on `setlocale()`, see *z/OS C/C++ Programming Guide*.

Examples

```
/*Module/File Name: EDC3CTY   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4 function;
  _CHAR2 country;

  /* query the current country setting */
  function = 2; /* function 2 is query */
  CEE3CTY(&function,country,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEE3CTY failed with message number %d\n",
             fc.tok_msgno);
     exit(2999);
  }

  /* if the current country is not Canada then set */
  /* it to Canada */
  if (memcmp(country,"CA",2) != 0) {
     memcpy(country,"CA",2);
     function = 1; /* function 1 is set */
     CEE3CTY(&function,country,&fc);

     if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3CTY failed with message number %d\n",
                fc.tok_msgno);
        exit(2999);
     }
  }
}
```

Figure 18. C/C++ Example of CEE3CTY

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3CTY
      ************************************************
      **                                            **
      ** Function: CEE3CTY - set default country    **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3CTY.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  FUNCTN                  PIC S9(9) BINARY.
       01  COUNTRY                 PIC X(2).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 19. COBOL Example of CEE3CTY (Part 1 of 2)

```
 PARA-3CTYQRY.
************************************************
** Call CEE3CTY with the QUERY function,
**     and display current country code.
************************************************
     MOVE 2 TO FUNCTN.
     CALL "CEE3CTY" USING FUNCTN, COUNTRY, FC.
     IF CEE000 of FC  THEN
         DISPLAY "THE CURRENT COUNTRY CODE IS "
             COUNTRY
     ELSE
         DISPLAY "CEE3CTY(query) failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 PARA-3CTYSET.
************************************************
** If the current country code is not the US,
** call CEE3CTY with the SET function to make
** it the US. Display result.
************************************************
     IF ( COUNTRY IS NOT = "US" ) THEN
         MOVE 1 TO FUNCTN
         MOVE "US" TO COUNTRY
         CALL "CEE3CTY" USING FUNCTN,
                              COUNTRY, FC
         IF CEE000 of FC  THEN
             DISPLAY "THE NEW COUNTRY CODE IS ",
                 COUNTRY
         ELSE
             DISPLAY "CEE3CTY(set) failed with msg "
                 Msg-No of FC UPON CONSOLE
             STOP RUN
         END-IF
     END-IF.

     GOBACK.
```

Figure 19. COBOL Example of CEE3CTY (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBM3CTY                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3CTY - set current country        **/
 /**                                                **/
 /** In this example, a call is made to the query   **/
 /** function of CEE3CTY to return the current      **/
 /** default country setting.  This is then         **/
 /** printed out. If the current country code is    **/
 /** not 'US', then it is set to 'US' and printed.  **/
 /**                                                **/
 /****************************************************/
 PLI3CTY: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL FUNCTN   REAL FIXED BINARY(31,0);
    DCL COUNTRY  CHARACTER ( 2 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    FUNCTN = 2; /* Specify 2 for the query function  */

    /* Call CEE3CTY with the query function to       */
    /*    return the current country setting         */
    CALL CEE3CTY ( FUNCTN, COUNTRY, FC );

    /* If CEE3CTY ran successfully, print the        */
    /*    current country                            */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'The current country code is "'
          || COUNTRY || '".' );
       END;
    ELSE  DO;
       DISPLAY( 'CEE3CTY failed with msg '
          || FC.MsgNo );
       STOP;
       END;
```

Figure 20. PL/I Example of CEE3CTY (Part 1 of 2)

```
   /* If the current default country is not the US, */
   /*    set it to the US                           */
   IF  COUNTRY ¬= 'US'  THEN DO;
      FUNCTN = 1; /* Specify 1 for the set function */
      COUNTRY = 'US'; /* Specify country code for US*/
      CALL CEE3CTY ( FUNCTN, COUNTRY, FC );

      /* If CEE3CTY ran successfully print the      */
      /*    current country                         */
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST( 'The new country code is "'
            || COUNTRY || '".' );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3CTY failed with msg '
            || FC.MsgNo );
         STOP;
         END;

      END;

END PLI3CTY;
```

Figure 20. PL/I Example of CEE3CTY (Part 2 of 2)

CEE3DMP—Generate dump

CEE3DMP generates a dump of Language Environment and the member language libraries. Sections of the dump are selectively included, depending on options specified with the *options* parameter. When an error occurs that would cause a CEEDUMP to be taken, and this is a POSIX application, Language Environment writes this dump to the current directory. Output from CEE3DMP is written to one of the following (in top down order):

- The directory found in _CEE_DMPTARG, if found.
- The current working directory, if this is not the root (/), and if the directory is writeable.
- The directory found in environment variable TMPDIR (if the temporary directory is not /TMP.
- /TMP

(See the Fname suboption of CEE3DMP on page 134 for more information about the dump output filename.)

Dumps are written only in mixed-case U.S. English. If longer than 60 characters, the dump title is truncated to 60 characters in order to match the record size of the dump file. Only nested enclaves within a single process are supported.

CEE3DMP establishes a condition handler that captures all conditions that occur during dump processing. It terminates the section of the dump in progress when a condition occurs and inserts the following line into the dump:

```
Exception occurred during dump processing at nnnnnnnn
```

nnnnnnnn is the instruction address at the time of the exception. After this line is inserted in the report, dump processing continues for other member languages until CEE3DMP is complete.

If an abend occurs, or if any other condition occurs or is raised, the condition manager attempts to handle it. If the condition remains unhandled, and it is of

sufficient severity, the condition manager might, based on whether the TERMTHDACT TRACE or DUMP suboption is specified, invoke dump services and then terminate the program. You do not have to call CEE3DMP to use the dump services. Any routine can use them. To support this case, dump services are invoked as follows:

- The title is 'Condition processing resulted in the unhandled condition' to indicate why the dump was produced.
- The dump options are 'TRACE COND THR(ALL) BLOCKS STOR NOENTRY' for dump output and 'TRACE COND THR(ALL) NOBLOCK NOSTOR NOENTRY' for trace output.

Reprinting of section title and control block name at the top of each page is suppressed. Only the main title 'CEE3DMP: ...' is reprinted.

The IBM-supplied default settings for the CEE3DMP options are:

```
TRACEBACK THREAD(CURRENT) FILES VARIABLES NOBLOCKS
NOSTORAGE STACKFRAME(ALL) PAGESIZE(60) FNAME(CEEDUMP)
CONDITION ENTRY
```

Syntax

```
►►──CEE3DMP──(──title──,──options──,──fc──)──────────────────────────►◄
```

title (input)
An 80-byte fixed-length character string containing a title printed at the top of each page of the dump.

options
A 255-byte fixed-length character string enclosed in single quotes containing options describing the type, format, and destination of dump information.

Options are declared as a string of keywords separated by blanks or commas. Some options have suboptions that follow the option keyword and are contained in parentheses. The options can be specified in any order, but the last option declaration is honored if there is a conflict between it and any preceding options.

The following options are recognized by Language Environment:

ENCLave(ALL | CURrent | n)
Dumps the current enclave, a fixed number of enclaves, or all enclaves associated with the current process. **n** is an integer ranging from 1 to 2**31-1, inclusive, that indicates the maximum number of enclaves that should be dumped. ENCLAVE(CURRENT) and ENCLAVE(1) are equivalent.

THRead(ALL|CURrent)
Dumps the current thread (the thread that invoked this service) or all threads associated with the current enclave.

When you specify THREAD(ALL) and more than one thread is running, the library quiesces all threads before writing the dump. Therefore, the state of the library changes from the time the dump is requested to the time the dump is written.

TRACEback
Includes a traceback of all routines on the call chain. The traceback shows

transfers of control from either calls or exceptions. The traceback extends backwards to the main program of the current thread.

PL/I transfers of control into BEGIN-END blocks or ON-units are considered calls.

NOTRACEback
Does not include a traceback.

FILEs
Includes attributes of all open files and the buffer contents used by the files. The particular attributes displayed are defined by the member languages.

File buffers are dumped when FILE and STORAGE are specified. File control blocks are dumped when FILE and BLOCKS are specified.

NOFILEs
Does not include file attributes of open files.

VARiables
Includes a symbolic dump of all variables, arguments, and registers.

Variables include arrays and structures. Register values are those saved in the stack frame at the time of call. There is no way to print a subset of this information.

Variables and arguments are printed only if the symbol tables are available. A symbol table is generated when a program is compiled with the options shown below for each HLL, except for PL/I, which does not support the VARIABLE option.

Language	Compile-Time Option
C	TEST(SYM)
C++	TEST
COBOL	TEST or TEST(h,SYM)

The variables, arguments, and registers are dumped, beginning with the routine that called CEE3DMP. The dump proceeds up the chain for the number of routines specified by the STACKFRAME option. See below for a description of the STACKFRAME option.

NOVARiables
Does not include a dump of variables, arguments, and registers.

BLOCKs
Dumps the control blocks used in Language Environment and member language libraries.

Global control blocks, as well as control blocks associated with routines on the call chain, are printed. Control blocks are printed for the routine that called CEE3DMP. The dump proceeds up the call chain for the number of routines specified by the STACKFRAME option (see below). Control blocks for files are also dumped if the FILES option was specified. See the FILES option above for more information.

If the TRACE run-time option is set to ON, the trace table is dumped when BLOCKS is specified.

If the heap storage diagnostics report is requested via the HEAPCHK run-time option, the report is displayed when BLOCKS is specified.

NOBLOCKs
Suppresses the dump of control blocks.

STORage
Dumps the storage used by the program.

The storage is displayed in hexadecimal and character format. Global storage, as well as storage associated with each routine on the call chain, is printed. Storage is dumped for the routine that called CEE3DMP, which proceeds up the call chain for the number of routines specified by the STACKFRAME option. Storage for all file buffers is also dumped if the FILES option was specified (see above).

NOSTORage
Suppresses storage dumps.

StackFrame(n|ALL)
Specifies the number of stack frames dumped from the call chain.

If STACKFRAME(ALL) is specified, all stack frames are dumped. No stack frame storage is dumped if STACKFRAME(0) is specified.

The particular information dumped for each stack frame depends on the VARIABLE, BLOCK, and STORAGE option declarations specified for CEE3DMP. The first stack frame dumped is the one associated with the routine that called CEE3DMP, followed by its caller, and proceeding backwards up the call chain.

PAGEsize(n)
Specifies the number of lines on each page of the dump.

This value must be greater than 9. A value of 0 indicates that there should be no page breaks in the dump. The default setting is PAGESIZE(60).

FNAME(ddname)
Specifies the ddname of the file to which the dump report is written.

The ddname supplied in this option must be a valid ddname for the system on which the application is running. CEE3DMP does not check the ddname for validity, nor does CEE3DMP translate or modify the ddname. Supplying an invalid ddname can result in unpredictable behavior.

The default ddname CEEDUMP is used if this option is not specified.

CONDition
Specifies that for each active condition on the call chain, the following information is dumped from the CIB:

- The address of the CIB.
- The message associated with the current condition token.
- The message associated with the original condition token, if different from the current one.
- The location of the error.
- The machine state at the time the condition manager was invoked, if an abend or hardware condition occurred.
- The abend code and reason code, if the condition occurred as a result of an abend.
- Language-specific error information.

  The information supplied by Language Environment-conforming languages differs. PL/I supplies DATAFIELD, ONCHAR, ONCOUNT, ONFILE, ONKEY, and ONSOURCE built-in function (BIF) values, which are shown in the context of the condition raised.

This option does not apply to asynchronous signals.

NOCONDition
Does not dump condition information for active conditions on the call chain.

ENTRY
Includes in the dump a description of the routine that called CEE3DMP and the contents of the registers on entry to CEE3DMP.

NOENTRY
Does not include in the dump a description of the routine that called CEE3DMP and the contents of the registers on entry to CEE3DMP.

GENOpts
Includes in the dump a run-time options report like that generated by the use of the RUNOPTS run-time option.

NOGENOpts
Does not include in the dump a run-time options report like that generated by the use of the RPTOPTS run-time option.

fc (output)
A 12-byte feedback token code that indicates the result of a call to CEE3DMP. If specified as an argument, feedback information, in the form of a condition token, is returned to the calling routine. If not specified, and the requested operation was not successfully completed, the condition is signaled to the condition manager.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE30U	2	3102	Invalid CEE3DMP options or suboptions were found and ignored.
CEE30V	3	3103	An error occurred in writing messages to the dump file.

Usage notes

- CICS consideration—Only ENCLAVE(CURRENT) and ENCLAVE(1) are supported on CICS.
- VM considerations—All values for the ENCLAVE option are supported on VM for nested enclaves created by the C `system()` function. Only ENCLAVE(CURRENT) and ENCLAVE(1) are supported on CMS for nested enclaves created by SVC LINK, CMSCALL or PL/I FETCH and CALL of a fetchable main.
- MVS consideration—On MVS, all values for the ENCLAVE option are supported.
- z/OS UNIX consideration—CEE3DMP applies to the enclave.

  When you call CEE3DMP in a multithread environment, the current thread or all threads might be dumped. Enclave- and process-related storage (along with storage related to threads other than the current thread) might have changed in value from the time the dump request was issued.

  If the CEEDUMP DD has a PATH= parameter, the dump is directed to the hierarchic file system (HFS) file specified.

  If your application is running under z/OS UNIX System Services and is either running in an address space created by using the `fork()` function or is invoked by one of the `exec` family of functions, the dump is written to the HFS. Language

Environment writes the dump to a file in your current working directory, unless that directory is the root directory, in which case the dump is written to a file in the directory `/tmp`..

The name of this file changes with each dump and uses the following format:

```
/path/Fname.Date.Time.Pid
```

path The current working directory

Fname The name specified in the FNAME parameter on the call to CEE3DMP (default is CEEDUMP)

Date The date the dump is taken, appearing in the format `YYYYMMDD` (such as 19940325 for March 25, 1994)

Time The time the dump is taken, appearing in the format `HHMMSS` (such as 175501 for 05:55:01 PM)

Pid The process ID the application is running in when the dump is taken

For more information

- See “TERMTHDACT” on page 81 for more information about the TERMTHDACT run-time option.
- For more information on generating dumps, see *z/OS Language Environment Debugging Guide*.

Examples

```
/*Module/File Name: EDC3DMP   */

#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

#define OPT_STR "THREAD(CURRENT) TRACEBACK FILES"

int main(void) {

  _CHAR80 title =
           "This is the title of the dump report";
  _CHAR255 options;
  FILE *f;
  _FEEDBACK fc;

  memset(options,' ',sizeof(options));
  memcpy(options,OPT_STR,sizeof(OPT_STR)-1);

  f = fopen("my.file","wb");
  fprintf(f,"my file record 1\n");

  CEE3DMP(title,options,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEE3DMP failed with msgno %d\n",
       fc.tok_msgno);
     exit(2999);
  }
}
```

Figure 21. C/C++ Example of CEE3DMP

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3DMP
      ************************************************
      **                                            **
      ** CBL3DMP - Call CEE3DMP to generate a dump   **
      **                                            **
      ** In this example, a call to CEE3DMP is made  **
      ** to request a dump of the run-time           **
      ** environment. Several options are specified  **
      ** to customize the dump.                      **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3DMP.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  DMPTITL                PIC X(80).
       01  OPTIONS                PIC X(255).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
      ************************************************
      ** Specify title to appear on each page of the
      **     dump report.
      ** Specify options that will request that a
      **     traceback be provided, but no variables,
      **     stack frames, condition information, or
      **     registers be dumped.
      ************************************************
       PARA-CBL3DMP.
           MOVE "This is the dump report title."
                 TO DMPTITL.
           MOVE "TRACE NOVAR SF(0) NOCOND NOENTRY"
                 TO OPTIONS.
           CALL "CEE3DMP" USING DMPTITL, OPTIONS, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEE3DMP failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 22. COBOL Example of CEE3DMP

```
*PROCESS MACRO;
 /* Module/File Name: IBM3DMP                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3DMP - generate dump              **/
 /**                                                **/
 /** In this example, a call to CEE3DMP is made to  **/
 /** request a dump of the run-time environment.    **/
 /** Several options are specified, to customize    **/
 /** the dump.                                      **/
 /****************************************************/
 PLI3DMP: PROC OPTIONS(MAIN);
    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL DMPTITL  CHAR(80);
    DCL OPTIONS  CHARACTER ( 255 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Specify a string to be printed at the top of  */
    /*    each page of dump                          */

    DMPTITL = 'This is the title for the dump report.';

    /* Request that a traceback be provided, but     */
    /*    no variables, stack frames, condition      */
    /*    information, or registers be dumped        */

    OPTIONS = 'TRACE NOVAR SF(0) NOCOND NOENTRY';

    /* Call CEE3DMP with options to customize dump   */
    CALL CEE3DMP ( DMPTITL, OPTIONS, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Successfully produced dump with'
          || ' title "' || DMPTITL || '"' );
       PUT SKIP LIST( ' and options:  ' || OPTIONS );
       END;
    ELSE  DO;
       DISPLAY( 'CEE3DMP failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLI3DMP;
```

Figure 23. PL/I Example of CEE3DMP

CEE3GRC—Get the enclave return code

CEE3GRC retrieves the current value of the user enclave return code. Use CEE3GRC in conjunction with CEE3SRC to get and then set user enclave return codes.

Syntax

```
►►──CEE3GRC──(──return_code──,──fc──)──────────────────────────────►◄
```

return_code (output)
The enclave return code.

fc (output)
A feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

Usage notes

- z/OS UNIX consideration—CEE3GRC is not supported in multithread applications.
- PL/I MTF consideration—CEE3GRC is not supported in PL/I MTF applications.
- PL/I consideration—When running PL/I with POSIX(ON), CEE3GRC is not supported.

For more information

- See “CEE3SRC—Set the enclave return code” on page 197 for more information about the CEE3SRC callable service.
- See *z/OS Language Environment Programming Guide* for more information about the CEE3GRC and CEE3SRC callable services.

Examples

```
/*Module/File Name: EDC3GRC   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

 /*****************************************************/
 /**                                                 */
 /** Function: CEEHDLR - Register user condition     */
 /**                     handler                     */
 /**         : CEE3GRC - Get enclave return code     */
 /*                                                  */
 /* 1. Register the user-written condition handler   */
 /*    CESETRC.                                      */
 /* 2. Call CERCDIV, which performs a divide-by-zero. */
 /* 3. CESETRC is entered, sets the enclave return   */
 /*    code to 999998 and resumes.                   */
 /* 4. The main routine regains control and          */
 /*    retrieves the enclave return code             */
 /*****************************************************/

void CERCDIV(int);
 /*****************************************************
   Declaration of user-written condition handler
  *****************************************************/
#ifdef __cplusplus
   extern "C" {
#endif
   void CESETRC(_FEEDBACK *, _INT4*, _INT4 *, _FEEDBACK *);
#ifdef __cplusplus
   }
#endif

main()
{
 _INT4 idivisor = 0;
 _INT4 enclave_RC;
 _FEEDBACK feedback, new_feedback;
 _ENTRY pgmptr;
 _INT4 token;

 /*****************************************************
  The condition handler CESETRC is registered
  *****************************************************/
 pgmptr.address = (_POINTER)&CESETRC;;
 pgmptr.nesting = NULL;
 token = 97;
 CEEHDLR(&pgmptr, &token, &feedback);
```

Figure 24. C/C++ main() Routine that Calls CEEHDLR and CEE3GRC (Part 1 of 2)

```
 /*****************************************************
  A divide-by-zero is accomplished by calling CERCDIV.
  *****************************************************/
 CERCDIV(idivisor);   /* this causes a zero divide    */

 /*****************************************************
  Call CEE3GRC and check that enclave return code was set.
  *****************************************************/
 CEE3GRC(&enclave_RC, &feedback);
   if ( _FBCHECK ( feedback , CEE000 ) != 0 ) {
      printf("CEE3GRC failed with message number %d\n",
             feedback.tok_msgno);
      exit(2999);
   }

 if (enclave_RC != 999998)
   printf ("Error setting enclave return code");
}
```

Figure 24. C/C++ main() Routine that Calls CEEHDLR and CEE3GRC (Part 2 of 2)

```
/*Module/File Name: EDC3SRC   */
 /*****************************************************/
 /**                                                 */
 /** Function: CEE3SRC - Set the enclave return code. */
 /*                                                  */
 /* This is the user-written condition handler       */
 /* registered by CEGETRC. It invokes CEE3SRC to set  */
 /* the enclave return code to 999998                */
 /* when a divide-by-zero condition is encountered.   */
 /**                                                 */
 /*****************************************************/
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>
#define RESUME 10
#define PERCOLATE 20
 /*****************************************************/

#ifdef __cplusplus
 extern "C" void CESETRC (_FEEDBACK *, _INT4 *,
 _INT4 *, _FEEDBACK *);
#endif

void CESETRC (_FEEDBACK *cond, _INT4 *input_token,
               _INT4 *result, _FEEDBACK *new_cond)
{
 _INT4 enclave_RC;
 _FEEDBACK feedback;

 if ( _FBCHECK ( *cond , CEE349 ) == 0 )
  {
   enclave_RC = 999998;
   CEE3SRC(&enclave_RC, &feedback);
   *result = RESUME;
  }
 else
  {
   *result = PERCOLATE;
  }
}
```

Figure 25. C/C++ User-Written Condition Handler that Sets a User Enclave Return Code

```
/*Module/File Name: EDCDIV    */
#include <stdio.h>
#include <string.h>
 /**************************************************/
 /**                                              */
 /* This is a divide-by-zero routine. It divides   */
 /* an input integer by a constant.                */
 /**                                              */
 /**************************************************/

void CERCDIV (int Integer)

{
 int num;
 num = 1/Integer;
}
```

Figure 26. C/C++ Subroutine that Generates the Divide-by-Zero Condition

```
CBL LIB,QUOTE,C,RENT,OPTIMIZE,NODYNAM
      *Module/File Name: IGZT3GRC
      ************************************************
      **                                            **
      ** CBL2GRC - Call the following Lang. Env. svcs: **
      **                                            **
      **         : CEEHDLR - register user condition  **
      **                     handler                **
      **         : CEE3GRC - get enclave return code  **
      **                                            **
      ** 1. Registers user condition handler CESETRC. **
      ** 2. Program then calls CERCDIV which performs **
      **    a divide by zero operation.             **
      ** 3. CESETRC gets control and set the enclave  **
      **    return code to 999998 and resumes.      **
      ** 4. Regains control and retrieves the enclave **
      **    return code.                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID.    CBL3GRC.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  TOKEN           PIC X(4).
       01  IDIVISOR        PIC S9(9)
                           BINARY VALUE ZERO.
       01  ENCLAVE-RC      PIC S9(9) BINARY.
      **
      **  Declares for condition handling
      **
       01  PGMPTR          USAGE IS PROCEDURE-POINTER.
       01  FBCODE.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 27. COBOL Main Routine that Calls CEEHDLR and CEE3GRC (Part 1 of 2)

```
 0001-BEGIN-PROCESSING.
**************************************************
** Register user condition handler CESETRC using
**     CEEHDLR
**************************************************
     SET PGMPTR TO ENTRY  "CESETRC".
     MOVE 97 TO TOKEN
     CALL "CEEHDLR" USING PGMPTR, TOKEN, FBCODE.
     IF NOT CEE000 of FBCODE  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FBCODE UPON CONSOLE
         STOP RUN
     END-IF.

**************************************************
** Call CERCDIV  to cause a divide by zero
**     condition
**************************************************
     CALL "CERCDIV" USING IDIVISOR.

**************************************************
** Call CEE3GRC  to get the enclave return code
**************************************************
     CALL "CEE3GRC" USING ENCLAVE-RC, FBCODE.
     IF NOT CEE000 of FBCODE  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FBCODE UPON CONSOLE
         STOP RUN
     END-IF.

     IF (ENCLAVE-RC =  999998) THEN
         DISPLAY "Enclave return code "
             "set and retrieved."
     ELSE
         DISPLAY "*** Unexpected enclave return "
             "code of " ENCLAVE-RC " encountered"
     END-IF.

     GOBACK.
 End program CBL3GRC.
```

Figure 27. COBOL Main Routine that Calls CEEHDLR and CEE3GRC (Part 2 of 2)

```
CBL C,RENT,OPTIMIZE,NODYNAM,LIB,QUOTE
   *Module/File Name: IGZT3SRC
   ************************************************
   **                                            **
   ** DRV3SRC - Drive sample program for CEE3SRC. **
   **                                            **
   ************************************************
    IDENTIFICATION DIVISION.
    PROGRAM-ID. DRV3SRC.

    DATA DIVISION.
    WORKING-STORAGE SECTION.
    01  ROUTINE         PROCEDURE-POINTER.
    01  DENOMINATOR     PIC S9(9) BINARY.
    01  NUMERATOR       PIC S9(9) BINARY.
    01  RATIO           PIC S9(9) BINARY.
    01  TOKEN           PIC S9(9) BINARY VALUE 0.
    01  FC.
        02  Condition-Token-Value.
        COPY  CEEIGZCT.
            03  Case-1-Condition-ID.
                04  Severity    PIC S9(4) BINARY.
                04  Msg-No      PIC S9(4) BINARY.
            03  Case-2-Condition-ID
                      REDEFINES Case-1-Condition-ID.
                04  Class-Code  PIC S9(4) BINARY.
                04  Cause-Code  PIC S9(4) BINARY.
            03  Case-Sev-Ctl    PIC X.
            03  Facility-ID     PIC XXX.
        02  I-S-Info            PIC S9(9) BINARY.

    PROCEDURE DIVISION.

    REGISTER-HANDLER.
   ************************************************
   ** Register handler
   ************************************************
        SET ROUTINE TO ENTRY "CBL3SRC".
        CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
        IF  NOT CEE000 of FC  THEN
            DISPLAY "CEEHDLR failed with msg "
                Msg-No of FC UPON CONSOLE
            STOP RUN
        END-IF.

    RAISE-CONDITION.
   ************************************************
   ** Cause a zero-divide condition.
   ************************************************
        MOVE 0 TO DENOMINATOR.
        MOVE 1 TO NUMERATOR.
        DIVIDE NUMERATOR BY DENOMINATOR
               GIVING RATIO.
```

Figure 28. COBOL Condition Handler that Sets a User Enclave Return Code and Resumes when a Divide-by-Zero Condition Occurs (Part 1 of 3)

```
 UNREGISTER-HANDLER.
**************************************************
** UNregister handler
**************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.

     STOP RUN.
 END PROGRAM DRV3SRC.

**************************************************
**                                              **
** CBL3SRC - Call CEE3SRC to set the enclave  **
**                     return code              **
**                                              **
** This is an example of a user-written       **
** condition handler that sets a user         **
** enclave return code and resumes when       **
** a divide-by-zero condition occurs.         **
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. CBL3SRC.

 DATA DIVISION.

 WORKING-STORAGE SECTION.
 01  ENCLAVE-RC              PIC S9(9) BINARY.
 01  FEEDBACK.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
```

Figure 28. COBOL Condition Handler that Sets a User Enclave Return Code and Resumes when a Divide-by-Zero Condition Occurs (Part 2 of 3)

```
 LINKAGE SECTION.
 01  TOKEN                  PIC X(4).
 01  RESULT-CODE            PIC S9(9) BINARY.
     88 RESUME              VALUE +10.
     88 PERCOLATE           VALUE +20.
 01  CURRENT-CONDITION.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  NEW-CONDITION.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.

 PROCEDURE DIVISION USING CURRENT-CONDITION,
                          TOKEN, RESULT-CODE,
                          NEW-CONDITION.

 HANDLE-CONDITION.
**************************************************
** Check for divide-by-zero condition (CEE349)
**************************************************
     IF CEE349 of CURRENT-CONDITION  THEN
         MOVE 761 TO ENCLAVE-RC
         CALL "CEE3SRC" USING ENCLAVE-RC,
                              FEEDBACK
         IF NOT CEE000 of FEEDBACK  THEN
             DISPLAY "CEE3SRC failed with msg "
                 Msg-No of FEEDBACK UPON CONSOLE
         END-IF
     END-IF.
     SET PERCOLATE TO TRUE

     GOBACK.

 END PROGRAM CBL3SRC.
```

Figure 28. COBOL Condition Handler that Sets a User Enclave Return Code and Resumes when a Divide-by-Zero Condition Occurs (Part 3 of 3)

```
CBL LIB,QUOTE,C,RENT,OPTIMIZE,NODYNAM
      *Module/File Name: IGZTDIV
      ************************************************
      **                                            **
      **Function       :                            **
      **                                            **
      **     A divide by zero is attempted. This    **
      **  induces the invocation of user condition  **
      **  handler CESETRC registered in program     **
      **  CEGETRC.                                  **
      **               :                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID.   CERCDIV.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  TO-DIVIDE        PIC S9(9) BINARY VALUE 1.
       LINKAGE SECTION.
       01  IDIVISOR         PIC S9(9) BINARY.

       PROCEDURE DIVISION USING IDIVISOR.

      ************************************************
      **  divide a constant by IDIVISOR.            **
      ************************************************
           DIVIDE IDIVISOR INTO TO-DIVIDE.

           GOBACK.
       End program CERCDIV.
```

Figure 29. COBOL Subroutine that Generates a Divide-by-Zero

```
*Process lc(101),opt(0),s,map,list,stmt,a(f),ag,macro ;
 /*Module/File Name: IBMDIV                          */
 /****************************************************/
 /**                                                 */
 /** Function: CEE3SRC - Set the enclave return code */
 /**         : CEE3GRC - Get the enclave return code */
 /*                                                  */
 /* 1. A user ZERODIVIDE ON-unit is established by   */
 /*    CESETRC.                                      */
 /* 2. A sub-program, sdivide, is called and causes  */
 /*    a ZERODIVIDE condition to occur.              */
 /* 3. The ON-unit for ZERODIVIDE is entered.        */
 /*    The ON-unit calls CEE3GRC to get the current  */
 /*    enclave return code. It increments the return */
 /*    code by 4444, and sets the enclave return     */
 /*    code to this new value.                       */
 /* 4. On completion, the program prints the enclave */
 /*    return code.                                  */
 /****************************************************/
 CESETRC: Proc Options(Main)        ;

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL Enclave_RC REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 30. PL/I Example that Sets and Retrieves the User Enclave Return Code when a Divide-by-Zero is Generated (Part 1 of 2)

```
/*****************************************************/
/* A ZERODIVIDE ON-unit is established              */
/*****************************************************/
   on zerodivide begin;
      call CEE3GRC (Enclave_RC, fc);
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST( 'Original Enclave RC was '
            || Enclave_RC );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3GRC failed with msg '
            || FC.MsgNo );
         STOP;
         END;
      Enclave_RC = Enclave_RC + 4444;
      call CEE3SRC (Enclave_RC, fc);
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST( 'New Enclave RC is '
            || Enclave_RC );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3SRC failed with msg '
            || FC.MsgNo );
         STOP;
         END;
      goto resume;
   end;
/*****************************************************/
/* Call sdivide to cause a ZERODIVIDE condition.    */
/*****************************************************/
   call sdivide;
resume:
   put skip edit('Enclave return code is ',
         Enclave_RC)  (A, F(10));

/*****************************************************/
/* The sdivide routine causes a ZERODIVIDE condition*/
/*****************************************************/
sdivide: proc;
   dcl int fixed bin (15,0);
   dcl int_2 fixed bin (15,0) init(5);
   dcl int_3 fixed bin (15,0) init(0);
   int = int_2 / int_3;
end sdivide;

End cesetrc;
```

Figure 30. PL/I Example that Sets and Retrieves the User Enclave Return Code when a Divide-by-Zero is Generated (Part 2 of 2)

CEE3GRN—Get name of routine that incurred condition

CEE3GRN gets the name of the most current Language Environment-conforming routine where a condition occurred. If there are nested conditions, the most recently signaled condition is used.

Syntax

```
►►──CEE3GRN──(──name──,──fc──)──────────────────────────────►◄
```

name (output)
A fixed-length 80-character string (VSTRING), that contains the name of the routine that was executing when the condition was raised. *name* is left-justified within the field and right-padded with blanks. If there are nested conditions, the most recently activated condition is used to determine *name*.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE35S	1	3260	No condition was active when a call to a condition management routine was made.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEE3GRN gets the name of the routine that incurred the condition on the current thread.

Examples

```
/*Module/File Name: EDC3GRN   */

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

#ifdef __cplusplus
  extern "C" {
#endif
  void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
  }
#endif

int main(void) {

  _FEEDBACK fc,condtok;
  _ENTRY routine;
  _INT4 token,qdata;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;

 /* .
    .
    . */
  /* register condition handler */
  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;
  CEEHDLR(&routine,&token,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEHDLR failed with message number %d\n",
            fc.tok_msgno);
     exit (2999);
  }

 /* .
    .
    . */

  /* set up any condition sev 2 or higher */
  c_1 = 3;
  c_2 = 99;
  cond_case = 1;
  sev = 3;
  control = 0;
  memcpy(facid,"ZZZ",3);
  isi = 0;
```

Figure 31. C/C++ Example of CEE3GRN (Part 1 of 2)

```
  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /* signal condition */
  CEESGL(&condtok,&qdata,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESGL failed with message number %d\n",
            fc.tok_msgno);
     exit (2999);
  }
}

void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {

   _CHAR80 name;
   _FEEDBACK grnfc;

   /* get name of the routine that signal the        */
   /* condition                                      */
   CEE3GRN(name,&grnfc);
  if ( _FBCHECK ( grnfc , CEE000 ) != 0 ) {
     printf("CEESGL failed with message number %d\n",
            grnfc.tok_msgno);
     exit (2999);
  }

   printf("the routine that called this condition");
   printf(" handler is:\n %.80s\n",name);
   *result = 10;
   return;
}
```

Figure 31. C/C++ Example of CEE3GRN (Part 2 of 2)

```
CBL LIB,QUOTE,NOOPT
      *Module/File Name: IGZT3GRN
      ************************************************
      **                                            **
      ** DRV3GRN - Drive sample program for CEE3GRN. **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRV3GRN.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE           PROCEDURE-POINTER.
       01  DENOMINATOR       PIC S9(9) BINARY.
       01  NUMERATOR         PIC S9(9) BINARY.
       01  RATIO             PIC S9(9) BINARY.
       01  TOKEN             PIC S9(9) BINARY VALUE 0.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 32. COBOL Example of CEE3GRN (Part 1 of 4)

```
 REGISTER-HANDLER.
************************************************
** Register handler
************************************************
     SET ROUTINE TO ENTRY "CBL3GRN".
     CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
     IF  NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 RAISE-CONDITION.
************************************************
** Cause a zero-divide condition.
************************************************
     MOVE 0 TO DENOMINATOR.
     MOVE 1 TO NUMERATOR.
     DIVIDE NUMERATOR BY DENOMINATOR
            GIVING RATIO.

 UNREGISTER-HANDLER.
************************************************
** UNregister handler
************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.

     STOP RUN.
 END PROGRAM DRV3GRN.

************************************************
**                                            **
** CBL3GRN - Call CEE3GRN to get the name of   **
**           the routine that incurred         **
**           the condition.                    **
**                                            **
************************************************
```

Figure 32. COBOL Example of CEE3GRN (Part 2 of 4)

```
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3GRN.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  RNAME                  PIC X(80).
01  FC.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
LINKAGE SECTION.
01  TOKEN                  PIC S9(9) BINARY.
01  RESULT                 PIC S9(9) BINARY.
    88 RESUME                   VALUE 10.
01  CURCOND.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
01  NEWCOND.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
```

Figure 32. COBOL Example of CEE3GRN (Part 3 of 4)

```
 PROCEDURE DIVISION USING CURCOND, TOKEN,
                          RESULT, NEWCOND.
 PARA-CBL3GRN.
     CALL "CEE3GRN" USING RNAME, FC.
     IF  CEE000 of FC  THEN
         DISPLAY "Name of routine which "
             "incurred the condition is:  " RNAME
     ELSE
         DISPLAY "CEE3GRN failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 PARA-HANDLER.
**************************************************
** In user handler - resume execution
**************************************************
     SET RESUME TO TRUE.

     GOBACK.

 END PROGRAM CBL3GRN.
```

Figure 32. COBOL Example of CEE3GRN (Part 4 of 4)

```
*PROCESS OPT(0), MACRO;
 /* Module/File Name: IBM3GRN                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3GRN - example of CEE3GRN         **/
 /**                     invoked from PL/I ON-unit  **/
 /**                                                **/
 /****************************************************/

 IBM3GRN:  PROCEDURE  OPTIONS(MAIN);

   %INCLUDE CEEIBMAW;
   %INCLUDE CEEIBMCT;

   DECLARE
      RNAME       CHAR(80),
      01 FC,                       /* Feedback token */
         03 MsgSev    REAL FIXED BINARY(15,0),
         03 MsgNo     REAL FIXED BINARY(15,0),
         03 Flags,
            05 Case      BIT(2),
            05 Severity  BIT(3),
            05 Control   BIT(3),
         03 FacID     CHAR(3),        /* Facility ID */
         03 ISI     /* Instance-Specific Information */
                      REAL FIXED BINARY(31,0),
      divisor     FIXED BINARY(31) INITIAL(0);

   ON  ZERODIVIDE  BEGIN;

   /* Call CEE3GRN to get the name of the routine    */
   /*    that incurred the most recently signalled   */
   /*    condition                                   */

      CALL CEE3GRN ( RNAME, FC );
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST( 'The most recently signalled '
            || 'condition was incurred by ' || RNAME );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3GRN failed with msg '
            || FC.MsgNo );
         END;

      END /* ON ZeroDivide */;


   divisor = 15 / divisor  /* signals ZERODIVIDE */;

 END IBM3GRN;
```

Figure 33. PL/I Example of CEE3GRN

CEE3GRO—Get offset of condition

The CEE3GRO service returns the offset within a failing routine of the most recent condition. If there are nested conditions, the most recently signaled condition is returned.

Syntax

```
►►──CEE3GRO──(──cond_offset──,──fc──)──────────────────────────────────►◄
```

cond_offset (output)
An INT4 data type that, upon completion of this service, contains the offset within a failing routine of the most recent condition.

fc (output, optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE35S	1	3260	No condition was active when a call to a condition management routine was made.

Examples

```
CBL  LIB,QUOTE,NOOPT
      *Module/File Name: IGZT3GRO
      ************************************************
      **                                            **
      ** DRV3GRO - Register a condition handler     **
      **           that calls CEE3GRO to determine  **
      **           the offset in the program that   **
      **           incurred the condition.          **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID.  DRV3GRO.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE      PROCEDURE-POINTER.
       01  DENOMINATOR  PIC S9(9) BINARY.
       01  NUMERATOR    PIC S9(9) BINARY.
       01  RATIO        PIC S9(9) BINARY.
       01  TOKEN        PIC S9(9) BINARY VALUE 0.
       01  FC.
           02  Condition-Token-Value.
           COPY CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                     REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 34. COBOL Example of CEE3GRO (Part 1 of 4)

```
 REGISTER-HANDLER.
**************************************************
** Register handler
**************************************************
     SET ROUTINE TO ENTRY "CBL3GRO".
     CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC THEN
        DISPLAY "CEEHDLR failed with msg "
                Msg-No of FC UPON CONSOLE
        STOP RUN
     END-IF.

 RAISE-CONDITION.
**************************************************
** Cause a zero-divide condition
**************************************************
     MOVE 0 TO DENOMINATOR.
     MOVE 1 TO NUMERATOR.
     DIVIDE NUMERATOR BY DENOMINATOR
        GIVING RATIO.

 UNREGISTER-HANDLER.
**************************************************
** Unregister handler
**************************************************
     CALL "CEEHDLU" USING ROUTINE, FC.
     IF NOT CEE000 of FC THEN
        DISPLAY "CEEHDLU failed with msg "
                Msg-No of FC UPON CONSOLE
        STOP RUN
     END-IF.

     STOP RUN.
 END PROGRAM DRV3GRO.

***********************************************
**                                           **
** CBL3GRO - Call CEE3GRO to get the offset  **
**           in the routine that incurred    **
**           the condition.                  **
**                                           **
***********************************************
```

Figure 34. COBOL Example of CEE3GRO (Part 2 of 4)

```
IDENTIFICATION DIVISION.
PROGRAM-ID.  CBL3GRO.

DATA DIVISION.
WORKING-STORAGE SECTION.
01  ROFFSET  PIC S9(9) BINARY.
01  FC.
    02  Condition-Token-Value.
    COPY CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
              REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
LINKAGE SECTION.
01  TOKEN        PIC S9(9) BINARY.
01  RESULT       PIC S9(9) BINARY.
    88  RESUME   VALUE 10.
01  CURCOND.
    02  Condition-Token-Value.
    COPY CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
              REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
01  NEWCOND.
    02  Condition-Token-Value.
    COPY CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
              REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
```

Figure 34. COBOL Example of CEE3GRO (Part 3 of 4)

```
       PROCEDURE DIVISION USING CURCOND, TOKEN,
                                RESULT, NEWCOND.
       PARA-CBL3GRO.
           CALL "CEE3GRO" USING ROFFSET, FC.
           IF CEE000 of FC THEN
              DISPLAY "Offset in routine which "
                      "incurred the condition is:  "
                      ROFFSET
           ELSE
              DISPLAY "CEE3GRO failed with msg "
                      Msg-No of FC UPON CONSOLE
           END-IF.

       PARA-HANDLER.
      ************************************************
      **  In user handler - resume execution
      ************************************************
           SET RESUME TO TRUE.

           GOBACK.
       END PROGRAM CBL3GRO.
```

Figure 34. COBOL Example of CEE3GRO (Part 4 of 4)

```
*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
 DRV3GRO: Proc Options(Main);

   /*Module/File Name: IBM3GRO                        */
   /**************************************************
    **                                                *
    ** DRV3GRO - Register a condition handler that    *
    **           calls CEE3GRO to determine           *
    **           the offset in the routine that       *
    **           incurred the condition.              *
    **                                                *
    **************************************************/

    %include CEEIBMCT;
    %include CEEIBMAW;
    declare 01 FBCODE    feedback;
    declare DENOMINATOR  real fixed binary(31,0);
    declare NUMERATOR    real fixed binary(31,0);
    declare RATIO        real fixed binary(31,0);
    declare PLI3GRO      external entry;
    declare U_PTR        pointer;
    declare 01 U_DATA,
              03 U_CNTL  fixed binary(31,0),
              03 U_TOK   pointer;

    U_PTR = addr(U_DATA);
    U_CNTL = 0;

    /* Set Resume Point              */
```

Figure 35. PL/I Example of CEE3GRO (Part 1 of 3)

```
   Display('Setting resume point via CEE3SRP');
   Call CEE3SRP(U_TOK,FBCODE);
   Display('After call to CEE3SRP ... Resume point');
   If U_CNTL = 0
     Do;
       Display('First time through...');

       /* Register User Handler  */

       Display('Registering user handler');
       Call CEEHDLR(PLI3GRO, U_PTR, FBCODE);
       If FBCHECK(FBCODE, CEE000) then
         Do;
           /* Cause a zero-divide condition  */
           DENOMINATOR = 0;
           NUMERATOR = 1;
           RATIO = NUMERATOR/DENOMINATOR;
         End;
       Else
         Do;
           Display('CEEHDLR failec with msg');
           Display(MsgNo);
         End;
     End;
   Else
     Display('2nd time...User can do whatever');

   /* Unregister handler  */

   Call CEEHDLU(PLI3GRO, FBCODE);
   If FBCHECK (FBCODE, CEE000) Then
     Display('Main: unregistered PLI3GRO);
   Else
     Do;
       Display('CEEHDLU failed with msg ');
       Display(MsgNo);
     End;
 End DRV3GRO;
```

Figure 35. PL/I Example of CEE3GRO (Part 2 of 3)

```
*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
 PLI3GRO: Proc (PTR1,PTR2,PTR3,PTR4);
   /**************************************************
    **                                              *
    ** PLI3GRO - Call CEE3GRO to get the offset in   *
    **           the routine that incurred the      *
    **           condition.                         *
    **                                              *
    **************************************************/

    %include CEEIBMCT;
    %include CEEIBMAW;
    declare (PTR1,PTR2,PTR3,PTR4) pointer;
    declare 01 CURCOND based(PTR1) feedback;
    declare TOKEN      pointer based(PTR2);
    declare RESULT     fixed binary(31,0) based(PTR3);
    declare 01 NEWCOND based(PTR4) feedback;
    declare ROFFSET    real fixed binary(31,0);
    declare 01 FBCODE  feedback;
    declare 01 U_DATA  based(TOKEN),
             03 U_CNTL fixed binary(31,0),
             03 U_TOK  pointer;

         Call CEE3GRO(ROFFSET,FBCODE);
         If fbcheck (fbcode, cee000) Then
           Do;
             Display('Routine offset which incurred');
             Display('the condition is: ');
             Display(ROFFSET);
           End;
         Else
           Do;
             Display('CEE3GRO failed with msg ');
             Display(FBCODE.MsgNo);
           End;

   /**************************************************
    ** In user handler - resume execution            *
    **************************************************/

         RESULT = 10;
         Call CEEMRCE(U_TOK,FBCODE);
         U_CNTL = 1;
         Return;
 End PLI3GRO;
```

Figure 35. PL/I Example of CEE3GRO (Part 3 of 3)

CEE3LNG—Set national language

CEE3LNG sets the current national language. You can also use CEE3LNG to query the current national language. Changing the national language changes the languages in which error messages are displayed and printed, the names of the days of the week, and the names of the months.

The current national language setting, as well as previous national language settings that have not been discarded, are recorded on the stack on a LIFO (last in, first out) basis. The current national language setting is always on the top of the stack.

There are two methods of changing the default national language setting with CEE3LNG:

- Specify the new national language setting and place it on top of the stack using a *function* value of 1 (SET). This discards the previous default setting.
- Specify the new national language setting and place it on top of the stack using a *function* value of 3 (PUSH). This pushes the previous national language setting down on the stack so that you can later retrieve it by discarding the current setting.

To illustrate the second method, suppose you live in the United States and the code for the United States is specified as the default at installation. If you want to use the French defaults for a certain application, you can use CEE3LNG to PUSH France as the national language setting; then when you want the defaults for the United States, you can POP France from the top of the stack, making the United States the national language setting.

If you specify a *desired_language* not available on your system, the IBM-supplied default *desired_language* is used. In Language Environment, this is ENU (mixed-case U.S. English). CEEUOPT, CEEROPT and CEEDOPT can specify an unknown national language code. They give a return code of 4 and a warning message. If an invalid language is specified, the IBM-supplied default ENU (mixed-case U.S. English) is used.

You can also use the NATLANG run-time option to set the national language.

CEE3LNG affects only the Language Environment NLS and date and time services, not the Language Environment locale callable services or C locale-sensitive functions.

Syntax

```
►►──CEE3LNG──(──function──,──desired_language──,──fc──)──────────────────►◄
```

function (input)

A fullword binary integer that specifies the service to perform. The possible values for *function* are:

1—SET Establishes the *desired_language* specified in the call to CEE3LNG as the current language. In effect, it replaces the current language on the top of the stack with the *desired_language* that you specify.

When setting the national language, the *desired_language* is folded to uppercase. "enu" and "ENU", for example, are considered to be the same national language.

2—QUERY Identifies the current language on the top of the stack to the calling routine by returning it in the *desired_language* parameter of CEE3LNG. The *desired_language* retained as the result of the QUERY function is in uppercase.

3—PUSH Pushes the *desired_language* specified in the call to CEE3LNG on to the top of the language stack, making it the current

language. Previous languages are retained on the stack on a LIFO basis, making it possible to return to a prior language at a later time.

4—POP Pops the current language off the stack. The previous language that was pushed on to the stack now becomes the new current language. Upon return to the caller, the *desired_language* parameter contains the discarded language. If the stack contains only one language and would be empty after the call, no action is taken and a feedback code indicating such is returned.

desired_language (input/output)
A 3-character fixed-length string. The string is not case-sensitive and is used in the following ways for different *functions*:

If *function* **is specified as:**	**Then** *desired_language***:**
1 or 3	Contains the desired national language identification. In this case, it is an input parameter. Table 22 on page 172 contains a list of national language identifiers. **Note:** Language Environment supports only these national languages: **ENU** Mixed-case U.S. English **UEN** Uppercase U.S. English **JPN** Japanese.
2	Returns the current language on top of the stack. In this case, it is an output parameter.
4	Returns the discarded national language. In this case, it is an output parameter.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	**Severity**	**Message Number**	**Message Text**
CEE000	0	—	The service completed successfully.
CEE3BQ	2	3450	Only one language was on the stack when a POP request was made to CEE3LNG. The current language was returned in the
CEE3BR	3	3451	The desired language *desired-language* for the PUSH or SET function for CEE3LNG was invalid. No operation was performed.
CEE3BS	3	3452	The function *function* specified for CEE3LNG was not recognized. No operation was performed.

Usage notes

- C/C++ consideration—Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale

callable services, such as date and time formatting, sorting, and currency symbols. To change the locale, you can use the `setlocale()` library function or the CEESETL callable service.

The settings of CEESETL or `setlocale()` do not affect the setting of the CEE3LNG callable service. CEE3LNG affects only Language Environment NLS and date and time services. `setlocale()` and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.

To ensure that all settings are correct for your country, use CEE3LNG and either CEESETL or `setlocale()`.

- PL/I MTF consideration—The CEE3LNG callable service is not supported in PL/I multitasking applications.
- PL/I consideration—When running PL/I with POSIX(ON), CEE3LNG is not supported.
- z/OS UNIX consideration—CEE3LNG applies to the enclave. Each enclave has a single current national language setting.

For more information

- See “NATLANG” on page 47 for more information about the NATLANG run-time option.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 444.
- For more information on `setlocale()`, see *z/OS C/C++ Programming Guide*.

Examples

```
/*Module/File Name: EDC3LNG   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4 function;
  _CHAR3 lang;

  /* Query the current language setting */
  function = 2; /* function 2 is query */
  CEE3LNG(&function,lang,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEE3LNG failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /* if the current language is not mixed-case */
  /* American English set the current language to */
  /* mixed-case American English */
  if (memcmp(lang,"ENU",3) != 0) {
     memcpy(lang,"ENU",3);
     function = 1; /* function 1 is set */
     CEE3LNG(&function,lang,&fc);
     if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3LNG failed with message number %d\n",
               fc.tok_msgno);
        exit(2999);
     }
  }
}
```

Figure 36. C/C++ Example of CEE3LNG

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3LNG
      ************************************************
      **                                            **
      ** CBL3LNG - Set national language            **
      **                                            **
      ** In this example, CEE3LNG is called to query **
      ** the current national language setting. If   **
      ** the setting is not mixed-case U.S. English, **
      ** CEE3LNG is called to change the setting.    **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3LNG.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  FUNCTN                  PIC S9(9) BINARY.
       01  LANG                    PIC X(3).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 37. COBOL Example of CEE3LNG (Part 1 of 2)

```
 PARA-3LNGQRY.
**************************************************
** Specify 2 for QUERY function.
** Call CEE3LNG to query the current
**     national language setting
**************************************************
     MOVE 2 TO FUNCTN.
     CALL "CEE3LNG" USING FUNCTN, LANG, FC.
     IF CEE000 of FC  THEN
         DISPLAY "Current National Language is: "
             LANG
     ELSE
         DISPLAY "CEE3LNG(query) failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 PARA-3LNGSET.
**************************************************
** If the current national language is not
**     mixed-case U.S. English, then call
**     CEE3LNG with the SET function (1) to
**     change the national language to mixed-case
**     U.S. English
**************************************************
     IF ( LANG IS NOT  = "ENU" )  THEN
         MOVE 1 TO FUNCTN
         CALL "CEE3LNG" USING FUNCTN, LANG, FC
         IF NOT CEE000 of FC  THEN
             DISPLAY "CEE3LNG(set) failed with msg "
                 Msg-No of FC UPON CONSOLE
             STOP RUN
         END-IF
         DISPLAY "The national language has ",
             "been changed to mixed-case "
             "U.S. English (ENU)."
     END-IF.

     GOBACK.
```

Figure 37. COBOL Example of CEE3LNG (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBM3LNG                          */
 /****************************************************/
 /**                                                  */
 /** Function: CEE3LNG - set national language        */
 /**                                                  */
 /** In this example, CEE3LNG is called to query the */
 /** current national language setting.  If the      */
 /** setting is not mixed case American English,     */
 /** CEE3LNMG is called to change the setting to that*/
 /**                                                  */
 /****************************************************/
 PLI3LNG: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL FUNCTN  REAL FIXED BINARY(31,0);
    DCL LANG    CHARACTER ( 3 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    FUNCTN = 2; /* Specify code to query current     */
                /* national language                 */

    /* Call CEE3LNG with function code 2 to query    */
    /*    national language                          */

    CALL CEE3LNG ( FUNCTN, LANG, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST('The current national language '
          || 'is ' || LANG );
       END;
    ELSE  DO;
       DISPLAY('CEE3LNG failed with msg ' || FC.MsgNo);
       STOP;
       END;
```

Figure 38. PL/I Example of CEE3LNG (Part 1 of 2)

```
   /* If the current language is not mixed-case     */
   /*    American English, set it to mixed-case     */
   /*    American English                           */

   IF  LANG ¬=  'ENU'  THEN DO;
      FUNCTN = 1;
      CALL CEE3LNG ( FUNCTN, 'ENU', FC);
      IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
         DISPLAY( 'CEE3LNG failed with msg '
            || FC.MsgNo );
         STOP;
         END;
      CALL CEE3LNG ( 2, LANG, FC);
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST('The national language is now '
            || LANG );
         END;
      ELSE  DO;
         DISPLAY( 'CEE3LNG failed with msg '
            || FC.MsgNo );
         STOP;
         END;

      END /* Language is not ENU */;

 END PLI3LNG;
```

Figure 38. PL/I Example of CEE3LNG (Part 2 of 2)

Table 22. National Language Codes

ID	National Language
AFR	Afrikaans
ARA	Arab countries
BGR	Bulgarian
CAT	Catalan
CHT	Traditional Chinese
CHS	Simplified Chinese
CSY	Czech
DAN	Danish
DEU	German
DES	Swiss German
ELL	Greek
ENG	U.K. English
ENU	U.S. English
ESP	Spanish
FIN	Finnish
FRA	French
FRB	Belgian French
FRC	Canadian French
FRS	Swiss French
HEB	Hebrew
HUN	Hungarian
ISL	Icelandic
ITA	Italian
ITS	Swiss Italian
JPN	Japanese
KOR	Korean

Table 22. National Language Codes (continued)

ID	National Language
NLD	Dutch
NLB	Belgian Dutch
NOR	Norwegian - Bokmal
NON	Norwegian - Nynorsk
PLK	Polish
PTG	Portuguese
PTB	Brazilian Portuguese
RMS	Rhaeto-Romanic
ROM	Romanian
RUS	Russian
SHC	Serbo-Croatian (Cyrillic)
SHL	Serbo-Croatian (Latin)
SKY	Slovakian
SQI	Albanian
SVE	Swedish
THA	Thai
TRK	Turkish
UEN	U.S. uppercase English
URD	Urdu

CEE3MCS—Get default currency symbol

CEE3MCS returns the default currency symbol for the country you specify with *country_code*. For a list of the default settings for a specified country, see Table 27 on page 513.

Syntax

```
►►──CEE3MCS──(──country_code──,──currency_symbol──,──fc──)──────────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY run-time option or the CEE3CTY callable service, is used.

currency_symbol (output)
A 4-character fixed-length string returned to the calling routine. It contains the default currency symbol for the country specified. The currency symbol is left-justified and padded on the right with blanks, if necessary.

fc (output)
A feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

Code	Severity	Message Number	Message Text
CEE3C6	2	3462	The currency symbol *currency_symbol* was truncated and was not defined in CEE3MCS.
CEE3C7	2	3463	The country code *country_code* was invalid for CEE3MCS. The default currency symbol *currency_symbol* was returned.

Usage notes

- If you specify an invalid *country_code*, the default currency symbol is X'9F404040'. In the United States, it is shown as a '$'followed by three blanks.
- z/OS UNIX considerations—CEE3MCS applies to the enclave. Every enclave has a single current country setting that has a single currency symbol. Every thread in every enclave has the same default.

For more information

- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

```
/*Module/File Name: EDC3MCS   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _CHAR2 country,currency;

   /* get the default currency symbol for Canada */
   memcpy(country,"CA",2);
   CEE3MCS(country,currency,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3MCS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   printf("The default currency symbol for Canada is:"
          " %.2s\n",currency);
}
```

Figure 39. C/C++ Example of CEE3MCS

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3MCS
      ************************************************
      **                                            **
      ** CBL3MCS - Call CEE3MCS to obtain the       **
      **           default currency symbol          **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3MCS.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  CURSYM                 PIC X(2).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       PARA-CBL3MCS.
      ************************************************
      ** Specify country code for the US in the call
      **     to CEE3MCS
      ************************************************
           MOVE "US" TO COUNTRY.
           CALL "CEE3MCS" USING COUNTRY, CURSYM, FC.

      ************************************************
      ** If CEE3MCS runs successfully, display result.
      ************************************************
           IF CEE000 of FC  THEN
               DISPLAY "The default currency symbol "
                   "for the " COUNTRY " is: " CURSYM
           ELSE
               DISPLAY "CEE3MCS failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 40. COBOL Example of CEE3MCS

```
*PROCESS MACRO;
 /* Module/File Name: IBM3MCS                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3MCS - Obtain default currency    **/
 /**                     symbol                     **/
 /**                                                **/
 /****************************************************/
 PLI3MCS: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;
    DCL COUNTRY  CHARACTER ( 2 );
    DCL CURSYM   CHARACTER ( 4 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US'; /* Specify country code for the  */
                    /* United States                 */

    /* Call CEE3MCS to return currency symbol for    */
    /*    the United States                          */
    CALL CEE3MCS ( COUNTRY, CURSYM, FC );

    /* Print the default currency symbol for the US  */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'The default currency symbol for the '
          || COUNTRY || ' is "' || CURSYM || '"');
       END;
    ELSE  DO;
       DISPLAY( 'CEE3MCS failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLI3MCS;
```

Figure 41. PL/I Example of CEE3MCS

CEE3MDS—Get default decimal separator

CEE3MDS returns the default decimal separator for the country specified by *country_code*. For a list of the default settings for a specified country, see Table 27 on page 513.

Syntax

```
►►──CEE3MDS──(──country_code──,──decimal_separator──,──fc──)──────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY run-time option or the CEE3CTY callable service, is used.

decimal_separator (output)
A 2-character fixed-length string containing the default decimal separator for the country specified. The decimal separator is left-justified and padded on the right with a blank.

fc (output)
A 12-byte feedback code, optional in some languages, indicating the service result.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE3C4	2	3460	The decimal separator '*decimal-separator*' was truncated and was not defined in CEE3MDS.
CEE3C5	2	3461	The country code *country-code* was invalid for CEE3MDS. The default decimal separator '*decimal-separator*' was returned.

Usage notes

- If you specify an invalid *country_code*, the default decimal separator is a period (.).
- z/OS UNIX considerations—CEE3MDS applies to the enclave. Every enclave has a single current country setting that has a single decimal separator. Every thread in every enclave has the same default.

For more information

- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

```
/*Module/File Name: EDC3MDS   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _CHAR2 country,decimal;

   /* get the default decimal separator for Canada */
   memcpy(country,"CA",2);
   CEE3MDS(country,decimal,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3MDS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   /* print out the default decimal separator */
   printf("The default decimal separator for");
   printf(" Canada is: %.2s\n",decimal);
}
```

Figure 42. C/C++ Example of CEE3MDS

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3MDS
      ************************************************
      **                                            **
      ** CBL3MDS - Call CEE3MDS to get the          **
      **           default decimal separator        **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3MDS.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  DECSEP                 PIC X(2).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

      ************************************************
      ** Specify the country code for the US in the
      **     call to CEE3MDS.
      ** If call was successful, print result.
      ************************************************
       PARA-CBL3MDS.
           MOVE "US" TO COUNTRY.
           CALL "CEE3MDS" USING COUNTRY, DECSEP, FC.
           IF CEE000 of FC  THEN
               DISPLAY "The default Decimal Separator "
                   "for " COUNTRY " is "" DECSEP """
           ELSE
               DISPLAY "CEE3MDS failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 43. COBOL Example of CEE3MDS

```
*PROCESS MACRO;
 /* Module/File Name: IBM3MDS                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3MDS - get default decimal        **/
 /**           separator                            **/
 /****************************************************/
 PLI3MDS: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL COUNTRY  CHARACTER ( 2 );
    DCL DECSEP   CHARACTER ( 2 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US';     /* Specify country code for  */
                        /* the United States         */

    /* Call CEE3MDS to get default decimal           */
    /*    separator for the US                       */
    CALL CEE3MDS ( COUNTRY, DECSEP, FC );

    /*     Print the default decimal separator for   */
    /* the US             */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'The default decimal separator for the '
          || COUNTRY || ' is "' || DECSEP || '"' );
       END;
    ELSE  DO;
       DISPLAY( 'CEE3MDS failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLI3MDS;
```

Figure 44. PL/I Example of CEE3MDS

CEE3MTS—Get Default thousands separator

CEE3MTS returns the default thousands separator for the specified country with *country_code*.

Syntax

```
►►──CEE3MTS──(──country_code──,──thousands_separator──,──fc──)──────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY run-time option or the CEE3CTY callable service, is used.

thousands_separator (output)
A 2-character fixed-length string representing the default thousands separator for the country specified. The thousands separator is left-justified and padded on the right with a blank.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE3C8	2	3464	The thousands separator '*thousands-separator*' was truncated and was not defined in CEE3MTS.
CEE3C9	2	3465	The country code *country-code* was invalid for CEE3MTS. The default thousands separator '*thousands-separator*' was returned.

Usage notes

- If you specify an invalid *country_code*, the default thousands separator is a comma (,).
- z/OS UNIX considerations—CEE3MTS applies to the enclave. Every enclave has a single current country setting that has a single thousands separator. Every thread in every enclave has the same default.

For more information

- For a list of the default settings for a specified country, see Table 27 on page 513.
- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

```
/*Module/File Name: EDC3MTS   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _CHAR2 country,thousand;

   /* get the default thousands separator for Canada */
   memcpy(country,"CA",2);
   CEE3MTS(country,thousand,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3MTS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   /* print out the default thousands separator */
   printf("The default thousands separator for Canada");
   printf(" is:  %.2s\n",thousand);
}
```

Figure 45. C/C++ Example of CEE3MTS

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3MTS
      ************************************************
      **                                            **
      ** CBL3MTS - Call CEE3MTS to obtain the       **
      **           default thousands separator      **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3MTS.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  THOUSEP                PIC X(2).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       PARA-CBL3MTS.
      ************************************************
      ** Specify the country code for the US in the
      **     call to CEE3MTS.
      ************************************************
           MOVE "US" TO COUNTRY.
           CALL "CEE3MTS" USING COUNTRY, THOUSEP, FC.

      ************************************************
      ** If CEE3MTS runs successfully, display result
      ************************************************
           IF CEE000 of FC  THEN
               DISPLAY "The default Thousands Separator"
                   " for " COUNTRY " is "" THOUSEP """
           ELSE
               DISPLAY "CEE3MDS failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 46. COBOL Example of CEE3MTS

```
*PROCESS MACRO;
 /* Module/File Name: IBM3MTS                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3MTS - obtain default thousands   **/
 /** separator                                      **/
 /**                                                **/
 /****************************************************/
 PLI3MTS: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL COUNTRY  CHARACTER ( 2 );
    DCL THOUSEP  CHARACTER ( 2 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US';   /* Specify US as the country   */
                      /* code for the United States  */

    /* Call CEE3MTS to return default thousands      */
    /*    separator for the US                       */
    CALL CEE3MTS ( COUNTRY, THOUSEP, FC );

    /* If CEE3MTS ran successfully print out result  */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'The default thousands separator for the '
          || COUNTRY || ' is "' || THOUSEP || '"' );
       END;
    ELSE  DO;
       DISPLAY( 'CEE3MTS failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLI3MTS;
```

Figure 47. PL/I Example of CEE3MTS

CEE3PRM—Query parameter string

CEE3PRM queries and returns to the calling routine the parameter string specified at invocation of the program. The returned parameter string contains only program arguments. If no program arguments are available, a blank string is returned.

Syntax

```
►►──CEE3PRM──(──char_parm_string──,──fc──)──────────────────────────►◄
```

char_parm_string (output)
An 80-byte fixed-length string passed by CEE3PRM.

On return from this service, the *char_parm_string* contains the parameter string specified at invocation of the program. If this parameter string is longer than 80 characters, it is truncated. If the parameter string is shorter than 80 characters, the returned string is padded with blanks. If the program argument passed to the service is absent, or is not a character string, *char_parm_string* is blank.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3I1	1	3649	The parameter string returned from CEE3PRM exceeded the maximum length of 80 bytes and was truncated.

Usage notes

- C/C++ consideration—C/C++ users can use the `__osplist` to return a program argument longer than 80 characters.
- z/OS UNIX considerations—CEE3PRM is allowed only in the initial thread.
- COBOL consideration— COBOL users can use the the following coding example to return a program argument longer than 80 characters: Linkage Section. 01 Passed-Parm. 05 Parm-Length Pic 9(4) BINARY. 05 Full-Data. 10 Each-byte OCCURS 1 to 255 TIMES DEPENDING ON Parm-Length PIC X. Procedure Division Using Passed-Parm. DISPLAY ’Input parameters are: ’ Full-data. Goback.

Examples

```
/*Module/File Name: EDC3PRM   */

#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

int main() {

   _CHAR80 parm;
   _FEEDBACK fc;

   CEE3PRM(parm,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3PRM failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   printf("%.80s\n",parm);
}
```

Figure 48. C/C++ Example of CEE3PRM

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3PRM
      ************************************************
      **                                            **
      ** CBL3PRM - Call CEE3PRM to query the        **
      **           parameter string                 **
      **                                            **
      ** In this example, a call is made to         **
      ** CEE3PRM to return the parameter string     **
      ** that was specified at invocation of the    **
      ** program. The string is then displayed.     **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3PRM.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  PARMSTR                PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       PARA-CBL3PRM.
           CALL "CEE3PRM" USING PARMSTR, FC.
           IF CEE000 THEN
               DISPLAY "Program arguments specified: "
                "'" PARMSTR "'"
           ELSE
               DISPLAY "CEE3PRM failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 49. COBOL Example of CEE3PRM

```
*PROCESS MACRO;
 /* Module/File Name: IBM3PRM                          */
 /****************************************************/
 /**                                                  **/
 /** Function: CEE3PRM - Query Parameter String     **/
 /**                                                  **/
 /****************************************************/
 PLI3PRM: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL PARMSTR CHAR(80);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

   /* Call CEE3PRM to return the program arguments   */
   /* specified at invocation of the program         */
    CALL CEE3PRM ( PARMSTR, FC );

   /* There are no non-zero feedback codes to        */
   /* check, so print result                         */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'These program arguments were specified:  "'
          || PARMSTR || '"');
       END;
    ELSE  DO;
       DISPLAY( 'CEE3PRM failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLI3PRM;
```

Figure 50. PL/I Example of CEE3PRM

CEE3RPH—Set report heading

CEE3RPH sets the heading displayed at the top of the storage or options report generated when you specify the RPTSTG(ON) or RPTOPTS(ON) run-time options. Figure 3 on page 64 contains a sample storage report and Figure 2 on page 61 contains a sample options report.

Syntax

```
►►──CEE3RPH──(──report_heading──,──fc──)──────────────────────────────►◄
```

report_heading (input)
An 80-character fixed-length string.

report_heading sets the identifying character string displayed at the top of the storage or options report. Language Environment uses only the first 79 bytes of *report_heading*; the last byte is ignored. *report_heading* can contain DBCS characters surrounded by X'0E' (shift-out) and X'0F' (shift-in).

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Feedback Code (fc)	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE3JK	0	3700	The storage and options report heading replaced a previous heading.

Usage notes

- PL/I considerations—CEE3RPH is designed to provide an equivalent function to the special PL/I variable PLIXHD.
- z/OS UNIX considerations—CEE3RPH applies to the enclave.

For more information

- See “RPTSTG” on page 62 for more information about the RPTSTG run-time option.
- See “RPTOPTS” on page 59 for more information about the RPTOPTS run-time option.
- See *PL/I for MVS & VM Programming Guide* for further information on PLIXHD.

Examples

```
/*Module/File Name: EDC3RPH   */

#pragma runopts(RPTOPTS(ON))
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _CHAR80   heading;

   /* initialize heading to blanks and then set the */
   /* heading */
   memset(heading,' ',80);
   memcpy(heading,"User Defined Report Heading",27);

   /* set the report heading...do not need to check */
   /* feedback token because all return codes are */
   /* successful */
   CEE3RPH(heading,NULL);
  /* .
     .
     . */
}
```

Figure 51. C/C++ Example of CEE3RPH

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3RPH
      ************************************************
      **                                            **
      ** CBL3RPH - Call CEE3RPH to set report heading**
      **                                            **
      ** In this example, a call is made to CEE3RPH  **
      ** to set the report heading that appears at   **
      ** the top of each page of the options report  **
      ** (generated by RPTOPTS) and storage report   **
      ** (generated by RPTSTG).                      **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3RPH.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  RPTHEAD                PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

      ************************************************
      ** Specify user-defined report heading via CEE3RPH
      ************************************************
       PARA-CBL3RPH.
           MOVE "My options and storage reports heading"
               TO RPTHEAD.
           CALL "CEE3RPH" USING RPTHEAD, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEE3RPH failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 52. COBOL Example of CEE3RPH

```
*PROCESS MACRO;
 /* Module/File Name: IBM3RPH                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEE3RPH - set report heading        **/
 /**                                              **/
 /**************************************************/
 PLI3RPH: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL RPTHEAD  CHAR(80);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Define report heading                         */
    RPTHEAD = 'My storage report heading';

    /* Set report heading in call to CEE3RPH         */
    CALL CEE3RPH ( RPTHEAD, FC );

    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Report heading now set to "'
          || RPTHEAD || '"' );
       END;
    ELSE  DO;
       DISPLAY( 'CEE3RPH failed with msg '
          || FC.MsgNo );
       STOP;
       END;


 END PLI3RPH;
```

Figure 53. PL/I Example of CEE3RPH

CEE3SPM—Query and modify Language Environment hardware condition enablement

CEE3SPM queries and modifies the enablement of Language Environment hardware conditions. You can use the CEE3SPM service to:

- Alter the settings of the Language Environment conditions, using an *action* value of 1 (SET), to those specified by the caller.
- Query the current settings of the Language Environment conditions and return the settings to the caller.
- Push the current settings of the Language Environment conditions on to the condition stack using an *action* value of 3 (PUSH). This pushes the current setting down on the stack for later retrieval, and, in effect, places a copy of the current setting on top of the stack. It does not alter the current condition settings.

- Pop the pushed settings of the Language Environment conditions from the condition stack using an *action* value of 4 (POP). This reinstates the previous condition settings as the current condition settings.
- Push the current settings of the Language Environment conditions on to the Language Environment-managed condition stack and alter the settings of the Language Environment conditions to those supplied by the caller.

The enabled or disabled Language Environment conditions are:

fixed-overflow
When enabled, raises the fixed-overflow condition when an overflow occurs during signed binary arithmetic or signed left-shift operations.

decimal-overflow
When enabled, raises the decimal-overflow condition when one or more nonzero digits are lost because the destination field in a decimal operation is too short to contain the results.

underflow
When enabled, raises the underflow condition when the result characteristic of a floating-point operation is less than zero and the result fraction is not zero. For an extended-format floating-point result, the condition is raised only when the high-order characteristic underflows.

significance
When enabled, raises the significance condition when the resulting fraction in floating-point addition or subtraction is zero.

When you use the CEE3SPM callable service, maintenance of the condition stack is required. For example, one user-written condition handler can disable a hardware condition while another enables it. Therefore, do not assume that the program mask is at a given setting. The program mask is set differently based on different HLL requirements. You can find out what the current setting is by using the QUERY function of CEE3SPM.

Language Environment initialization sets conditions based on the languages in the initial load module. Each language present adds to the conditions that are enabled.

Some S/370 hardware interrupt codes and their matching Language Environment feedback codes appear in Table 23 on page 193.

Syntax

```
►►──CEE3SPM──(──action──,──cond_string──,──fc──)──────────────────────────►◄
```

action (input)
The action to be performed. *action* is specified as a fullword binary signed integer corresponding to one of the numbers in the following list:

1—SET
Alters the settings of the Language Environment conditions to those specified in the *cond_string* parameter.

2—QUERY
Queries the current settings of the Language

	Environment conditions and return the settings in the *cond_string* parameter.
3—PUSH	Pushes the current settings of the Language Environment conditions on to the Language Environment-managed condition stack.
4—POP	Pops the pushed settings of the Language Environment conditions from the condition stack, discarding the current settings, and reinstating the previous condition settings as the current condition settings.
5—PUSH, SET	Pushes the current settings of the Language Environment conditions on to the Language Environment-managed condition stack and alters the settings of the Language Environment conditions to those supplied by the caller in the *cond_string* parameter.

cond_string (input/output)
A fixed-length string of 80 bytes containing a sequence of identifiers representing the requested settings for the Language Environment conditions that can be enabled and disabled.

A list of conditions enabled and disabled and their associated identifiers is given below:

Condition	Identifier
fixed-overflow	F (NOF for disablement)
decimal-overflow	D (NOD for disablement)
underflow	U (NOU for disablement)
significance	S (NOS for disablement)

An identifier with the 'NO' prefix is used to disable the condition it represents. An identifier without the 'NO' prefix is used to enable the condition that it represents. For example, the token 'F' is used to enable the fixed-overflow condition. The identifier 'NOF' is used to disable the fixed-overflow condition. The rightmost option takes effect in the event of a conflict. Identifiers are separated by blanks or commas.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE36V	4	3295	The condition string from CEE3SPM did not contain all of the settings, because the returned string was truncated.
CEE370	4	3296	Some of the data in the condition string from CEE3SPM could not be recognized.
CEE371	4	3297	The service completed successfully for recognized condition(s), unsuccessfully for unrecognized (unsupported) condition(s).

Code	Severity	Message number	Message text
CEE372	4	3298	A call to CEE3SPM attempted to PUSH settings onto a full stack.
CEE373	4	3299	A call to CEE3SPM attempted to POP settings off an empty stack.
CEE374	4	3300	The action parameter in CEE3SPM was not one of the digits 1 to 5.

Usage notes

- PL/I MTF consideration—In PL/I MTF applications, CEE3SPM affects only the calling task.
- C/C++ consideration—C/C++ ignores the fixed-overflow, decimal-overflow, underflow, and significance interrupts, no matter what you specify in CEE3SPM.
- COBOL consideration—COBOL ignores the fixed-overflow and decimal-overflow interrupts, no matter what you specify in CEE3SPM.
- z/OS UNIX consideration—In multithread applications, CEE3SPM affects only the calling thread.
- You cannot use CEE3SPM to enable the fixed-overflow, decimal-overflow, underflow or significance interrupts. You can, however, query the settings of CEE3SPM.

Table 23. S/370 Interrupt Code Descriptions

S/370 Interrupt Code	Description	Maskable	Symbolic Feedback Code	Message Number	Severity
0001	Operation exception	No	CEE341	3201	3
0002	Privileged operation exception	No	CEE342	3202	3
0003	Execute exception	No	CEE343	3203	3
0004	Protection exception	No	CEE344	3204	3
0005	Addressing exception	No	CEE345	3205	3
0006	Specification exception	No	CEE346	3206	3
0007	Data exception	No	CEE347	3207	3
0008	Fixed-point overflow exception	Yes	CEE348	3208	3
0009	Fixed-point divide exception	No	CEE349	3209	3
000A	Decimal-overflow exception	Yes	CEE34A	3210	3
000B	Decimal divide exception	No	CEE34B	3211	3
000C	Exponent-overflow exception	No	CEE34C	3212	3
000D	Exponent-underflow exception	Yes	CEE34D	3213	3
000E	Significance exception	Yes	CEE34E	3214	3
nn0F	Floating-point divide exception	No	CEE34F	3215	3

Examples

```
/*Module/File Name: EDC3SPM   */

/*****************************************************/
/* This example queries the enablement of LE/370     */
/* hardware conditions.                              */
/*****************************************************/
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4 action;
  _CHAR80 cond_string;
  char *cond;

  /* query the current settings */
  action = 2;
  CEE3SPM(&action,cond_string,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEE3SPM query failed with message %\n",
            fc.tok_msgno);
     exit(2999);
   }
}
```

Figure 54. C/C++ Example of CEE3SPM

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3SPM
      ************************************************
      **                                            **
      ** CBL3SPM - Call CEE3SPM to query and modify  **
      **           Lang. Environ. hardware condition  **
      **           enablement                          **
      ** In this example, a call is made to CEE3SPM  **
      ** to check the setting of the program mask.   **
      ** See the parameter list of CEE3SPM to        **
      ** interpret what is returned as CONDSTR in    **
      ** this example.                               **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3SPM.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ACTION                  PIC S9(9) BINARY.
       01  CONDSTR                 PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

      ************************************************
      ** Specify 2 for the QUERY function.
      ** Pass ACTION in the call to CEE3SPM to return
      **     the condition string DISPLAY results.
      ************************************************
       PARA-CBL3SPM.
           MOVE 2 TO ACTION.
           CALL "CEE3SPM" USING ACTION, CONDSTR, FC.
           IF  CEE000 of FC  THEN
               DISPLAY "The current setting of the ",
                   "program mask is: " CONDSTR
           ELSE
               DISPLAY "CEE3SPM failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 55. COBOL Example of CEE3SPM

```
*PROCESS MACRO;
 /* Module/File Name: IBM3SPM                        */
 /****************************************************/
 /**                                                 */
 /** Function: CEE3SPM - Query and Modify LE/370     */
 /**                   Hardware Condition Enablement */
 /**                                                 */
 /** This example calls CEE3SPM to query the current */
 /** setting of the program mask. See the parameter  */
 /** list of CEE3SPM to interpret what is returned   */
 /** as CONDSTR in this example.                     */
 /**                                                 */
 /****************************************************/
 PLI3SPM: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL ACTION   REAL FIXED BINARY(31,0);
    DCL CONDSTR  CHAR(80);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Call CEE3SPM to query the current setting of  */
    /*    the program mask                           */

    ACTION = 2; /* Specify action code 2 to query    */
                /* the program mask                  */
    CALL CEE3SPM ( ACTION, CONDSTR, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
         'The initial setting of the program mask is: '
         || CONDSTR );
       END;
    ELSE  DO;
       DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
       STOP;
       END;
```

Figure 56. PL/I Example of CEE3SPM (Part 1 of 2)

```
/* Call CEE3SPM to enable specification exceptions. */

/* Specify action code 1 to SET the program mask.   */
   ACTION = 1;

/* Specify a program mask that allows specification */
/* exceptions (all others are unchanged)            */
   CONDSTR = 'S';

   CALL CEE3SPM ( ACTION, CONDSTR, FC );
   IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
      DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
      STOP;
      END;

   CALL CEE3SPM (2, CONDSTR, FC); /* Query settings */
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST(
         'The new setting of the program mask is: '
         || CONDSTR );
      END;
   ELSE  DO;
      DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
      STOP;
      END;

END PLI3SPM;
```

Figure 56. PL/I Example of CEE3SPM (Part 2 of 2)

CEE3SRC—Set the enclave return code

CEE3SRC sets the user enclave return code. The value set is used in the calculation of the final enclave return code at enclave termination.

Syntax

```
►►──CEE3SRC──(──return_code──,──fc──)──────────────────────────────►◄
```

return_code (input)
An INT4 data type. The enclave return code to be set should be <= 999,999 and >= 0 to be in the Language Environment-preferred range. (The initial value is 0.)

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE0HA	1	0554	A value outside the preferred range of 0 through 999,999 was supplied. However, the value was still used as the enclave return code.

Usage note

- z/OS UNIX consideration—CEE3SRC is not supported in multithread applications.
- PL/I MTF consideration—For PL/I multitasking applications, the user return code value set during invocation of CEE3SRC affects the current task only. If a PL/I program causes an enclave to terminate, the value set by CEE3SRC at the associated task level is reflected in the final return code at enclave termination.
- PL/I consideration—When running PL/I with POSIX(ON), CEE3SRC is not supported.

For more information

- See *z/OS Language Environment Programming Guide*, for more information about the CEE3SRC callable service.

Examples

CEE3SRC is used with CEE3GRC—see the examples for CEE3GRC, “Examples” on page 138.

CEE3SRP—Set resume point

The CEE3SRP service sets the resume point at the next instruction in the calling routine. CEE3SRP works only in conjunction with the CEEMRCE service.

Syntax

```
►►──CEE3SRP──(──resume_token──,──fc──)──────────────────────────────►◄
```

resume_token (output)
An INT4 data type that, upon completion of this service, contains a token that represents a machine state block, which Language Environment allocates from heap storage. Language Environment automatically frees the heap storage for the machine state block when the routine associated with the stack frame to which it points returns to its caller.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE390	3	3360	The stack frame was not found on the call chain.

Usage notes

- An example for Service Label under COBOL follows:

```
   SET-RECOVERY-POINT-PARAGRAPH.
      CALL 'CEE3SRP' USING RECOVERY-POINT FC.
      SERVICE LABEL.
   ERROR-PARAGRAPH.
* code to do post-error processing
```

- Use the CEE3SRP service only with the CEEMRCE service from within a user condition handler. The token returned by this service is used as input to the CEEMRCE service.
- Language Environment automatically frees the heap storage for the machine state block when the routine associated with the stack frame to which it points returns to its caller. Attempts to use the machine state block after it is freed result in unpredictable behavior.
- COBOL consideration— A Service Label compiler directive must be specified immediately after the call to CEE3SRP.

Examples

For examples of how to use CEE3SRP in combination with other CEEMRCE and CEEHDLR, see “CEEMRCE—Move resume cursor explicit” on page 376.

CEE3USR—Set or query user area fields

CEE3USR sets or queries one of two 4-byte fields known as the user area fields. The user area fields are associated with an enclave and are maintained on an enclave basis. A user area field can be used by vendor or application programs to store a pointer to a global data area or to keep a recursion counter.

Be careful not to confuse the Language Environment user area fields with the PL/I user area. The PL/I user area is a 4-byte field in the PL/I TCA and can be accessed only through assembler language. The PL/I user area continues to be supported for compatibility.

Language Environment initializes both user area fields to X'00000000' during enclave initialization.

Syntax

```
►►──CEE3USR──(──function_code──,──field_number──,──field_value──,──fc──)──────►◄
```

function_code(input)
A fullword binary integer representing the function performed:

1—SET User area field according to the value specified in *field_value*.

2—QUERY User area field; return current value in *field_value*.

field_number(input)
A fullword binary integer indicating the field to set or query. *field_number* must be specified as either 1 or 2.

field_value(input/output)
A fullword binary integer.

If *function_code* is specified as 1 (meaning SET user area field), *field_value* contains the value to be copied to the user area field.

If *function_code* is specified as 2 (meaning QUERY user area field), the value in the user area field is copied to *field_value*.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE3PS	3	3900	The function code passed to CEE3USR was not 1 or 2.
CEE3PT	3	3901	The field number passed to CEE3USR was not 1 or 2.

Usage note

- z/OS UNIX consideration—CEE3USR applies to the enclave.

Examples

```
/*Module/File Name: EDC3USR   */

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>

typedef struct {
   int value1,value2,value3;
   char slot1_80¨;
} info_struct;

int main (void) {

   _INT4 function_code, field_number, field_value;
   _FEEDBACK fc;
   info_struct *info;

   info = (info_struct *)malloc(sizeof(info_struct));
  /* .
     .
     . */
   /* Set User field 1 to point to info_struct */
   function_code = 1;
   field_number = 1;
   field_value = (int)info;

   CEE3USR(&function_code,&field_number,&field_value,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3USR failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
  /* .
     .
     . */
   /* get the value of field 2 */
   function_code = 2;
   field_number = 1;

   CEE3USR(&function_code,&field_number,&field_value,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3USR failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
  /* .
     .
     . */
}
```

Figure 57. C/C++ Example of CEE3USR

```
CBL LIB,QUOTE
      *Module/File Name: IGZT3USR
      ************************************************
      **                                            **
      ** CBL3USR - Call CEE3USR to set or query user **
      **           area fields                      **
      **                                            **
      ** In this example, CEE3USR is called twice:   **
      ** once to set the value of a user area, and   **
      ** once to query it.                           **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL3USR.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  FUNCODE                PIC S9(9) BINARY.
       01  FIELDNO                PIC S9(9) BINARY.
       01  INVALUE                PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

      ************************************************
      ** Specify 1 for SET function.
      ** Specify field number 1 to set the value field
      **     number 1.
      ** Specify 23 to make the value of field number 1
      **     equal to 23.
      ************************************************
       PARA-3USRSET.
           MOVE 1  TO FUNCODE.
           MOVE 1  TO FIELDNO.
           MOVE 23 TO INVALUE.
           CALL "CEE3USR" USING FUNCODE, FIELDNO,
                                INVALUE, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEE3USR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
```

Figure 58. COBOL Example of CEE3USR (Part 1 of 2)

```
      ************************************************
      ** Specify 2 for QUERY function.
      ** Specify field number 1 to query the value
      **     of field number 1.
      ************************************************
       PARA-3USRQRY.
           MOVE 2 TO FUNCODE.
           MOVE 1 TO FIELDNO.
           CALL "CEE3USR" USING FUNCODE, FIELDNO,
                                INVALUE, FC.
           IF CEE000 of FC  THEN
               DISPLAY "User Area field " FIELDNO
                   " is: " INVALUE
           ELSE
               DISPLAY "CEE3USR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 58. COBOL Example of CEE3USR (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBM3USR                        */
 /****************************************************/
 /**                                                **/
 /** Function: CEE3USR - set/query user area fields **/
 /**                                                **/
 /** In this example, CEE3USR is called twice: once **/
 /** to set the value of a user area, and once to   **/
 /** query it.                                      **/
 /****************************************************/
 PLI3USR: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL FUNCODE   REAL FIXED BINARY(31,0);
    DCL FIELDNO   REAL FIXED BINARY(31,0);
    DCL OUTVALUE  REAL FIXED BINARY(31,0);
    DCL INVALUE   REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    FUNCODE = 1; /* Specify 1 for the set function   */
    FIELDNO = 1; /* Specify field 1 of two           */
    INVALUE = 5; /* Value to put in field 1          */
```

Figure 59. PL/I Example of CEE3USR (Part 1 of 2)

```
   /* Call CEE3USR to set user field 1 to 5         */
   CALL CEE3USR ( FUNCODE, FIELDNO, INVALUE, FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'LE/370 User field ' || FIELDNO
         || ' has been set to ' || INVALUE );
      END;
   ELSE  DO;
      DISPLAY( 'CEE3USR failed with msg '
         || FC.MsgNo );
      STOP;
      END;

   /* Call CEE3USR to query the value of field 1    */

   FUNCODE = 2; /* Specify 2 for query function     */
   FIELDNO = 1; /* Specify field 1 of two           */

   CALL CEE3USR ( FUNCODE, FIELDNO, OUTVALUE, FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'LE/370 User field ' || FIELDNO
         || ' is currently set to ' || OUTVALUE );
      END;
   ELSE  DO;
      DISPLAY( 'CEE3USR failed with msg '
         || FC.MsgNo );
      STOP;
      END;

END PLI3USR;
```

Figure 59. PL/I Example of CEE3USR (Part 2 of 2)

CEECBLDY—Convert date to COBOL Integer format

CEECBLDY converts a string representing a date into a COBOL Integer format, which is the number of days since 1 January 1601. This service is similar to CEEDAYS, except that it provides a string in COBOL Integer format, which is compatible with ANSI intrinsic functions. Use CEECBLDY to access the century window of Language Environment and to perform date calculations with COBOL intrinsic functions for programs compiled with the INTDATE(ANSI) compiler option.

Call CEECBLDY only from COBOL programs that use the returned value as input for COBOL intrinsic functions. You should not use the returned value with other Language Environment callable services, nor should you call CEECBLDY from any non-COBOL programs. Unlike CEEDAYS, there is no inverse function for CEECBLDY, because it is only for COBOL users who want to use the Language Environment century window service together with COBOL intrinsic functions for date calculations. The inverse function for CEECBLDY is provided by the DATE-OF-INTEGER and DAY-OF-INTEGER intrinsic functions.

To handle dates earlier than 1601, add 4000 to each year, convert to Integer, calculate, subtract 4000 from the result, and then convert back to character format. By default, 2-digit years lie within the 100-year range starting 80 years prior to the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. You can change this default range by using the CEESCEN callable service.

Syntax

```
►►──CEECBLDY──(──input_char_date──,──picture_string──,──output_ANSI_date──────►
►──,──)──────────────────────────────────────────────────────────────────────►◄
```

input_char_date (input)

A halfword length-prefixed character string (VSTRING) representing a date or timestamp, in a format conforming to that specified by *picture_string*.

The character string must contain between 5 and 255 characters, inclusive. *input_char_date* can contain leading or trailing blanks. Parsing for a date begins with the first nonblank character (unless the picture string itself contains leading blanks, in which case CEECBLDY skips exactly that many positions before parsing begins).

After parsing a valid date, as determined by the format of the date specified in *picture_string*, CEECBLDY ignores all remaining characters. Valid dates range between and include 01 January 1601 to 31 December 9999.

See Table 28 on page 517 for a list of valid picture character terms that can be specified in *input_char_date*.

picture_string (input)

A halfword length-prefixed character string (VSTRING), indicating the format of the date specified in *input_char_date*.

Each character in the *picture_string* corresponds to a character in *input_char_date*. For example, if you specify MMDDYY as the *picture_string*, CEECBLDY reads an *input_char_date* of 060288 as 02 June 1988.

If delimiters such as the slash (/) appear in the picture string, leading zeros can be omitted. For example, the following calls to CEECBLDY:

```
MOVE '6/2/88' TO DATEVAL.
MOVE 'MM/DD/YY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);

MOVE '06/02/88' TO DATEVAL.
MOVE 'MM/DD/YY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);

MOVE '060288' TO DATEVAL.
MOVE 'MMDDYY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);

MOVE '88154' TO DATEVAL.
MOVE 'YYDDD' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);
```

would each assign the same value, 148155 (02 June 1988), to COBINTDATE.

Whenever characters such as colons or slashes are included in the *picture_string* (such as `HH:MI:SS YY/MM/DD`), they count as placeholders but are otherwise ignored.

See Table 28 on page 517 for a list of valid picture character terms and Table 29 on page 518 for examples of valid picture strings.

If *picture_string* includes a Japanese Era symbol `<JJJJ>`, the `YY` position in *input_char_date* is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 29 on page 518 for an additional example. See also Table 30 on page 518 for a list of Japanese Eras supported by CEEDATE.

If *picture_string* includes era symbol `<CCCC>` or `<CCCCCCCC>`, the `YY` position in *input_char_date* is replaced by the year number within the era. See Table 29 on page 518 for an additional example.

output_Integer_date (output)
A 32-bit binary integer representing the COBOL Integer date, the number of days since 31 December 1600. For example, 16 May 1988 is day number 141485.

If *input_char_date* does not contain a valid date, *output_Integer_date* is set to 0 and CEECBLDY terminates with a non-CEE000 symbolic feedback code.

Date calculations are performed easily on the *output_Integer_date*, because *output_Integer_date* is an integer. Leap year and end-of-year anomalies do not affect the calculations.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2EB	3	2507	Insufficient data was passed to CEEDAYS or CEESECS. The Lilian value was not calculated.
CEE2EC	3	2508	The date value passed to CEEDAYS or CEESECS was invalid.
CEE2ED	3	2509	The era passed to CEEDAYS or CEESECS was not recognized.
CEE2EH	3	2513	The input date passed in a CEEISEC, CEEDAYS, or CEESECS call was not within the supported range.
CEE2EL	3	2517	The month value in a CEEISEC call was not recognized.
CEE2EM	3	2518	An invalid picture string was specified in a call to a date/time service.
CEE2EO	3	2520	CEEDAYS detected non-numeric data in a numeric field, or the date string did not match the picture string.
CEE2EP	3	2521	The (<JJJJ>) or (<CCCC>) year-within-era value passed to CEEDAYS or CEESECS was zero.

Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- z/OS UNIX consideration—In multithread applications, CEECBLDY affects only the calling thread.

For more information

- See the INTDATE COBOL compiler installation option in*Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for information about how to get ANSI integer values from COBOL Intrinsic Functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.
- See “CEESCEN—Set the century window” on page 422 for more information about the CEESCEN callable service.
- See Table 28 on page 517 for a list of valid picture character terms that can be specified in *input_char_date*.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTCBLD
************************************************
**                                            **
** Function: Invoke CEECBLDY callable service  **
** to convert date to COBOL Integer format.    **
** This service is used when using the         **
** Lang. Environ. Century Window                **
** mixed with COBOL Intrinsic Functions.       **
**                                            **
************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. CBLDY.

 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  CHRDATE.
     02  Vstring-length      PIC S9(4) BINARY.
     02  Vstring-text.
         03  Vstring-char    PIC X
                     OCCURS 0 TO 256 TIMES
                     DEPENDING ON Vstring-length
                         of CHRDATE.
 01  PICSTR.
     02  Vstring-length      PIC S9(4) BINARY.
     02  Vstring-text.
         03  Vstring-char    PIC X
                     OCCURS 0 TO 256 TIMES
                     DEPENDING ON Vstring-length
                         of  PICSTR.
 01  INTEGER                 PIC S9(9) BINARY.
 01  NEWDATE                 PIC 9(8).
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                 REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION.
```

Figure 60. COBOL Example of CEECBLDY (Part 1 of 2)

```
 PARA-CBLDAYS.
*************************************************
** Specify input date and length               **
*************************************************
     MOVE 25 TO Vstring-length of CHRDATE.
     MOVE "1 January 00"
         to Vstring-text of CHRDATE.

*************************************************
** Specify a picture string that describes     **
** input date, and set the string's length.    **
*************************************************
     MOVE 23 TO Vstring-length of PICSTR.
     MOVE "ZD Mmmmmmmmmmmmmmz YY"
               TO Vstring-text of PICSTR.

*************************************************
** Call CEECBLDY to convert input date to a    **
** COBOL Integer date                          **
*************************************************
     CALL "CEECBLDY" USING CHRDATE, PICSTR,
                           INTEGER, FC.

*************************************************
** If CEECBLDY runs successfully, then compute **
**     the date of the 90th day after the      **
**     input date using Intrinsic Functions    **
*************************************************
     IF CEE000 of FC  THEN
         COMPUTE INTEGER = INTEGER + 90
         COMPUTE NEWDATE = FUNCTION
             DATE-OF-INTEGER (INTEGER)
         DISPLAY NEWDATE
             " is Lilian day: " INTEGER
     ELSE
         DISPLAY "CEECBLDY failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 60. COBOL Example of CEECBLDY (Part 2 of 2)

CEECMI—Store and load message insert data

CEECMI copies message insert data and loads the address of that data into the Instance Specific Information (ISI) associated with the condition being processed. CEECMI also allocates storage for the ISI, if necessary. The number of ISIs per thread is determined by the MSGQ run-time option.

ISIs are released when the value specified in the MSGQ run-time option is exceeded. The least recently used ISI is overwritten.

If you plan on using a routine that signals a new condition with a call to the CEESGL callable service, you should first call CEECMI to copy any insert information into the ISI associated with the condition.

Syntax

```
►►──CEECMI──(──cond_rep──,──insert_seq_num──,──insert_data──,──fc──)──────────►◄
```

cond_rep (input/output)
A condition token that defines the condition for which the q_data_token is retrieved.

insert_seq_num (input)
A 4-byte integer that contains the insert sequence number (such as insert 1 insert 2). It corresponds to an insert number specified with an `ins` tag in the message source file created by the CEEBLDTX EXEC.

insert_data (input)
A halfword-prefixed length string that represents the insert data. The entire length described in the halfword prefix is used without truncation. DBCS strings must be enclosed within shift-out (X'0E') and shift-in (X'0F') characters.

The maximum size for an individual insert data item is 254 bytes.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0EB	3	0459	Not enough storage was available to create a new instance specific information block.
CEE0EC	1	0460	Multiple instances of the condition token with message number *message-number* and facility ID *facility-id* were detected.
CEE0ED	3	0461	The maximum number of unique message insert blocks was reached. This condition token had its I_S_info field set to 1.
CEE0EE	3	0462	Instance specific information for the condition token with message number *message-number* and facility ID *facility-id* could not be found.
CEE0EF	3	0463	The maximum size for an insert data item was exceeded.
CEE0H9	3	0553	An internal error was detected in creating the inserts for a condition.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEECMI applies to message insert data for only the calling thread.

For more information

- See "MSGQ" on page 47 for more information about the MSGQ run-time option.
- For more information about CEEBLDTX, see *z/OS Language Environment Programming Guide*.

Examples

```
/*Module/File Name: EDCCMI    */
   /**************************************************
    **                                              *
    ** FUNCTION: CEENCOD - set up a condition token  *
    **         : CEECMI  - store and load message    *
    **                     insert data              *
    **         : CEEMSG  - retrieve, format, and     *
    **                     dispatch a message to    *
    **                     message file             *
    **                                              *
    **   This example illustrates the invocation of  *
    **   the Lang. Environ. message services to      *
    **    store and load message insert data.        *
    **   The resulting message and insert is written *
    **   to the Lang. Environ. MSGFILE ddname.       *
    **                                              *
    **************************************************/
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

void main ()
{
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;
  _VSTRING insert;
  _FEEDBACK ctok;
  _FEEDBACK fbcode;
  _INT4 MSGFILE;
  _INT4 insert_no ;
  /* Condition Token Declarations */
  /**************************************************
   * EXMPLMSG is a token that represents message      *
   * number 10 in a user message file constructed     *
   * using the CEEBLDTXT facility.                    *
   * Message 10 is designed to allow one insert.      *
   **************************************************/
  insert.length = 18;
  memcpy(insert.string ,"<CEPGCMI's insert>",
         insert.length);
  /*give ctok value of hex 0000000A40E7D4D700000000   */
  /*sev = 0  msgno =  10 facid = XMP                  */
   c_1 = 0;
   c_2 = 10;
   cond_case = 1;
   sev = 0;
   control = 0;
   memcpy(facid,"XMP",3);
   isi = 0;
```

Figure 61. C/C++ Example of CEECMI (Part 1 of 2)

```
 /*********************************************/
 /* Call CEENCOD to set-up a condition token */
 /*********************************************/
  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&ctok,&fbcode);
  if ( _FBCHECK ( fbcode , CEE000 ) != 0 )
   printf("CEENCOD failed with message number %d\n",
           fbcode.tok_msgno);

 /*******************************************/
 /* Call CEECMI to create a message insert */
 /*******************************************/
  CEECMI(&ctok, &insert_no, &insert, &fbcode);
  if ( _FBCHECK ( fbcode , CEE000 ) != 0 )
   printf("CEECMI failed with message number %d\n",
           fbcode.tok_msgno);

 /*******************************************/
 /* Call CEEMSG to issue the message       */
 /*******************************************/
  CEEMSG(&ctok, &MSGFILE , &fbcode);
  if ( _FBCHECK ( fbcode , CEE000 ) != 0 )
   printf("CEEMSG failed with message number %d\n",
           fbcode.tok_msgno);

}
```

Figure 61. C/C++ Example of CEECMI (Part 2 of 2)

```
CBL LIB,QUOTE
      *Module/File Name: IGZTCMI
      ************************************************
      **                                            *
      ** Function: CEECMI  - Store and load message *
      **                     insert data            *
      **         : CEENCOD - Construct a condition  *
      **                     token                  *
      **         : CEEMSG  - Dispatch a Message.    *
      **                                            *
      **   This example illustrates the invocation  *
      **   of the Lang. Environ. message services to*
      **    store and load message insert data. *
      **   CEENCOD is called to construct a token   *
      **   for a user defined message (message 10)  *
      **   in a user message file.                  *
      **   CEECMI is called to insert text into     *
      **   message 10. The resulting message and    *
      **   insert is written to the MSGFILE.        *
      **                                            *
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLCMI.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  INSERTNO                PIC S9(9) BINARY.
       01  CTOK                    PIC X(12).
       01  FBCODE.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity        PIC S9(4) BINARY.
                   04  Msg-No          PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code      PIC S9(4) BINARY.
                   04  Cause-Code      PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  MSGDEST                 PIC S9(9) BINARY.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.
       01  VSTRING.
```

Figure 62. COBOL Example of CEECMI (Part 1 of 2)

```
     05  INSERT-TXTL         PIC S9(4) BINARY.
     05  INSERT-TXT          PIC X(80).
 PROCEDURE DIVISION.
 PARA-CEPGCMI.
************************************************
*   Set up token fields for creation of a      *
*   condition token for the user defined       *
*   message file and message number.           *
************************************************
     MOVE   0 TO SEV.
     MOVE  10 TO MSGNO.
     MOVE   1 TO CASE.
     MOVE   0 TO SEV2.
     MOVE   0 TO CNTRL.
     MOVE "XMP" TO FACID.
     MOVE   0 TO ISINFO.
************************************************
*  Call CEENCOD to construct a condition token *
************************************************
     CALL "CEENCOD" USING SEV, MSGNO, CASE,
                          SEV2, CNTRL, FACID,
                          ISINFO, CTOK, FBCODE.
     IF NOT CEE000 of FBCODE  THEN
         DISPLAY "CEENCOD failed with msg"
             Msg-No of FBCODE UPON CONSOLE
         STOP RUN
     END-IF.
***********************************************
*   Call CEECMI to store and load message     *
*   insert 1.                                 *
***********************************************
     MOVE "<CEPGCMI""s insert>" TO INSERT-TXT.
     MOVE 19 TO INSERT-TXTL.
     MOVE 1 TO INSERTNO.
     CALL "CEECMI" USING CTOK, INSERTNO, VSTRING.
***********************************************
*   Call CEEMSG to write message to MSGFILE   *
***********************************************
     MOVE 2 TO MSGDEST.
     CALL "CEEMSG" USING CTOK, MSGDEST, FBCODE.
     IF  NOT CEE000 of FBCODE  THEN
         DISPLAY "CEEMSG failed with msg "
             Msg-No of FBCODE UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 62. COBOL Example of CEECMI (Part 2 of 2)

```
*PROCESS MACRO;
 IBMCMI: Proc Options(Main);

   /*Module/File Name: IBMCMI                        */
   /**************************************************
    **                                               *
    ** FUNCTION  : CEECMI  - store and load message   *
    **                      insert data              *
    **           : CEEMSG  - retrieve, format, and    *
    **                      dispatch a message to    *
    **                      message file             *
    **                                               *
    **   This example illustrates the invocation of   *
    **   LE/370 message services to store and load    *
    **   message insert data. The resulting message   *
    **   and insert are written to the MSGFILE.       *
    **                                               *
    **************************************************/
    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;
    DECLARE INSERT     CHAR(255) VARYING;
    DCL 01 CTOK,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);
    DCL 01 FBCODE,                 /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);
    DECLARE MSGFILE    REAL FIXED BINARY(31,0);
    DECLARE INSERT_NO  REAL FIXED BINARY(31,0);
```

Figure 63. PL/I Example (Part 1 of 2)

```
   /*************************************************/
   /* Ctok is initialized in the DECLARE statement  */
   /* to message 10 in a user message file          */
   /* constructed using the CEEBLDTX tool.          */
   /* Message 10 is designed to allow one insert.   */
   /* The message facility ID is XMP.               */
   /*************************************************/
   insert = '<CEPGCMI's insert>';
   insert_no = 1;

   /*****************************************/
   /* Call CEECMI to create a message insert */
   /*****************************************/
   Call CEECMI(ctok, insert_no, insert, *);

   /*****************************************/
   /* Call CEEMSG to issue the message       */
   /*****************************************/
   MSGFILE = 2;
   Call CEEMSG(ctok, MSGFILE, *);

 End IBMCMI;
```

Figure 63. PL/I Example (Part 2 of 2)

CEECRHP—Create new additional heap

CEECRHP lets you define additional heaps. It returns a unique *heap_id*. The heaps defined by CEECRHP can be used just like the initial heap (*heap_id=0*), below heap, and anywhere heap. Unlike the heaps created by these heap services, all heap elements within an additional heap can be quickly freed by a single call to CEEDSHP (discard heap).

The number of heaps supported by Language Environment is limited only by the amount of virtual storage available.

Syntax

```
►►──CEECRHP──(──heap_id──,──initial_size──,──increment──,──options──,──────►
►─fc──)──────────────────────────────────────────────────────────────────►◄
```

heap_id (output)
A fullword binary signed integer. *heap_id* is the heap identifier of the created heap. If a new heap cannot be created, the value of *heap_id* remains undefined.

Storage obtained from *heap_id*s 79 and 80 is set to binary 0 independent of any initialization value specified by the STORAGE option.

initial_size (input)
A fullword binary signed integer. *initial_size* is the initial amount of storage, in bytes, allocated for the new heap. *initial_size* is rounded up to the nearest increment of 4096 bytes.

If *initial_size* is specified as 0, then the *init_size* specified in the HEAP run-time option is used. If no HEAP run-time option was provided and *initial_size* is specified as 0, CEECRHP uses the installation default.

increment (input)
A fullword binary signed integer. When it is necessary to enlarge the heap to satisfy an allocation request, *increment* represents the number of bytes by which the heap is extended. *increment* is rounded up to the nearest 4096 bytes.

If *increment* is specified as 0, then the *incr_size* specified in the HEAP run time option is used. If no HEAP run-time option was provided and *increment* equals 0, CEECRHP uses the installation default.

options (input)
A fullword binary signed integer. *options* are specified with the decimal codes as shown in Table 24.

Table 24. HEAP Attributes Based on the Setting of the options Parameter

Option Setting	HEAP Attributes
00	Use same attributes as the initial heap (copy them from the HEAP run-time option)
01	HEAP(,,,FREE) (location inherited from HEAP run-time option)
70	HEAP(,,,KEEP) (location inherited from HEAP run-time option)
71	HEAP(,,ANYWHERE,KEEP)
72	HEAP(,,ANYWHERE,FREE)
73	HEAP(,,BELOW,KEEP)
74	HEAP(,,BELOW,FREE)
75	HEAP(,,ANYWHERE,) (disposition inherited from the HEAP run-time option)
76	HEAP(,,BELOW,) (disposition inherited from the HEAP run-time option)
77	HEAP(,,ANYWHERE,KEEP) (all heap storage obtained using this heap_id is allocated on a 4K boundary)
78	HEAP(,,ANYWHERE,FREE) (all heap storage obtained using this heap_id is allocated on a 4K boundary)
79	HEAP(,,ANYWHERE,KEEP) (all heap storage obtained using this heap_id is set to binary 0 when allocated using CEEGTST)
80	HEAP(,,ANYWHERE,FREE) (all heap storage obtained using this heap_id is set to binary 0 when allocated using CEEGTST)

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE0P2	4	0802	Heap storage control information was damaged.
CEE0P4	3	0804	The initial size value supplied in a create heap request was unsupported.
CEE0P5	3	0805	The increment size value supplied in a create heap request was unsupported.
CEE0P6	3	0806	The options value supplied in a create heap request was unrecognized.

Code	Severity	Message number	Message text
CEE0PD	3	0813	Insufficient storage was available to satisfy a get storage request.

Usage notes

- z/OS UNIX consideration—CEECRHP applies to the enclave.

For more information

- See “CEEDSHP—Discard heap” on page 257 for more information about the CEEDSHP callable service.
- See “HEAP” on page 33 for more information about the HEAP run-time option and IBM-supplied defaults.
- See “HEAP” on page 33 for more information about the HEAP run-time option and IBM-supplied defaults.

Examples

```
/*Module/File Name: EDCCRHP   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _INT4 heapid, size, increment, options;
   _FEEDBACK fc;
 /*  .
     .
     .  */
   heapid = 0;        /* heap identifier is set */
                      /* by CEECRHP */
   size = 4096;       /* initial size of heap  (in */
                      /* bytes) */
   increment = 4096;  /* increment to extend heap by */
   options = 72;      /* set up heap as */
                      /* (,,ANYWHERE,FREE) */

   /* create heap using CEECRHP */
   CEECRHP(&heapid,&size,&increment,&options,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful)  */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEECRHP failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */
   /* discard the heap that was previously created  */
   /* using CEECRHP */
   CEEDSHP(&heapid,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000) != 0 ) {
      printf("CEEDSHP failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */
}
```

Figure 64. C/C++ Example of CEECRHP

```
CBL LIB,QUOTE
      *Module/File Name: IGZTCRHP
      ***********************************************
      **                                           **
      ** Function: CEECRHP - create new additional **
      **                     heap                  **
      **                                           **
      ***********************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLCRHP.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HEAPID                  PIC S9(9) BINARY.
       01  HPSIZE                  PIC S9(9) BINARY.
       01  INCR                    PIC S9(9) BINARY.
       01  OPTS                    PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
      ***************************************************
      ** Specify 0 for HEAPID, and heap id will be   **
      **     set by CEECRHP.                         **
      ** Heap size and increment will each be        **
      **     4096 bytes.                             **
      ** Specify 00 for OPTS, and HEAP attributes    **
      **     will be inherited from the initial heap **
      **     (copied from the HEAP run-time option). **
      ***************************************************
           MOVE 0 TO HEAPID.
           MOVE 4096 TO HPSIZE.
           MOVE 4096 TO INCR.
           MOVE 00 TO OPTS.

           CALL "CEECRHP" USING HEAPID, HPSIZE,
                                INCR, OPTS, FC.
           IF CEE000 of FC  THEN
               DISPLAY "Created heap number " HEAPID
                    " which is " HPSIZE " bytes long"
           ELSE
               DISPLAY "CEECRHP failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 65. COBOL Example of CEECRHP

```
*PROCESS MACRO;
 /*Module/File Name: IBMCRHP                      */

 /**************************************************/
 /**                                              */
 /** Function: CEECRHP - create new additional    */
 /**                     heap                     */
 /**                                              */
 /** In this example, CEECRHP is called to set up */
 /** a new additional heap of 4096 bytes. Each    */
 /** time the heap needs to be extended, an       */
 /** increment of 4096 bytes will be added.       */
 /**                                              */
 /**************************************************/
 PLICRHP: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;
    DCL HEAPID  REAL FIXED BINARY(31,0) ;
    DCL HPSIZE  REAL FIXED BINARY(31,0) ;
    DCL INCR    REAL FIXED BINARY(31,0) ;
    DCL OPTS    REAL FIXED BINARY(31,0) ;
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    HEAPID = 0;    /* HEAPID will be set and     */
                   /* returned by CEECRHP        */
    HPSIZE = 4096; /* Initial size of heap,      */
                   /* in bytes                   */
    INCR = 4096;   /* Number of bytes to extend  */
                   /* heap by                    */
    OPTS = 00;     /* Set up heap with the same  */
                   /* attributes as the          */
                   /* initial heap (HEAPID = 0)  */

    /* Call CEECRHP to set up new heap  */
    CALL CEECRHP ( HEAPID, HPSIZE, INCR, OPTS, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Created heap number ' || HEAPID
          || ' consisting of ' || HPSIZE || ' bytes' );
       END;
    ELSE  DO;
       DISPLAY( 'CEECRHP failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLICRHP;
```

Figure 66. PL/I Example of CEECRHP

CEECZST—Reallocate (change size of) storage

CEECZST changes the size of a previously allocated heap element. The *address* parameter points to the beginning of the heap element. The *new_size* parameter gives the new size of the heap element, in bytes. The contents of the heap element are unchanged up to the shorter of the new and old sizes.

The CEECZST service returns a pointer to the reallocated heap element. It can move the storage location of the heap element. As a result, the *address* parameter passed to CEECZST is not necessarily the same as the value returned.

Because the new storage might be allocated at a different location from the existing allocation, any pointers (specifically any addresses) that referred to the old storage become invalid. Continued use of such dangling pointers gives unpredictable, and almost certainly incorrect, results.

The heap identifier is inferred from the address. The new storage block is allocated from the same heap that contained the old block.

The contents of the old storage are preserved in the following manner:

- If *new_size* is greater than the old size, the entire contents of the old storage block are copied to the new block. The remaining bytes in the new element are left uninitialized unless an initialization suboption value was specified for the heap in the STORAGE option.
- If *new_size* is less than the old size, the contents of the old block are truncated to the size of the new block.
- If *new_size* is equal to the old size, no operations are performed; a successful feedback code is returned.

Syntax

```
►►──CEECZST──(──address──,──new_size──,──fc──)──────────────────────────►◄
```

address (input/output)
A fullword address pointer. On input, this parameter contains an address returned by a previous CEEGTST call. On output, the address of the first byte of the newly allocated storage is returned in this parameter.

new_size (input)
A fullword binary signed integer. *new_size* is the number of bytes of storage to be allocated for the new heap element.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE0P2	4	0802	Heap storage control information was damaged.
CEE0P8	3	0808	Storage size in a get storage request or a re-allocate request was not a positive number.
CEE0PA	3	0810	The storage address in a free storage request was not recognized, or heap storage control information was damaged.
CEE0PD	3	0813	Insufficient storage was available to satisfy a get storage request.

Usage notes

- Storage that is reallocated maintains the same mark/release status as the old storage block. If the old storage block was marked, the new storage block carries the same mark and is released by a release operation that specifies that mark.
- z/OS UNIX consideration—CEECZST applies to the enclave.

For more information

- See “STORAGE” on page 79 for more information about the STORAGE run-time option.
- For information about CEEGTST, see “CEEGTST—Get heap storage” on page 321.

Examples

```
/*Module/File Name: EDCCZST   */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
int main(void) {
   _INT4 heapid, size;
   _POINTER address;
   _FEEDBACK fc;
  /* .
     .
     .  */
   heapid = 0;    /* get storage from initial heap */
   size = 4000;   /* number of bytes of heap storage */

   /* obtain the storage using CEEGTST */
   CEEGTST(&heapid,&size,&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEGTST failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
  /* .
     .
     .  */
   size = 2000;  /* new size of storage element */

   /* change the size of the storage element */
   CEECZST(&address,&size,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEECZST failed with message number %d\n",
              fc.tok_msgno);
      exit(99);
   }
  /* .
     .
     .  */
   /* free the storage that was previously obtained */
   /* using CEEGTST */
   CEEFRST(&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEFRST failed with message number %d\n",
              fc.tok_msgno);
      exit(99);
   }
  /* .
     .
     .  */
}
```

Figure 67. C/C++ Example of CEECZST

```
CBL LIB,QUOTE
      *Module/File Name: IGZTCZST
      ************************************************
      **                                            **
      ** Function: CEECZST - reallocate storage     **
      **                                            **
      ** In this example, CEEGTST is called to      **
      ** request storage from HEAPID = 0, and       **
      ** CEECZST is called to change the size of    **
      ** that storage request.                      **
      **                                            **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLCZST.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01   HEAPID                PIC S9(9) BINARY.
       01   HPSIZE                PIC S9(9) BINARY.
       01   ADDRSS                POINTER.
       01   NEWSIZE               PIC S9(9) BINARY.
       01   FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLGTST.
      ************************************************
      ** Specify 0 to get storage from the initial   **
      **     heap. Specify 4000 to get 4000 bytes of **
      **     storage.                                 **
      ************************************************
           MOVE 0 TO HEAPID.
           MOVE 4000 TO HPSIZE.

      ************************************************
      ** Call CEEGTST to obtain storage.             **
      ************************************************
           CALL "CEEGTST" USING HEAPID, HPSIZE,
                                ADDRSS, FC.
```

Figure 68. COBOL Example of CEECZST (Part 1 of 2)

```
**************************************************
** If CEEGTST runs successfully, display result**
**************************************************
     IF CEE000 OF FC THEN
         DISPLAY " " HPSIZE
             " bytes have been allocated."
     ELSE
         DISPLAY "CEEGTST failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

**************************************************
** Specify a new size of 2000 bytes.           **
**************************************************
     MOVE 2000 TO NEWSIZE.

**************************************************
** Call CEECZST to change the size of the      **
** storage allocated in the call to CEEGTST.   **
**************************************************
     CALL "CEECZST" USING ADDRSS, NEWSIZE, FC.

**************************************************
** If CEECZST runs successfully, display result**
**************************************************
     IF CEE000 OF FC THEN
         DISPLAY
             "The storage element now contains "
             NEWSIZE " bytes."
     ELSE
         DISPLAY "CEEGTST failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 68. COBOL Example of CEECZST (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMCZST                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEECZST - reallocate storage       **/
 /**                                              **/
 /** In this example, CEEGTST is called to request **/
 /** storage from HEAPID = 0, and CEECZST is called**/
 /** to change the size of that storage request.   **/
 /**                                              **/
 /**                                              **/
 /**************************************************/
 PLICZST: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL HEAPID   REAL FIXED BINARY(31,0) ;
    DCL STGSIZE  REAL FIXED BINARY(31,0) ;
    DCL ADDRSS1  POINTER;
    DCL 01 FC1,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 69. PL/I Example of CEECZST (Part 1 of 2)

```
   DCL ADDRSS2  POINTER;
   DCL NEWSIZE  REAL FIXED BINARY(31,0) ;
   DCL 01 FC2,                    /* Feedback token */
          03 MsgSev    REAL FIXED BINARY(15,0),
          03 MsgNo     REAL FIXED BINARY(15,0),
          03 Flags,
             05 Case      BIT(2),
             05 Severity  BIT(3),
             05 Control   BIT(3),
          03 FacID     CHAR(3),    /* Facility ID */
          03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);

   HEAPID = 0;    /* get storage from initial heap */
   STGSIZE = 4000; /* get 4000 bytes of storage    */

   /* Call CEEGTST to obtain the storage           */
   CALL CEEGTST ( HEAPID, STGSIZE, ADDRSS1, FC1 );
   IF  FBCHECK( FC1, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Obtained ' || STGSIZE
         || ' bytes of storage at location '
         || DECIMAL( UNSPEC( ADDRSS1 ) )
         || ' from heap ' || HEAPID );
      END;
   ELSE  DO;
      DISPLAY( 'CEEGTST failed with msg '
         || FC1.MsgNo );
      STOP;
      END;

   NEWSIZE = 2000;
          /* change size of HEAPID 0 to 2000 bytes */

   /* Call CEECZST to change the size of storage   */
   ADDRSS2 = ADDRSS1;
   CALL CEECZST ( ADDRSS2, NEWSIZE , FC2 );
   IF  FBCHECK( FC2, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Obtained ' || NEWSIZE
         || ' bytes of storage at location '
         || DECIMAL( UNSPEC( ADDRSS1 ) ) );
      PUT SKIP LIST( 'Original ' || STGSIZE
         || ' bytes of storage at location '
         || DECIMAL( UNSPEC( ADDRSS1 ) )
         || ' no longer valid' );
      END;
   ELSE  DO;
      DISPLAY( 'CEECZST failed with msg '
         || FC2.MsgNo );
      STOP;
      END;

 END PLICZST;
```

Figure 69. PL/I Example of CEECZST (Part 2 of 2)

CEEDATE—Convert Lilian date to character format

CEEDATE converts a number representing a Lilian date to a date written in character format. The output is a character string, such as `1993/09/09`.

Do not use CEEDATE in combination with COBOL intrinsic functions.

The inverse of CEEDATE is CEEDAYS, which converts character dates to the Lilian format.

CEEDATE is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

Syntax

```
►►──CEEDATE──(──input_Lilian_date──,──picture_string──,──────────────────►
►──output_char_date──,──fc──)──────────────────────────────────────────►◄
```

input_Lilian_date (input)
A 32-bit integer representing the Lilian date. The Lilian date is the number of days since 14 October 1582. For example, 16 May 1988 is Lilian day number 148138. The valid range of Lilian dates is 1 to 3,074,324 (15 October 1582 to 31 December 9999).

picture_string (input)
A halfword length-prefixed character string (VSTRING), representing the desired format of *output_char_date*, for example `MM/DD/YY`. Each character in *picture_string* represents a character in *output_char_date*. If delimiters such as the slash (/) appear in the picture string, they are copied to *output_char_date*.

See Table 28 on page 517 for a list of valid picture characters, and Table 29 on page 518 for examples of valid picture strings.

If *picture_string* is null or blank, CEEDATE gets *picture_string* based on the current value of the COUNTRY run-time option. For example, if the current value of the COUNTRY run-time option is US (United States), the date format would be `MM/DD/YY`. If the current COUNTRY value is FR (France), the date format would be `MM/DD/YY HH:MM:SS AM (or PM)`, for example: `09/09/93 4:56:29 PM`. This default mechanism makes it easy for translation centers to specify the preferred date, and for applications and library routines to use this format automatically.

If *picture_string* includes a Japanese Era symbol `<JJJJ>`, the `YY` position in *output_char_date* is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 29 on page 518 for an additional example. Also see Table 30 on page 518 for a list of Japanese Eras supported by CEEDATE.

If *picture_string* includes a era symbol `<CCCC>` or `<CCCCCCCC>`, the `YY` position in *output_char_date* is replaced by the year number within the era. See Table 29 on page 518 for an example.

output_char_date (output)
A fixed-length 80-character string (VSTRING), is the result of converting *input_Lilian_date* to the format specified by *picture_string*. See Table 25 on page 235 for sample output dates. If *input_Lilian_date* is invalid, *output_char_date* is set to all blanks. CEEDATE terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE2EG	3	2512	The Lilian date value was not within the supported range.
CEE2EM	3	2518	An invalid picture string was specified.
CEE2EQ	3	2522	<JJJJ>, <CCCC> or <CCCCCCCC> was used in a picture string passed to CEEDATE, but the Lilian date value was not within the supported range. The Era could not be determined.
CEE2EU	2	2526	The date string returned by CEEDATE was truncated.

Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- To create a null VSTRING, set the length to zero; the content of the text portion does not matter. To create a blank VSTRING, any length greater than zero can be used; the content of the text portion must be spaces or blanks.
- z/OS UNIX consideration—In multithread applications, CEEDATE applies to the enclave.

For more information

- See the INTDATE COBOL compiler installation option in *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for information about how to get Lilian integer values from COBOL intrinsic functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.
- See “CEEDAYS—Convert date to Lilian format” on page 243 for more information about the CEEDAYS callable service.
- See “COUNTRY” on page 22 for more information about the COUNTRY run-time option.
- See “CEEFMDA—Get default date format” on page 268 for information about how to get the default format for a given country code.

Examples

```
/*Module/File Name: EDCDATE   */

#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _INT4 lil_date = 139370;   /* May 14, 1964 */
   _VSTRING date_pic,date;
   _CHAR80 date_out;

   strcpy(date_pic.string,
     "The date is Wwwwwwwwwz, Mmmmmmmmmz ZD, YYYY");
   date_pic.length = strlen(date_pic.string);

   CEEDATE(&lil_date,&date_pic,date_out,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEDATE failed with message number %d\n",
              fc.tok_msgno);
      exit(2999);
   }
   printf("%.80s\n",date_out);
}
```

Figure 70. C/C++ Example of CEEDATE

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDATE
      ************************************************
      **                                            **
      ** Function: CEEDATE - convert Lilian date to **
      **                     character format       **
      **                                            **
      ** In this example, a call is made to CEEDATE **
      ** to convert a Lilian date (the number of    **
      ** days since 14 October 1582) to a character **
      ** format (such as 6/22/88). The result is    **
      ** displayed.  The Lilian date is obtained    **
      ** via a call to CEEDAYS.                     **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDATE.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  LILIAN                 PIC S9(9) BINARY.
       01  CHRDATE                PIC X(80).
       01  IN-DATE.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char    PIC X
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of IN-DATE.
```

Figure 71. COBOL Example of CEEDATE (Part 1 of 3)

```
 01  PICSTR.
     02  Vstring-length      PIC S9(4) BINARY.
     02  Vstring-text.
         03  Vstring-char    PIC X
                     OCCURS 0 TO 256 TIMES
                     DEPENDING ON Vstring-length
                        of PICSTR.
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.

 PROCEDURE DIVISION.
 PARA-CBLDAYS.
**************************************************
** Call CEEDAYS to convert date of 6/2/88 to   **
**     Lilian representation                    **
**************************************************
     MOVE 6 TO Vstring-length of IN-DATE.
     MOVE "6/2/88" TO Vstring-text of IN-DATE(1:6).
     MOVE 8 TO Vstring-length of PICSTR.
     MOVE "MM/DD/YY" TO Vstring-text of PICSTR(1:8).
     CALL "CEEDAYS" USING IN-DATE, PICSTR,
                          LILIAN, FC.

**************************************************
** If CEEDAYS runs successfully, display result**
**************************************************
     IF  CEE000 of FC  THEN
         DISPLAY Vstring-text of IN-DATE
             " is Lilian day: " LILIAN
     ELSE
         DISPLAY "CEEDAYS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

**************************************************
** Specify picture string that describes the   **
**  desired format of the output from CEEDATE, **
**  and the picture string's length.           **
**************************************************
     MOVE 23 TO Vstring-length OF PICSTR.
     MOVE "ZD Mmmmmmmmmmmmmmz YYYY" TO
                   Vstring-text OF PICSTR(1:23).

**************************************************
** Call CEEDATE to convert the Lilian date     **
**     to  a picture string.                    **
**************************************************
     CALL "CEEDATE" USING LILIAN, PICSTR,
                          CHRDATE, FC.
```

Figure 71. COBOL Example of CEEDATE (Part 2 of 3)

```
************************************************
** If CEEDATE runs successfully, display result**
************************************************
     IF CEE000 of FC  THEN
         DISPLAY "Input Lilian date of " LILIAN
             " corresponds to:  " CHRDATE
     ELSE
         DISPLAY "CEEDATE failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 71. COBOL Example of CEEDATE (Part 3 of 3)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDATE                    */
 /**********************************************/
 /**                                            */
 /** Function: CEEDATE - convert Lilian date to */
 /**                     character format       */
 /**                                            */
 /** In this example, a call is made to CEEDATE */
 /** to convert a date in the Lilian format     */
 /** (the number of days since 14 October 1582) */
 /** to a date in character format. This date   */
 /** is then printed out.                       */
 /**                                            */
 /********************************************* */
 PLIDATE: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL LILIAN  REAL FIXED BINARY(31,0) ;
    DCL PICSTR  CHAR(255) VARYING;
    DCL CHRDATE CHAR(80) ;
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI    * Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    LILIAN = 152385;  /* input date in Lilian format */
    /* picture string that describes how converted   */
    /* date is to be formatted                       */
    PICSTR = 'ZD Mmmmmmmmmmmmmmz YYYY';

    /* Call CEE3DATE to convert input Lilian date to */
    /* a date in the character format specified in   */
    /* PICSTR                                        */
    CALL CEEDATE ( LILIAN , PICSTR , CHRDATE , FC );

    /* Print results if call to CEEDATE succeeds     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
        PUT SKIP LIST( 'Lilian day ' || LILIAN
           || ' is equivalent to ' || CHRDATE );
       END;
    ELSE  DO;
       DISPLAY( 'CEEDATE failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIDATE;
```

Figure 72. PL/I Example of CEEDATE

Table 25 shows the sample output from CEEDATE.

Table 25. Sample Output of CEEDATE

input_Lilian_date	picture_string	output_char_date
148138	YY	88
	YYMM	8805
	YY-MM	88-05
	YYMMDD	880516
	YYYYMMDD	19880516
	YYYY-MM-DD	1988-05-16
	YYYY-ZM-ZD	1988-5-16
	JJJJ YY.MM.DD	Showa 63.05.16 (in a DBCS string)
	CCCC YY.MM.DD	Min Guo 77.05.16 (in a DBCS string)
148139	MM	05
	MMDD	0517
	MM/DD	05/17
	MMDDYY	051788
	MM/DD/YYYY	05/17/1988
	ZM/DD/YYYY	5/17/1988
148140	DD	18
	DDMM	1805
	DDMMYY	180588
	DD.MM.YY	18.05.88
	DD.MM.YYYY	18.05.1988
	DD Mmm YYYY	18 May 1988
148141	DDD	140
	YYDD	88148
	YY.DDD	88.140
	YYYY.DDD	1988.140
148142	YY/MM/DD HH:MI:SS.99	88/05/20 00:00:00.00
	YYYY/ZM/ZD ZH:MI AP	1988/5/20 0:00 AM
148143	WWW., MMM DD, YYYY	SAT., MAY 21, 1988
	Www., Mmm DD, YYYY	Sat., May 21, 1988
	Wwwwwwwwww Mmmmmmmmmm DD, YYYY	Saturdaybb, Maybbbbbbb 21, 1988
	Wwwwwwwwwz, Mmmmmmmmmz DD, YYYY	Saturday, May 21, 1988

CEEDATM—Convert seconds to character timestamp

CEEDATM converts a number representing the number of seconds since 00:00:00 14 October 1582 to a character string format. The format of the output is a character string timestamp, for example: `1988/07/26 20:37:00`.

The inverse of CEEDATM is CEESECS, which converts a timestamp to number of seconds.

CEEDATM is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

Syntax

```
►►──CEEDATM──(──input_seconds──,──picture_string──,──output_timestamp──,──────►
►─fc──)──────────────────────────────────────────────────────────────────────►◄
```

input_seconds (input)
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds.

For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range of *input_seconds* is 86,400 to 265,621,679,999.999 (23:59:59.999 31 December 9999).

picture_string (input)
A halfword length-prefixed character string (VSTRING), representing the desired format of *output_timestamp*, for example, `MM/DD/YY HH:MI AP`.

Each character in the *picture_string* represents a character in *output_timestamp*. If delimiters such as a slash (/) appear in the picture string, they are copied as is to *output_timestamp*.

See Table 28 on page 517 for a list of valid picture character terms and Table 29 on page 518 for examples of valid picture strings.

If *picture_string* is null or blank, CEEDATM gets *picture_string* based on the current value of the COUNTRY run-time option. For example, if the current value of the COUNTRY run-time option is US (United States), the date-time format would be "`MM/DD/YY HH:MI:SS AP`"; if the current COUNTRY value is FR (France), however, the date-time format would be "`DD.MM.YYYY HH:MI:SS`".

If *picture_string* includes the Japanese Era symbol `<JJJJ>`, the `YY` position in *output_timestamp* represents the year within Japanese Era. See Table 29 on page 518 for an example. See Table 30 on page 518 for a list of Japanese Eras supported by CEEDATM.

If *picture_string* includes era symbol `<CCCC>` or `<CCCCCCCC>`, the `YY` position in *output_timestamp* represents the year within the era. See Table 29 on page 518 for an example.

output_timestamp (output)
A fixed-length 80-character string (VSTRING), that is the result of converting *input_seconds* to the format specified by *picture_string*.

If necessary, the output is truncated to the length of *output_timestamp*. See Table 26 on page 243 for sample output.

If *input_seconds* is invalid, *output_timestamp* is set to all blanks and CEEDATM terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.

Code	Severity	Message number	Message text
CEE2E9	3	2505	The number-of-seconds value was not within the supported range.
CEE2EA	3	2506	<JJJJ>, <CCCC> or <CCCCCCCC> was used in a picture string passed to CEEDATM, but the input number-of-seconds value was not within the supported range. The Era could not be determined.
CEE2EM	3	2518	An invalid picture string was specified.
CEE2EV	2	2527	The timestamp string returned by CEEDATM was truncated.
CEE3CF	2	3471	The country code *country-code* was invalid for CEEFMDT. The default date and time picture string *datetime-string* was returned.

Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- To create a null VSTRING, set the length to zero; the content of the text portion does not matter. To create a blank VSTRING, any length greater than zero can be used; the content of the text portion must be spaces or blanks.
- z/OS UNIX consideration—In multithread applications, CEEDATM applies to the enclave.

For more information

- See “CEESECS—Convert timestamp to seconds” on page 436 for more information about the CEESECS callable service.
- See “COUNTRY” on page 22 for more information about the COUNTRY run-time option.
- See “CEEFMDT—Get default date and time format” on page 271 for information about how to get a default timestamp for a given country code.

Examples

```
/*Module/File Name: EDCDATM   */

#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

             /* September 13, 1991 at 11:23:23 PM */
   _FLOAT8 seconds = 12904183403.0;
   _VSTRING date,date_pic;
   _CHAR80 out_date;
   _FEEDBACK fc;

   strcpy(date_pic.string,
   "Mmmmmmmmmmmz DD, YYYY at ZH:MI:.SS AP");
   date_pic.length = strlen(date_pic.string);

   CEEDATM(&seconds,&date_pic,out_date,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEDATM failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }

   printf("%.80s\n",out_date);
}
```

Figure 73. C/C++ Example of CEEDATM

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDATM
      ************************************************
      **                                            **
      ** Function: CEEDATM - convert seconds to     **
      **                     character timestamp    **
      **                                            **
      ** In this example, a call is made to CEEDATM **
      ** to convert a date represented in Lilian    **
      ** seconds (the number of seconds since       **
      ** 00:00:00 14 October 1582) to a character   **
      ** format (such as 06/02/88 10:23:45). The    **
      ** result is displayed.                       **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDATM.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  DEST          PIC S9(9) BINARY VALUE 2.
       01  SECONDS                 COMP-2.
       01  IN-DATE.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char    PIC X
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of IN-DATE.
```

Figure 74. COBOL Example of CEEDATM (Part 1 of 3)

```
 01  PICSTR.
     02  Vstring-length      PIC S9(4) BINARY.
     02  Vstring-text.
         03  Vstring-char    PIC X
                     OCCURS 0 TO 256 TIMES
                     DEPENDING ON Vstring-length
                        of PICSTR.
 01  TIMESTP                 PIC X(80).
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.

 PROCEDURE DIVISION.
 PARA-CBLDATM.
**************************************************
** Call CEESECS to convert timestamp of 6/2/88 **
**     at 10:23:45 AM to Lilian representation **
**************************************************
     MOVE 20 TO Vstring-length of IN-DATE.
     MOVE "06/02/88 10:23:45 AM"
         TO Vstring-text of IN-DATE.
     MOVE 20 TO Vstring-length of PICSTR.
     MOVE "MM/DD/YY HH:MI:SS AP"
         TO Vstring-text of PICSTR.
     CALL "CEESECS" USING IN-DATE, PICSTR,
                          SECONDS, FC.

**************************************************
** If CEESECS runs successfully, display result**
**************************************************
     IF  CEE000 of FC  THEN
         DISPLAY Vstring-text of IN-DATE
             " is Lilian second:  " SECONDS
     ELSE
         DISPLAY "CEESECS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.


**************************************************
** Specify desired format of the output.       **
**************************************************
     MOVE 35 TO Vstring-length OF PICSTR.
     MOVE "ZD Mmmmmmmmmmmmmmz YYYY at HH:MI:SS"
             TO Vstring-text OF PICSTR.
```

Figure 74. COBOL Example of CEEDATM (Part 2 of 3)

```
**************************************************
** Call CEEDATM to convert Lilian seconds to   **
**     a character timestamp                   **
**************************************************
     CALL "CEEDATM" USING SECONDS, PICSTR,
                          TIMESTP, FC.

**************************************************
** If CEEDATM runs successfully, display result**
**************************************************
     IF CEE000 of FC  THEN
         DISPLAY "Input seconds of " SECONDS
             " corresponds to: " TIMESTP
    ELSE
         DISPLAY "CEEDATM failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 74. COBOL Example of CEEDATM (Part 3 of 3)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDATM

 /****************************************************/
 /**                                               **/
 /** Function: CEEDATM - Convert seconds to        **/
 /**                     character timestamp       **/
 /**                                               **/
 /** In this example, CEEDATM is called to convert  **/
 /** the number of seconds since 00:00:00 14        **/
 /** October 1582 to the character format specified **/
 /** in PICSTR.                                    **/
 /**                                               **/
 /****************************************************/

 PLIDATM: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL SECONDS REAL FLOAT DECIMAL(16);
    DCL PICSTR  CHAR(255) VARYING;
    DCL TIMESTP CHAR(80);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    SECONDS = 13166064060; /* Input is Lilian seconds*/

    PICSTR = 'ZD Mmmmmmmmmmmmmmz YYYY';  /* Picture  */
          /* string describing desired output format */

    /* Call CEEDATM to convert Lilian seconds to     */
    /*    format specified in PICSTR                 */
    CALL CEEDATM ( SECONDS , PICSTR , TIMESTP , FC );

    /* If CEEDATM ran successfully, print result     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'Input Lilian seconds correspond to '
          || TIMESTP);
       END;
    ELSE  DO;
       DISPLAY( 'CEEDATM failed with msg '
          || FC.MsgNo );
       STOP;
       END;

  END PLIDATM;
```

Figure 75. PL/I Example of CEEDATM

Table 26 shows the sample output of CEEDATM.

Table 26. Sample Output of CEEDATM

input_seconds	picture_string	output_timestamp
12,799,191,601.000	YYMMDD	880516
	HH:MI:SS	19:00:01
	YY-MM-DD	88-05-16
	YYMMDDHHMISS	880516190001
	YY-MM-DD HH:MI:SS	88-05-16
	YYYY-MM-DD HH:MI:SS	19:00:01
	AP	1988-05-16
		07:00:01 PM
12,799,191,661.986	DD Mmm YY	16 May 88
	DD MMM YY HH:MM	16 MAY 88 19:01
	WWW, MMM DD, YYYY	MON, MAY 16,
	ZH:MI AP	1988 7:01 PM
	Wwwwwwwwwz, ZM/ZD/YY	Monday, 5/16/88
	HH:MI:SS.99	19:01:01.98
12,799,191,662.009	YYYY	1988
	YY	88
	Y	8
	MM	05
	ZM	5
	RRRR	Vbbb
	MMM	MAY
	Mmm	Maybbbbb
	Mmmmmmmmmm	May
	Mmmmmmmmmz	16
	DD	16
	ZD	137
	DDD	19
	HH	01
	ZH	02
	MI	00
	SS	009
	99	PM
	999	MON
	AP	Mon
	WWW	Mondaybbbb
	Www	Monday
	Wwwwwwwwww	
	Wwwwwwwwwz	

CEEDAYS—Convert date to Lilian format

CEEDAYS converts a string representing a date into a Lilian format, which represents a date as the number of days from the beginning of the Gregorian calendar. CEEDAYS converts the specified *input_char_date* to a number representing the number of days since day one in the Lilian format: Friday, 14 October, 1582.

Do not use CEEDAYS in combination with COBOL intrinsic functions unless the programs are compiled with the INTDATE(LILIAN) compiler option. Use CEECBLDY for COBOL programs that use intrinsic functions and that are compiled with INTDATE(ANSI).

CEEDAYS can convert a date into Lilian format. The inverse of CEEDAYS is CEEDATE, which converts *output_Lilian_date* from Lilian format to character format.

To handle dates earlier than 1601, it is possible to add 4000 to each year, convert to Lilian, calculate, subtract 4000 from the result, and then convert back to character format.

By default, 2-digit years lie within the 100-year range starting 80 years prior to the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. This default range is changed by using the callable service CEESCEN.

Syntax

```
►►──CEEDAYS──(──input_char_date──,──picture_string──,──────────────────►
►──output_Lilian_date──,──fc──)──────────────────────────────────────►◄
```

input_char_date (input)
A halfword length-prefixed character string (VSTRING), representing a date or timestamp, in a format conforming to that specified by *picture_string*.

The character string must contain between 5 and 255 characters, inclusive. *input_char_date* can contain leading or trailing blanks. Parsing for a date begins with the first nonblank character (unless the picture string itself contains leading blanks, in which case CEEDAYS skips exactly that many positions before parsing begins).

After parsing a valid date, as determined by the format of the date specified in *picture_string*, CEEDAYS ignores all remaining characters. Valid dates range between and include 15 October 1582 to 31 December 9999.

See Table 28 on page 517 for a list of valid picture character terms that can be specified in *input_char_date*.

picture_string (input)
A halfword length-prefixed character string (VSTRING), indicating the format of the date specified in *input_char_date*.

Each character in the *picture_string* corresponds to a character in *input_char_date*. For example, if you specify MMDDYY as the *picture_string*, CEEDAYS reads an *input_char_date* of 060288 as 02 June 1988.

If delimiters such as a slash (/) appear in the picture string, leading zeros can be omitted. For example, the following calls to CEEDAYS:

```
CALL CEEDAYS('6/2/88'  , 'MM/DD/YY', lildate, fc);
CALL CEEDAYS('06/02/88', 'MM/DD/YY', lildate, fc);
CALL CEEDAYS('060288'  , 'MMDDYY'  , lildate, fc);
CALL CEEDAYS('88154'   , 'YYDDD'   , lildate, fc);
CALL CEEDAYS('1988154' , 'YYYYDDD' , lildate, fc);
```

would each assign the same value, 148155 (02 June 1988), to *lildate*.

Whenever characters such as colons or slashes are included in the *picture_string* (such as `HH:MI:SS YY/MM/DD`), they count as placeholders but are otherwise ignored.

See Table 28 on page 517 for a list of valid picture character terms and Table 29 on page 518 for examples of valid picture strings.

If *picture_string* includes a Japanese Era symbol `<JJJJ>`, the `YY` position in *input_char_date* is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 29 on page 518 for an additional example. See also Table 30 on page 518 for a list of Japanese Eras supported by CEEDATE.

If *picture_string* includes era symbol `<CCCC>` or `<CCCCCCCC>`, the `YY` position in *input_char_date* is replaced by the year number within the era. See Table 29 on page 518 for an additional example.

output_Lilian_date (output)
A 32-bit binary integer representing the Lilian date, the number of days since 14 October 1582. For example, 16 May 1988 is day number 148138.

If *input_char_date* does not contain a valid date, *output_Lilian_date* is set to 0 and CEEDAYS terminates with a non-CEE000 symbolic feedback code.

Date calculations are performed easily on the *output_Lilian_date*, because it is an integer. Leap year and end-of-year anomalies do not affect the calculations.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE2EB	3	2507	Insufficient data was passed to CEEDAYS or CEESECS. The Lilian value was not calculated.
CEE2EC	3	2508	The date value passed to CEEDAYS or CEESECS was invalid.
CEE2ED	3	2509	Tbe era passed to CEEDAYS or CEESECS was not recognized.
CEE2EH	3	2513	The input date was not within the supported range.
CEE2EL	3	2517	The month value was not recognized.
CEE2EM	3	2518	An invalid picture string was specified.
CEE2EO	3	2520	CEEDAYS detected non-numeric data in a numeric field, or the date string did not match the picture string.
CEE2EP	3	2521	The year-within-era value passed to CEEDAYS or CEESECS was zero.

Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- z/OS UNIX consideration—In multithread applications, CEEDAYS applies to the enclave.

For more information

- See the INTDATE COBOL compiler installation option in *Enterprise COBOL for z/OS and OS/390 Programming Guide* or *COBOL for OS/390 & VM Programming Guide* for information about how to get Lilian integer values from

COBOL intrinsic functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.

- See “CEEDATE—Convert Lilian date to character format” on page 228 for more information about the CEEDATE run-time option.
- See “CEESCEN—Set the century window” on page 422 for more information about the CEESCEN callable service.

Examples

```
/*Module/File Name: EDCDAYS   */

#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _INT4 lil_date1,lil_date2;
   _VSTRING date,date_pic;

   /* use CEEDAYS to get the Lilian format */
   strcpy(date.string,"05/14/64");
   date.length = strlen(date.string);
   strcpy(date_pic.string,"MM/DD/YY");
   date_pic.length = strlen(date_pic.string);

   CEEDAYS(&date,&date_pic,&lil_date1,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEDAYS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }

   /* use CEEDAYS to get the Lilian format */
   strcpy(date.string,"August 14, 1966");
   date.length = strlen(date.string);
   strcpy(date_pic.string,"Mmmmmmmmmmz DD, YYYY");
   date_pic.length = strlen(date_pic.string);

   CEEDAYS(&date,&date_pic,&lil_date2,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEDAYS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }

   /* subtract the two Lilian dates to find out */
   /* difference in days */
   printf("The number of days between"
   " May 14, 1964 and August 14, 1966"
   " is: %d\n",lil_date2 - lil_date1);
}
```

Figure 76. C/C++ Example of CEEDAYS

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDAYS
      ******************************************
      **                                      **
      ** Function: CEEDAYS - convert date to   **
      **                     Lilian format     **
      **                                      **
      ******************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDAYS.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  CHRDATE.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char    PIC X
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of CHRDATE.
       01  PICSTR.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char    PIC X
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of PICSTR.
       01  LILIAN                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
       PARA-CBLDAYS.
      ************************************************
      ** Specify input date and length               **
      ************************************************
           MOVE 16 TO Vstring-length of CHRDATE.
           MOVE "1 January 2000"
               TO Vstring-text of CHRDATE.
```

Figure 77. COBOL Example of CEEDAYS (Part 1 of 2)

```
**************************************************
** Specify a picture string that describes     **
** input date, and the picture string's length.**
**************************************************
     MOVE 25 TO Vstring-length of PICSTR.
     MOVE "ZD Mmmmmmmmmmmmmmz YYYY"
             TO Vstring-text of PICSTR.

**************************************************
** Call CEEDAYS to convert input date to a     **
** Lilian date                                 **
**************************************************
     CALL "CEEDAYS" USING CHRDATE, PICSTR,
                          LILIAN, FC.

**************************************************
** If CEEDAYS runs successfully, display result**
**************************************************
     IF  CEE000 of FC  THEN
         DISPLAY Vstring-text of CHRDATE
             " is Lilian day: " LILIAN
     ELSE
         DISPLAY "CEEDAYS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 77. COBOL Example of CEEDAYS (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDAYS                        */
 /**************************************************/
 /**                                              **/
 /** Function     : CEEDAYS - Convert date to      **/
 /**                          Lilian format        **/
 /**                                              **/
 /** This example converts two dates to the Lilian **/
 /** format in order to calculate the number of    **/
 /** days between them.                            **/
 /**                                              **/
 /**************************************************/

 PLIDAYS: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL CHRDATE  CHAR(255) VARYING;
    DCL CHRD2    CHAR(255) VARYING;
    DCL PICSTR   CHAR(255) VARYING;
    DCL PICST2   CHAR(255) VARYING;
    DCL LILIAN   REAL FIXED BINARY(31,0);
    DCL LIL2     REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* First date to be converted to Lilian format   */
```

Figure 78. PL/I Example of CEEDAYS (Part 1 of 2)

```
   CHRDATE = '5/7/69';

   /* Picture string of first input date           */
   PICSTR = 'ZM/ZD/YY';

   /* Call CEEDAYS to convert input date to the     */
   /*    Lilian format                              */
   CALL CEEDAYS ( CHRDATE , PICSTR , LILIAN , FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'The Lilian date for ' || CHRDATE
         || ' is ' || LILIAN );
      END;
   ELSE  DO;
      DISPLAY( 'CEEDAYS failed with msg '
         || FC.MsgNo );
      STOP;
      END;

   /* Second date to be converted to Lilian format  */
   CHRD2 = '1 January 2000';

   /* Picture string of second input date          */
   PICST2 = 'ZD Mmmmmmmmmmmmmmz YYYY';

   /* Call CEEDAYS to convert input date to the     */
   /*    Lilian format                              */
   CALL CEEDAYS ( CHRD2 , PICST2 , LIL2 , FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'The Lilian date for ' || CHRD2
         || ' is ' || LIL2 );
      END;
   ELSE  DO;
      DISPLAY( 'CEEDAYS failed with msg '
         || FC.MsgNo );
      STOP;
      END;

   /* Subtract the two Lilian dates to find out     */
   /*    the difference in days between the two     */
   /*    input dates                                */
   PUT SKIP LIST( 'The number of days between '
      || CHRDATE || ' and ' || CHRD2 || ' is'
      || LIL2 - LILIAN || '.');

 END PLIDAYS;
```

Figure 78. PL/I Example of CEEDAYS (Part 2 of 2)

CEEDCOD—Decompose a condition token

CEEDCOD alters an existing condition token.

Language Environment-conforming HLLs can decompose or alter the condition token fields without using the CEEDCOD service. See the CEESGL HLL examples starting on page Figure 181 on page 453 for examples of how to alter the condition token field.

Syntax

```
►►──CEEDCOD──(──cond_token──,──c_1──,──c_2──,──case──,──severity──,──────────►
►──control──,──facility_ID──,──i_s_info──,──────────────────────────────────►
►──fc──)──────────────────────────────────────────────────────────────────►◄
```

cond_token (input)
A 12-byte condition token representing the current condition or feedback information.

c_1 (output)
A 2-byte binary integer representing the value of the first 2 bytes of the condition_ID.

c_2 (output)
A 2-byte binary integer representing the value of the second 2 bytes of the condition_ID. See “CEENCOD—Construct a condition token” on page 401 for a detailed explanation of the condition_ID.

case (output)
A 2-byte binary integer field defining the format of the condition_ID portion of the token. A value of 1 identifies a case 1 condition. A value of 2 identifies a case 2 condition. The values 0 and 3 are reserved.

severity (output)
A 2-byte binary integer representing the severity of the condition. *severity* specifies the following values:

0 Information only (or, if the entire token is zero, no information).

1 Warning—service completed, probably correctly.

2 Error detected—correction attempted; service completed, perhaps incorrectly.

3 Severe error—service not completed.

4 Critical error—service not completed; condition signaled. A critical error is a condition that jeopardizes the environment. If a critical error occurs during a Language Environment callable service, instead of returning synchronously to the caller, the condition manager is always signaled.

control (output)
A 2-byte binary integer containing flags describing aspects of the state of the condition. Valid values for the control field are 1 and 0. 1 indicates that the *facility_ID* is assigned by IBM. 0 indicates the *facility_ID* is assigned by the user.

facility_ID (output)
A 3-character field containing three alphanumeric characters identifying the product generating the condition or feedback information.

i_s_info
A fullword binary integer that identifies the ISI associated with the given

instance of the condition represented by the condition token where it is contained. If an ISI is not associated with a given condition token, the *i_s_info* field contains a value of binary zero.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE036	3	0102	An unrecognized condition token was passed to *routine* and could not be used.

Usage notes

- C/C++ considerations—The structure of the condition token (type_FEEDBACK) is described in the `leawi.h` header file shipped with Language Environment. C users can assign values directly to the fields of the token in the header file without using the CEENCOD service.

  The layout of the type_FEEDBACK condition token in the header file is shown in Figure 156 on page 403.
- z/OS UNIX consideration—In multithread applications, CEEDCOD affects only the calling thread.

For more information

- See the CEESGL HLL examples starting in Figure 181 on page 453 for examples of how to alter the condition token field.
- See “CEENCOD—Construct a condition token” on page 401 for a detailed explanation of the condition_ID.
- See CEENCOD “Usage notes” on page 403 for a discussion of case 1 and case 2 types.
- See the *facility_ID* parameter of “CEENCOD—Construct a condition token” on page 401 for more information.
- For more C user information about assigning values directly to the fields of the token in the header file without using the CEENCOD service, see the example for “CEESGL—Signal a condition” on page 450.

Examples

```
/*Module/File Name: EDCDCOD   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

/*****************************************************/
/* In C/C++ it is not necessary to use this service.*/
/* The fields can be manipulated directly.  See the */
/* example for CEESGL to see how to manipulate      */
/* condition token fields directly.                 */
/*****************************************************/

int main(void) {

  _FEEDBACK fc,newfc;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi, heapid, size;
  _POINTER address;

  heapid = 0;
  size = 4000;

  CEEGTST(&heapid,&size,&address,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEGTST failed with msgno %d\n",
       fc.tok_msgno);
     exit(2999);
  }

  /* decompose the feedback token to check for errors */
  CEEDCOD(&fc,&c_1,&c_2,&cond_case,&sev,&control,facid,;
          &isi,&newfc);

  if ( _FBCHECK ( newfc , CEE000 ) != 0 ) {
     printf("CEEDCOD failed with msgno %d\n",
       newfc.tok_msgno);
     exit(2889);
  }
  if (c_1 != 0 || c_2 != 0)
     printf(
     "c_1 and c_2 returned from CEEDCOD should be 0\n");
 /* .
    .
    . */
}
```

Figure 79. C/C++ Example of CEEDCOD

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDCOD
      ************************************************
      **                                            **
      ** Function: CEEDCOD - Decompose a condition **
       **                     token                **
      **                                            **
      ** In this example, a call is made to        **
      ** CEEGTST in order to obtain a condition    **
      ** token to use in the call to CEEDCOD.      **
      ** A call could also have been made to any   **
      ** other Lang Env svc., or a condition token **
      ** could have been constructed using         **
      ** CEEDCOD.                                  **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDCOD.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HEAPID                  PIC S9(9) BINARY.
       01  HPSIZE                  PIC S9(9) BINARY.
       01  ADDRSS                  USAGE POINTER.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  FC2.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
```

Figure 80. COBOL Example of CEEDCOD (Part 1 of 2)

```
 PROCEDURE DIVISION.
*************************************************
** Call any Lang Env svc to receive a condition**
**     token to use as input to CEEDCOD.       **
*************************************************

 PARA-CBLGTST.
************************************************
** Specify 0 to get storage from the initial  **
**     heap.                                  **
** Specify 4000 to get 4000 bytes of storage. **
** Call CEEGTST to obtain storage.            **
************************************************

     MOVE 0 TO HEAPID.
     MOVE 4000 TO HPSIZE.

     CALL "CEEGTST" USING HEAPID, HPSIZE,
                          ADDRSS, FC.

 PARA-CBLDCOD.
************************************************
** Use the FC returned from CEEGTST as an     **
**     input condition token to CEEDCOD.      **
************************************************

     CALL "CEEDCOD" USING FC, SEV, MSGNO, CASE,
                          SEV2, CNTRL, FACID,
                          ISINFO, FC2.
     IF CEE000 of FC2  THEN
         DISPLAY "CEEGTST completed with msg "
             MSGNO ", Severity " SEV ", Case "
             CASE ", Control " CNTRL ", and "
             "Instance-Specific Information of "
             ISINFO "."
     ELSE
         DISPLAY "CEEDCOD failed with msg "
             Msg-No of FC2 UPON CONSOLE
     END-IF.

     GOBACK.
```

Figure 80. COBOL Example of CEEDCOD (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDCOD                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEEDCOD - decompose a condition    **/
 /**                     token                    **/
 /**                                              **/
 /** In this example, a call is made to CEEGTST to **/
 /** receive a condition token to decompose.      **/
 /** A call could have been made to any LE/370    **/
 /** service. The condition token returned by     **/
 /** CEEGTST is used as input to CEEDCOD.         **/
 /**                                              **/
 /**************************************************/
 PLIDCOD: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL HEAPID  REAL FIXED BINARY(31,0);
    DCL STGSIZE REAL FIXED BINARY(31,0);
    DCL ADDRSS  POINTER;
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 81. PL/I Example of CEEDCOD (Part 1 of 2)

```
   DCL SEV     REAL FIXED BINARY(15,0);
   DCL MSGNO   REAL FIXED BINARY(15,0);
   DCL CASE    REAL FIXED BINARY(15,0);
   DCL SEV2    REAL FIXED BINARY(15,0);
   DCL CNTRL   REAL FIXED BINARY(15,0);
   DCL FACID   CHARACTER ( 3 );
   DCL ISINFO  REAL FIXED BINARY(31,0);
   DCL 01 FC2,                    /* Feedback token */
          03 MsgSev    REAL FIXED BINARY(15,0),
          03 MsgNo     REAL FIXED BINARY(15,0),
          03 Flags,
             05 Case      BIT(2),
             05 Severity  BIT(3),
             05 Control   BIT(3),
          03 FacID     CHAR(3),      /* Facility ID */
          03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);

   HEAPID = -1;    /* invalid heap ID               */
   STGSIZE = 4000; /* request 4000 bytes of storage */

   /* Call any service (in this case, CEEGTST) to   */
   /*       create a condition token to decompose   */
   CALL CEEGTST ( HEAPID , STGSIZE , ADDRSS , FC );
   /* Call CEEDCOD with the condition token         */
   /*    returned in FC from CEEGTST                */
   CALL CEEDCOD ( FC , SEV , MSGNO , CASE , SEV2 ,
         CNTRL , FACID , ISINFO , FC2 );
   IF  FBCHECK( FC2, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Feedback token from CEEGTST has'
         || ' Severity of ' || SEV
         || ', Message Number of ' || MSGNO
         || ', Case of ' || CASE || ',' );
      PUT SKIP LIST( '   Severity 2 of ' || SEV2
         || ', Control of ' || CNTRL
         || ', Facility ID of ' || FACID
         || ', and I-S-Info of ' || ISINFO || '.' );
      END;
   ELSE  DO;
      DISPLAY( 'CEEDCOD failed with msg '
         || FC2.MsgNo );
      STOP;
      END;

 END PLIDCOD;
```

Figure 81. PL/I Example of CEEDCOD (Part 2 of 2)

CEEDSHP—Discard heap

CEEDSHP discards an entire heap created by CEECRHP or by CEEGTST. CEECRHP and CEEGTST return a unique *heap_id* to the caller; use this ID in the CEEDSHP call. A *heap_id* of 0 is not permitted with CEEDSHP.

Discarding a heap with CEEDSHP immediately returns all storage allocated to the heap to the operating system, even if the KEEP suboption has been specified with the HEAP run-time option.

Syntax

```
►►──CEEDSHP──(──heap_id──,──fc──)──────────────────────────────────────►◄
```

heap_id (input)
A fullword binary signed integer. *heap_id* is a token specifying the discarded heap.

A *heap_id* of 0 is invalid; the initial heap is logically created during enclave initialization and cannot be discarded.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE0P2	4	0802	Heap storage control information was damaged.
CEE0P3	3	0803	The heap identifier in a get storage request or a discard heap request was unrecognized.
CEE0PC	3	0812	An invalid attempt to discard the Initial Heap was made.

Usage notes

- After the call to CEEDSHP, any existing pointers to storage allocated from this heap are dangling pointers, that is, pointers to storage that is freed. Using these pointers can cause unpredictable results.
- z/OS UNIX considerations—CEEDSHP applies to the enclave. Language Environment frees all storage in the heap regardless of which thread allocated it.

For more information

- For more information about the CEEDSHP callable service, see “CEECRHP—Create new additional heap” on page 216.
- For more information about the CEEGTST callable service, and “CEEGTST—Get heap storage” on page 321.

Examples

```
/*Module/File Name: EDCDSHP   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _INT4 heapid, size, increment, options;
   _FEEDBACK fc;
 /*  .
     .
     .  */
   heapid = 0;        /* heap identifier is set */
                      /* by CEECRHP */
   size = 4096;       /* initial size of heap */
                      /* (in bytes)       */
   increment = 4096;  /* increment to extend */
                      /* the heap by */
   options = 72;      /* set up heap as */
                      /* (,,ANYWHERE,FREE)*/

   /* create heap using CEECRHP */
   CEECRHP(&heapid,&size,&increment,&options,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEECRHP failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */

   /* discard the heap that was previously created */
   /* using CEECRHP */
   CEEDSHP(&heapid,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEDSHP failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */
}
```

Figure 82. C/C++ Example of CEEDSHP

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDSHP
      ************************************************
      **                                            **
      ** Function: CEEDSHP - discard heap           **
      **                                            **
      ** In this example, a new additional heap is  **
      ** created a call to CEECRHP, and then        **
      ** discarded through a call to CEEDSHP.       **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDSHP.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HEAPID                  PIC S9(9) BINARY.
       01  HPSIZE                  PIC S9(9) BINARY.
       01  INCR                    PIC S9(9) BINARY.
       01  OPTS                    PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLCRHP.
      ************************************************
      ** Specify 0 for HEAPID, and heap id will      **
      **     be set by CEECRHP.                     **
      ** Heap size and increment will each be 4096   **
      **     bytes.                                 **
      ** Specify 00 for OPTS, and HEAP attributes    **
      **     will be inherited from the initial heap **
      **     (copied from the HEAP run-time option). **
      ************************************************
           MOVE 0 TO HEAPID.
           MOVE 4096 TO HPSIZE.
           MOVE 4096 TO INCR.
           MOVE 00 TO OPTS.

           CALL "CEECRHP" USING HEAPID, HPSIZE,
                                INCR, OPTS, FC.
           IF CEE000 of FC  THEN
               DISPLAY "Created heap number " HEAPID
                    " which is " HPSIZE " bytes long"
           ELSE
               DISPLAY "CEECRHP failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
```

Figure 83. COBOL Example of CEEDSHP (Part 1 of 2)

```
      ************************************************
      ** To discard the heap, call CEEDSHP with the  **
      **     heap id returned from CEECRHP.          **
      ************************************************
           CALL "CEEDSHP" USING HEAPID, FC.
           IF CEE000 of FC THEN
               DISPLAY "Disposed of heap #  " HEAPID
           ELSE
               DISPLAY "CEEDSHP failed with msg "
                   Msg-No of FC UPON CONSOLE
           END-IF.

           GOBACK.
```

Figure 83. COBOL Example of CEEDSHP (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDSHP                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEEDSHP - discard heap             **/
 /**                                              **/
 /** In this example, calls are made to CEECRHP   **/
 /** and CEEDSHP to create a heap of 4096 bytes   **/
 /** and then discard it.                         **/
 /**                                              **/
 /**************************************************/

 PLIDSHP: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL HEAPID REAL FIXED BINARY(31,0) ;
    DCL HPSIZE REAL FIXED BINARY(31,0) ;
    DCL INCR REAL FIXED BINARY(31,0) ;
    DCL OPTS REAL FIXED BINARY(31,0) ;
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 84. PL/I Example of CEEDSHP (Part 1 of 2)

```
   DCL 01 FC2,                    /* Feedback token */
          03 MsgSev    REAL FIXED BINARY(15,0),
          03 MsgNo     REAL FIXED BINARY(15,0),
          03 Flags,
             05 Case      BIT(2),
             05 Severity  BIT(3),
             05 Control   BIT(3),
          03 FacID     CHAR(3),      /* Facility ID */
          03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);

   HEAPID = 0;    /* HEAPID will be set and         */
                  /*    returned by CEECRHP         */
   HPSIZE = 4096; /* Initial size of heap in bytes  */
   INCR = 4096;   /* Number of bytes to extend      */
                  /*    heap by                     */
   OPTS = 00;     /* Set up heap with the same      */
                  /*    attributes as the initial   */
                  /*    heap (HEAPID = 0)           */

   /* Call CEECRHP to set up new heap               */
   CALL CEECRHP ( HEAPID, HPSIZE, INCR,
         OPTS, FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Created heap number ' || HEAPID
         || ' consisting of ' || HPSIZE || ' bytes' );
      END;
   ELSE  DO;
      DISPLAY( 'CEECRHP failed with msg '
         || FC.MsgNo );
      STOP;
      END;

   /* Call CEEDSHP to discard heap with the id     */
   /*    returned by CEECRHP                       */
   CALL CEEDSHP ( HEAPID, FC2 );
   IF  FBCHECK( FC2, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Disposed of heap number '
         || HEAPID );
      END;
   ELSE  DO;
      DISPLAY( 'CEEDSHP failed with msg '
         || FC2.MsgNo );
      STOP;
      END;


 END PLIDSHP;
```

Figure 84. PL/I Example of CEEDSHP (Part 2 of 2)

CEEDYWK—Calculate day of week from Lilian date

CEEDYWK calculates the day of the week on which a Lilian date falls. The day of the week is returned to the calling routine as a number between 1 and 7.

The number returned by CEEDYWK is useful for end-of-week calculations.

Syntax

```
►►──CEEDYWK──(──input_Lilian_date──,──output_day_no──,──fc──)──────────────►◄
```

input_Lilian_date (input)
A 32-bit binary integer representing the Lilian date, the number of days since 14 October 1582.

For example, 16 May 1988 is day number 148138. The valid range of *input_Lilian_date* is between 1 and 3,074,324 (15 October 1582 and 31 December 9999).

output_day_no (output)
A 32-bit binary integer representing *input_Lilian_date*'s day-of-week: 1 equals Sunday, 2 equals Monday, ..., 7 equals Saturday.

If *input_Lilian_date* is invalid, *output_day_no* is set to 0 and CEEDYWK terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2EG	3	2512	The Lilian date value passed in a call to CEEDATE or CEEDYWK was not within the supported range.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEEDYWK affects only the calling thread.
- COBOL consideration—The CEEDYWK callable service has different values than the COBOL ACCEPT statement with conceptual data item DAY-OF-WEEK. Use one or the other, not both.

Examples

```
/*Module/File Name: EDCDYWK   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {

  _INT4 in_date, day;
  _FEEDBACK fc;

  in_date = 139370;  /* Thursday */

  CEEDYWK(&in_date,&day,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEDYWK failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  printf("Lilian date %d, occurs on a ",in_date);
  switch(day) {
     case 1: printf("Sunday.\n");
             break;
     case 2: printf("Monday.\n");
             break;
     case 3: printf("Tuesday.\n");
             break;
     case 4: printf("Wednesday.\n");
             break;
     case 5: printf("Thursday.\n");
             break;
     case 6: printf("Friday.\n");
             break;
     case 7: printf("Saturday.\n");
             break;
     default: printf(
           " ERROR! DAY RETURN BY CEEDYWK UNKNOWN\n");
             break;
  }
}
```

Figure 85. C/C++ Example of CEEDYWK

```
CBL LIB,QUOTE
      *Module/File Name: IGZTDYWK
      ************************************************
      **                                            **
      ** CBLDYWK - Call CEEDYWK to calculate the    **
      **           day of the week from Lilian date **
      **                                            **
      ** In this example, a call is made to CEEDYWK **
      ** to return the day of the week on which a   **
      ** Lilian date falls. (A Lilian date is the   **
      ** number of days since 14 October 1582)      **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLDYWK.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  LILIAN                  PIC S9(9) BINARY.
       01  DAYNUM                  PIC S9(9) BINARY.
       01  IN-DATE.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of IN-DATE.
       01  PICSTR.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of PICSTR.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
       PARA-CBLDAYS.
      ** Call CEEDAYS to convert date of 6/2/88 to
      **     Lilian representation
           MOVE 6 TO Vstring-length of IN-DATE.
           MOVE "6/2/88" TO Vstring-text of IN-DATE(1:6).
           MOVE 8 TO Vstring-length of PICSTR.
           MOVE "MM/DD/YY" TO Vstring-text of PICSTR(1:8).
           CALL "CEEDAYS" USING IN-DATE, PICSTR,
               LILIAN, FC.
```

Figure 86. COBOL Example of CEEDYWK (Part 1 of 2)

```
** If CEEDAYS runs successfully, display result.
     IF  CEE000 of FC  THEN
         DISPLAY Vstring-text of IN-DATE
             " is Lilian day: " LILIAN
     ELSE
         DISPLAY "CEEDAYS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 PARA-CBLDYWK.

** Call CEEDYWK to return the day of the week on
** which the Lilian date falls
     CALL "CEEDYWK" USING LILIAN , DAYNUM , FC.

** If CEEDYWK runs successfully, print results
     IF CEE000 of FC  THEN
         DISPLAY "Lilian day " LILIAN
             " falls on day " DAYNUM
             " of the week, which is a:"
** Select DAYNUM to display the name of the day
**     of the week.
         EVALUATE DAYNUM
           WHEN 1
             DISPLAY "Sunday."
           WHEN 2
             DISPLAY "Monday."
           WHEN 3
             DISPLAY "Tuesday"
           WHEN 4
             DISPLAY "Wednesday."
           WHEN 5
             DISPLAY "Thursday."
           WHEN 6
             DISPLAY "Friday."
           WHEN 7
             DISPLAY "Saturday."
         END-EVALUATE
     ELSE
         DISPLAY "CEEDYWK failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 86. COBOL Example of CEEDYWK (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMDYWK                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEEDYWK - calculate day of week    **/
 /** from Lilian date                             **/
 /**                                              **/
 /** In this example, CEEDYWK is called to        **/
 /** calculate the day of week on which a         **/
 /** Lilian date falls.                           **/
 /**                                              **/
 /**************************************************/

 PLIDYWK: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL LILIAN  REAL FIXED BINARY(31,0) ;
    DCL DAYNUM  REAL FIXED BINARY(31,0) ;
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    LILIAN = 152385; /* specify input as Lilian date */

    /* Call CEEDYWK to calculate the day of the      */
    /*    week on which Lilian date 152385 falls     */
    CALL CEEDYWK ( LILIAN , DAYNUM , FC );

    /* If CEEDYWK ran successfully, print result     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST ( 'Lilian date ' || LILIAN
          || ' falls on a ' );
       SELECT (DAYNUM);
          WHEN (1) PUT LIST ( 'Sunday.' );
          WHEN (2) PUT LIST ( 'Monday.' );
          WHEN (3) PUT LIST ( 'Tuesday.' );
          WHEN (4) PUT LIST ( 'Wednesday.' );
          WHEN (5) PUT LIST ( 'Thursday.' );
          WHEN (6) PUT LIST ( 'Friday.' );
          WHEN (7) PUT LIST ( 'Saturday.' );
          END /* Case of DAYNUM */;
       END;
    ELSE  DO;
       DISPLAY( 'CEEDYWK failed with msg '
          || FC.MsgNo );
       STOP;
       END;


 END PLIDYWK;
```

Figure 87. PL/I Example of CEEDYWK

CEEFMDA—Get default date format

CEEFMDA returns to the calling routine the default date picture string for a specified country.

CEEFMDA is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

Syntax

```
►►──CEEFMDA──(──country_code──,──date_pic_str──,──fc──)──────────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY run-time option or the CEE3CTY callable service) is used.

If you specify an invalid *country_code*, the default date format is `'YYYY-MM-DD'`.

date_pic_str (output)
A fixed-length 80-character string (VSTRING), returned to the calling routine. It contains the default date picture string for the country specified. The picture string is left-justified and padded on the right with blanks if necessary.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3CB	2	3467	The country code *country_code* was invalid for CEEFMDA. The default date picture string *date_pic_string* was returned.

Usage notes

- z/OS UNIX considerations—CEEFMDA applies to the enclave. Every enclave has a single current country setting that has a single date format. Every thread in every enclave has the same default.

For more information

- For a list of the default settings for a specified country, see Table 27 on page 513.
- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

```
/*Module/File Name: EDCFMDA   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _CHAR2 country;
  _CHAR80 date_pic;

  /* get the default date format for Canada */
  memcpy(country,"CA",2);
  CEEFMDA(country,date_pic,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEFMDA failed with message number %d\n",
             fc.tok_msgno);
     exit(2999);
  }
  /* print out the default date format for Canada */
  printf("%.80s\n",date_pic);
}
```

Figure 88. C/C++ Example of CEEFMDA

```
CBL LIB,QUOTE
      *Module/File Name: IGZTFMDA
      ******************************************
      **                                      **
      ** CBLFMDA - Call CEEFMDA to obtain the  **
      **           default date format         **
      ******************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLFMDA.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                 PIC X(2).
       01  PICSTR                  PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLFMDA.
      ** Specify country code for the US and call
      **     CEEFMDA to return the default date format
      **     for the US.
           MOVE "US" TO COUNTRY.
           CALL "CEEFMDA" USING COUNTRY , PICSTR , FC.

      ** If CEEFMDA runs successfully, display result
           IF CEE000 of FC THEN
               DISPLAY "The default date format for "
                   "the US is: " PICSTR
           ELSE
               DISPLAY "CEEFMDA failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
           GOBACK.
```

Figure 89. COBOL Example of CEEFMDA

```
*PROCESS MACRO;
 /* Module/File Name: IBMFMDA                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEFMDA - obtain default date        **/
 /**                     format                     **/
 /**                                                **/
 /****************************************************/

 PLIFMDA: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;
    DCL COUNTRY CHARACTER ( 2 );
    DCL PICSTR CHAR(80);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US';   /* Specify country code for    */
                      /*    the United States        */

    /* Get the default date format for the US        */
    CALL CEEFMDA ( COUNTRY , PICSTR , FC );

    /* Print the default date format for the US      */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'The default date format for the US is '
          || PICSTR );
       END;
    ELSE  DO;
       DISPLAY( 'CEEFMDA failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIFMDA;
```

Figure 90. PL/I Example of CEEFMDA

CEEFMDT—Get default date and time format

CEEFMDT returns the default date and time picture strings for the country specified by *country_code*.

CEEFMDT is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

Syntax

```
►►──CEEFMDT──(──country_code──,──datetime_str──,──fc──)──────────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY run-time option or by CEE3CTY) is used.

If you specify an invalid *country_code*, the default date/time picture string is `'YYYY-MM-DD HH:MI:SS'`.

datetime_str (output)
A fixed-length 80-character string (VSTRING), returned to the calling routine. It contains the default date and time picture string for the country specified. The picture string is left-justified and padded on the right with blanks, if necessary.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3CF	2	3471	The country code *country_code* was invalid for CEEFMDT. The default date and time picture string *datetime_str* was returned.

Usage notes

- z/OS UNIX considerations—CEEFMDT applies to the enclave. Every enclave has a single current country setting that has a single date and time format. Every thread in every enclave has the same default.

For more information

- For a list of the default settings for a specified country, see Table 27 on page 513.
- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of CEE3CTY.

Examples

```
/*Module/File Name: EDCFMDT   */

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _CHAR2 country;
   _CHAR80 date_pic;

   /* get the default date and time format for Canada */
   memcpy(country,"CA",2);
   CEEFMDT(country,date_pic,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEFMDT failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   /* print out the default date and time format */
   printf("%.80s\n",date_pic);
}
```

Figure 91. C/C++ Example of CEEFMDT

```
CBL LIB,QUOTE
      *Module/File Name: IGZTFMDT
      ************************************************
      **                                            **
      ** CBLFMDT - Call CEEFMDT to obtain the       **
      **           default date & time format       **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLFMDT.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  PICSTR                 PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
       PARA-CBLFMDT.
      ** Specify country code for the US
           MOVE "US" TO COUNTRY.
      ** Call CEEFMDT to return the default date and
      **     time format for the US
           CALL "CEEFMDT" USING COUNTRY , PICSTR , FC.

      ** If CEEFMDT runs successfully, display result.
           IF CEE000 of FC THEN
               DISPLAY "The default date and time "
                   "format for the US is: " PICSTR
             ELSE
               DISPLAY "CEEFMDT failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
           GOBACK.
```

Figure 92. COBOL Example of CEEFMDT

```
*PROCESS MACRO;
 /* Module/File Name: IBMFMDT                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEFMDT - obtain default             **/
 /**                     date & time format         **/
 /**                                                **/
 /****************************************************/

 PLIFMDT: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL COUNTRY CHARACTER ( 2 );
    DCL PICSTR  CHAR(80);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US';  /* Specify country code for     */
                     /* the United States            */

    /* Call CEEFMDT to get default date format       */
    /*    for the US                                 */
    CALL CEEFMDT ( COUNTRY , PICSTR , FC );

    /* Print default date format for the US          */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'The default date and time '
          || 'format for the US is ' || PICSTR );
       END;
    ELSE  DO;
       DISPLAY( 'CEEFMDT failed with msg '
          || FC.MsgNo );
       STOP;
       END;


 END PLIFMDT;
```

Figure 93. PL/I Example of CEEFMDT

CEEFMON—Format monetary string

CEEFMON, analogous to the C function `strfmon()`, converts numeric values to monetary strings according to the specifications passed to it. These specifications work in conjunction with the format conversions set in the current locale. The current locale's LC_MONETARY category affects the behavior of this service, including the monetary radix character, the thousands separator, the monetary grouping, the currency symbols (national and international), and formats.

CEEFMON is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEEFMON──(──omitted_parm──,──stringin──,──maxsize──,──format──,──────────►
►─stringout──,──result──,──fc──)──────────────────────────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parm, see “Invoking callable services” on page 107.

stringin (input)
An 8-byte field that contains the value of a double-precision floating point number.

maxsize (input)
A 4-byte integer that specifies the maximum number of bytes (including the string terminator) that can be placed in *stringout*.

format (input)
A halfword length-prefixed character string (VSTRING) of 256 bytes that contains plain characters and a conversion specification. Plain characters are copied to the output stream. Conversion specification results in the fetching of the input *stringin* argument that is converted and formatted.

A conversion specification consists of a percent character (%), optional flags, optional field width, optional left precision, optional right precision, and a required conversion character that determines the conversion to be performed.

Flags

You can specify one or more of the following flags to control the conversion.

=f An *=* followed by a single character *f* specifies that the character *f* should be used as the numeric fill character. The default numeric fill character is the space character. This option does not affect the other fill operations (such as field-width filling), which always use the space as the fill character.

^ Do not format the currency amount with the grouping characters. The default is to insert the grouping characters if defined for the current locale.

+ or (Specifies the style of representing positive and negative currency amounts. You must specify either *+* or *(*. If *+* is specified, the locale’s equivalent of + and - are used (for example, in USA: the empty (null) string if positive and - (minus sign) if negative). If *(* is specified, the locale’s equivalent of enclosing negative amounts within a parenthesis is used. If this option is not included, a default specified by the current locale is used.

! Suppresses the currency symbol from the output conversion.

Field Width

w The decimal digit string *w* specifies a minimum field width in which the result of the conversion is right-justified (or left-justified if *-w* is specified).

Left Precision

#n A # (pound sign) followed by the decimal digit string *n* specifies a maximum number of digits expected to be formatted to the left of the radix character. This option can be used to keep the formatted output from multiple calls to the CEEFMON service aligned in the same columns. It can also be used to fill unused positions with a special character as in $***123.45. This option causes an amount to be formatted as if it has the number of digits specified by *n*. If more digit positions are required than are specified, this conversion specification is ignored. Digit positions in excess of those actually required are filled with the numeric fill character. See the *=f* specification above.

If grouping is enabled, it is applied to the combined fill characters plus regular digits. However, if the fill character is not 0 (digit zero), grouping separators inserted after a fill character are replaced by the same fill character ($0,001,234.56 versus $****1,234.56).

Right Precision

.p A period followed by the decimal digit string *p* specifies the number of digits after the radix character. If the value of the precision *p* is zero, no radix character appears. If this option is not included, a default specified by the current locale is used. The amount being formatted is rounded to the specified number of digits prior to formatting.

Conversion Characters

i The double argument is formatted according to the locale's international currency format (for example, in USA: USD 1,234.56).

n The double argument is formatted according to the locale's national currency format (for example, in USA: $1,234.56).

% No argument is converted; the conversion specification %% is replaced by a single %.

stringout (output)
Contains the output of the CEEFMON service.

result (output)
Contains the number of characters placed in *stringout*, if successful. If unsuccessful, an error is reported.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.
CEE3VM	3	4086	Input Error: The number of characters to be formatted must be greater than zero.

Usage notes

- PL/I MTF consideration—CEEFMON is not supported in PL/I MTF applications.

- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- For more information about the `setlocale()` function, see “COUNTRY” on page 22, “CEE3CTY—Set default country” on page 122, and “CEE3LNG—Set national language” on page 164.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 444.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTFMON
**************************************************
*  Example for callable service CEEFMON         *
*   Function: Convert a numeric value to a      *
*             monetary string using specified   *
*             format passed as parameter.       *
*   Valid only for COBOL for MVS & VM Release 2 *
*   or later.                                   *
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBFMON.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  Monetary       COMP-2.
 01  Max-Size       PIC S9(9)  BINARY.
 01  Format-Mon.
     02  FM-Length  PIC S9(4)  BINARY.
     02  FM-String  PIC X(256).
 01  Output-Mon.
     02  OM-Length  PIC S9(4)  BINARY.
     02  OM-String  PIC X(60).
 01  Length-Mon     PIC S9(9)  BINARY.
 01  Locale-Name.
     02  LN-Length  PIC S9(4)  BINARY.
     02  LN-String  PIC X(256).
**   Use Locale category constants
```

Figure 94. COBOL Example of CEEFMON (Part 1 of 2)

```
 COPY CEEIGZLC.
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
**
 PROCEDURE DIVISION.
** Set up locale name for United States
     MOVE 14 TO LN-Length.
     MOVE "En_US.IBM-1047"
           TO LN-String (1:LN-Length).
** Set all locale categories to United States.
** Use LC-ALL category constant from CEEIGZLC.
     CALL "CEESETL" USING Locale-Name, LC-ALL, FC.
** Check feedback code
     IF Severity > 0
        DISPLAY "Call to CEESETL failed. " Msg-No
        STOP RUN
     END-IF.
** Set up numeric value
     MOVE 12345.62 TO Monetary.
     MOVE 60 TO Max-Size.
     MOVE 2 TO FM-Length.
     MOVE "%i" TO FM-String (1:FM-Length).
** Call CEEFMON to convert numeric value
     CALL "CEEFMON" USING OMITTED, Monetary,
                          Max-Size, Format-Mon
                          Output-Mon, Length-Mon,
                          FC.

** Check feedback code and display result
     IF Severity > 0
        DISPLAY "Call to CEEFMON failed. " Msg-No
     ELSE
        DISPLAY "International format is "
                OM-String(1:OM-Length)
     END-IF.

     STOP RUN.
 END PROGRAM COBFMON.
```

Figure 94. COBOL Example of CEEFMON (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMFMON                          */
 /****************************************************/
 /* Example for callable service CEEFMON             */
 /* Function: Convert a numeric value to a monetary  */
 /*  string using specified format passed as parm    */
 /****************************************************/

 PLIFMON: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */

 /* CEESETL service call arguments */
 DCL LOCALE_NAME CHAR(14) VARYING;

 /* CEEFMON service call arguments */
 DCL MONETARY REAL FLOAT DEC(16);   /* input value   */
 DCL MAXSIZE_FMON BIN FIXED(31);    /* output size   */
 DCL FORMAT_FMON CHAR(256) VARYING; /* format spec   */
 DCL RESULT_FMON BIN FIXED(31);     /* result status */
 DCL OUTPUT_FMON CHAR(60) VARYING;  /* output string */

 DCL 01 FC,                        /* Feedback token */
        03 MsgSev    REAL FIXED BINARY(15,0),
        03 MsgNo     REAL FIXED BINARY(15,0),
        03 Flags,
           05 Case      BIT(2),
           05 Severity  BIT(3),
           05 Control   BIT(3),
        03 FacID     CHAR(3),       /* Facility ID */
        03 ISI      /* Instance-Specific Information */
                     REAL FIXED BINARY(31,0);

   /* init locale name to United States */
   LOCALE_NAME = 'En_US.IBM-1047';

   /* use LC_ALL category constant from CEEIBMLC */
   CALL CEESETL (LOCALE_NAME, LC_ALL, FC);

   /* FBCHECK macro used (defined in CEEIBMCT) */
   IF FBCHECK (FC, CEE2KE) THEN
     DO;   /* invalid locale name */
       DISPLAY ('Locale LC_ALL Call '||FC.MsgNo);
       STOP;
     END;
```

Figure 95. PL/I Example of CEEFMON (Part 1 of 2)

```
  MONETARY = 12345.62; /* monetary numeric value    */
  MAXSIZE_FMON = 60;   /* max char length returned  */
  FORMAT_FMON = '%i';  /* international currency    */

  CALL CEEFMON ( *, /* optional argument            */
    MONETARY ,      /* input, 8 byte floating point */
    MAXSIZE_FMON,   /* maximum size of output string*/
    FORMAT_FMON,    /* conversion request           */
    OUTPUT_FMON,    /* string returned by CEEFMON   */
    RESULT_FMON,    /* no. of chars in OUTPUT_FMON  */
    FC );           /* feedback code structure      */

  IF RESULT_FMON = -1 THEN
    DO;
      /* FBCHECK macro used (defined in CEEIBMCT) */
      IF FBCHECK( FC, CEE3VM ) THEN
        DISPLAY ( 'Invalid input '||MONETARY );
      ELSE
        DISPLAY ('CEEFMON not completed '||FC.MsgNo );
      STOP;
    END;
  ELSE
    DO;
      PUT SKIP LIST(
        'International Format '||OUTPUT_FMON );
    END;

END PLIFMON;
```

Figure 95. PL/I Example of CEEFMON (Part 2 of 2)

CEEFMTM—Get default time format

CEEFMTM returns to the calling routine the default time picture string for the country specified by *country_code*. For a list of the default settings for a specified country, see Table 27 on page 513. CEEFMTM is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

Syntax

```
►►──CEEFMTM──(──country_code──,──time_pic_str──,──fc──)──────────────────►◄
```

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 27 on page 513.

country_code is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY run-time option or the CEE3CTY callable service) is used.

If you specify an invalid *country_code*, the default time picture string is `'HH:MI:SS'`.

time_pic_str (output)
A fixed-length 80-character string (VSTRING), representing the default time picture string for the country specified. The picture string is left-justified and padded on the right with blanks if necessary.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3CD	2	3469	The country code *country_code* was invalid for CEEFMTM. The default time picture string *time_pic_string* was returned.
CEE3CE	2	3470	The date and time string *datetime_str* was truncated and was not defined in CEEFMDT.

Usage notes

- z/OS UNIX considerations—CEEFMTM applies to the enclave. Every enclave has a single current country setting that has a single time format. Every thread in every enclave has the same default.

For more information

- See “COUNTRY” on page 22 for an explanation of the COUNTRY run-time option.
- See “CEE3CTY—Set default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

```
/*Module/File Name: EDCFMTM   */

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _CHAR2 country;
   _CHAR80 time_pic;

   /* get the default time format for Canada */
   memcpy(country,"CA",2);
   CEEFMTM(country,time_pic,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEFMTM failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   /* print out the default time format */
   printf("%.80s\n",time_pic);
}
```

Figure 96. C/C++ Example of CEEFMTM

```
CBL LIB,QUOTE
      *Module/File Name: IGZTFMTM
      ************************************************
      **                                            **
      ** IGZTFMTM - Call CEEFMTM to obtain the      **
      **            default time format             **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTFMTM.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  PICSTR                 PIC X(80).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLFMTM.
      ** Specify country code for the US.
           MOVE "US" TO COUNTRY.

      ** Call CEEFMTM to return the default time format
      ** for the US.
           CALL "CEEFMTM" USING COUNTRY , PICSTR , FC.

      ** If CEEFMTM runs successfully, display result.
           IF CEE000 of FC  THEN
               DISPLAY  "The default time format for "
                   "the US is: " PICSTR
           ELSE
               DISPLAY "CEEFMTM failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
           GOBACK.
```

Figure 97. COBOL Example of CEEFMTM

```
*PROCESS MACRO;
 /* Module/File Name: IBMFMTM                          */
 /*****************************************************/
 /**                                                 **/
 /** Function: CEEFMTM - obtain default time         **/
 /**                     format                      **/
 /**                                                 **/
 /** This example calls CEEFMTM to request the       **/
 /** default time format for the US and print        **/
 /** it out.                                         **/
 /**                                                 **/
 /*****************************************************/
 PLIFMTM: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL COUNTRY CHARACTER ( 2 );
    DCL PICSTR CHAR(80);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    COUNTRY = 'US'; /* Specify country code for      */
                    /*    the United States          */

    /* Call CEEFMTM to get default time format for   */
    /*    the US                                     */
    CALL CEEFMTM ( COUNTRY , PICSTR , FC );

    /* Print the default time format for the US      */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST(
          'The default time format for the US is '
          || PICSTR);
       END;
    ELSE  DO;
       DISPLAY( 'CEEFMTM failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIFMTM;
```

Figure 98. PL/I Example of CEEFMTM

CEEFRST—Free heap storage

CEEFRST frees storage previously allocated by CEEGTST or by a language intrinsic function. Normally, you do not need to call CEEFRST because Language Environment automatically returns all heap storage to the operating system when the enclave terminates. However, if you are allocating a large amount of heap storage, you should free the storage when it is no longer needed. This freed storage then becomes available for later requests for heap storage, thus reducing the total amount of storage needed to run the application.

All requests for storage are conditional. If storage is not available, the feedback code (*fc*) is set and returned to you, but the thread does **not** abend. An attempt to free storage that was already marked as free produces no action and returns a non-CEE000 symbolic feedback code. An attempt to free storage at anything other than a valid starting address produces no action and returns a non-CEE000 symbolic feedback code. The application does not abend.

However, if you call CEEFRST for an invalid address, and you had specified TRAP(OFF), your application **can** abend. Language Environment's reaction to this is undefined. Also, partial freeing of an allocated area is not supported.

When storage is allocated by CEEGTST, its allocated size is used during free operations. Storage allocated by CEEGTST, but not explicitly freed, is automatically freed at enclave termination.

CEEFRST generates a system-level free storage call to return a storage increment to the operating system only when:

- The last heap element within an increment is being freed, and
- The HEAP run-time option or a call to CEECRHP specifies FREE (note that KEEP is the IBM-supplied default setting for the initial heap).

Otherwise, the freed storage is simply added to the free list; it is not returned to the operating system until termination. The out-of-storage condition can cause freeing of empty increments even when KEEP is specified.

Syntax

```
►►──CEEFRST──(──address──,──fc──)──────────────────────────────────►◄
```

address (input)
A fullword address pointer. *address* is the address returned by a previous CEEGTST call or a language intrinsic function such as ALLOCATE or `malloc()`. The storage at this address is deallocated.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0P2	4	0802	Heap storage control information was damaged.
CEE0PA	3	0810	The storage address in a free storage (CEEFRST) request was not recognized, or heap storage (CEECZST) control information was damaged.

Usage notes

- If you specify *heap_free_value* in the STORAGE run-time option, all freed storage is overwritten with *heap_free_value*. Otherwise, it is simply marked as available.

Portions of the freed storage area can be used to hold internal storage manager control information. These areas are overwritten, but not with *heap_free_value*.

- The heap identifier is inferred from the address of the storage to be freed. The storage is freed from the heap in which it was allocated.
- The address passed as the argument is a dangling pointer after a call to CEEFRST. The storage freed by this operation can be reallocated on a subsequent CEEGTST call. If the pointer is not reassigned, any further use of it causes unpredictable results.
- z/OS UNIX considerations—CEEFRST applies to the enclave. One thread can allocate storage, and another can free it.

For more information

- See “CEEGTST—Get heap storage” on page 321 for more information about the CEEGTST callable service.
- See “HEAP” on page 33 for further information about the HEAP run-time option.
- See “CEECRHP—Create new additional heap” on page 216 for more information about the CEECRHP callable service.
- See “STORAGE” on page 79 for further information about the STORAGE run-time option.

Examples

```
/*Module/File Name: EDCFRST   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _INT4 heapid, size;
   _POINTER address;
   _FEEDBACK fc;
 /*  .
     .
     .  */
   heapid = 0;    /* get storage from initial heap   */
   size = 4000;   /* number of bytes of heap storage */

   /* obtain the storage using CEEGTST */
   CEEGTST(&heapid,&size,&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEGTST failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */

   /* free the storage that was previously obtained */
   /* using CEEGTST */
   CEEFRST(&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEFRST failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
 /*  .
     .
     .  */
}
```

Figure 99. C/C++ Example of CEEFRST

```
CBL LIB,QUOTE
      *Module/File Name: IGZTFRST
      ***********************************************
      **                                           **
      ** IGZTFRST - Call CEEFRST to free heap      **
      **            storage                        **
      **                                           **
      ** In this example, a call is made to        **
      ** CEEGTST to obtain 4000 bytes of storage   **
      ** from the initial heap (HEAPID = 0).       **
      ** A call is then made to CEEFRST to free    **
      ** the storage.                              **
      **                                           **
      ***********************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTFRST.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HEAPID                  PIC S9(9) BINARY.
       01  STGSIZE                 PIC S9(9) BINARY.
       01  ADDRSS                  USAGE IS POINTER.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLFRST.

      ** Specify 0 to get storage from the initial
      **    heap.
      ** Specify 4000 to get 4000 bytes of storage.
      ** Call CEEGTST to obtain storage.
           MOVE 0 TO HEAPID.
           MOVE 4000 TO STGSIZE.

           CALL "CEEGTST" USING HEAPID , STGSIZE ,
               ADDRSS , FC.
           IF CEE000 of FC  THEN
               DISPLAY "Obtained " STGSIZE " bytes of"
                   " storage at location " ADDRSS
                   " from heap number " HEAPID
           ELSE
               DISPLAY "CEEGTST failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
```

Figure 100. COBOL Example of CEEFRST (Part 1 of 2)

```
      ** To free storage, use the address returned
      **     by CEECRHP in the call to CEEFRST.
           CALL "CEEFRST" USING ADDRSS , FC.
           IF CEE000 of FC THEN
               DISPLAY "Returned " STGSIZE " bytes of"
                   " storage at location " ADDRSS
                   "  to  heap number " HEAPID
           ELSE
               DISPLAY "CEEFRST failed with msg "
                   Msg-No of FC UPON CONSOLE
           END-IF.
           GOBACK.
```

Figure 100. COBOL Example of CEEFRST (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMFRST                        */
 /**************************************************/
 /**                                              **/
 /** Function: CEEFRST - free heap storage        **/
 /**                                              **/
 /** This example calls CEEGTST to obtain storage **/
 /** from the initial heap, and then calls        **/
 /** CEEFRST to discard it.                       **/
 /**                                              **/
 /**************************************************/
 PLIFRST: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL ADDRSS   POINTER;
    DCL HEAPID   REAL FIXED BINARY(31,0);
    DCL STGSIZE  REAL FIXED BINARY(31,0);
    DCL 01 FC,                      /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI    /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    DCL 01 FC2,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),    /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    HEAPID = 0; /* get storage from the initial heap */
```

Figure 101. PL/I Example of CEEFRST (Part 1 of 2)

```
   STGSIZE = 4000;   /* get 4000 bytes of storage   */

   /* Call CEEGTST to obtain the storage           */
   CALL CEEGTST ( HEAPID, STGSIZE, ADDRSS, FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Obtained ' || STGSIZE
         || ' bytes of storage at location '
         || DECIMAL( UNSPEC( ADDRSS ) )
         || ' from heap ' || HEAPID );
      END;
   ELSE  DO;
      DISPLAY( 'CEEGTST failed with msg '
         || FC.MsgNo );
      STOP;
      END;


   /* Call CEEFRST with the address returned from   */
   /*    CEEGTST to free the storage allocated by   */
   /*    the call to CEEGTST                        */
   CALL CEEFRST ( ADDRSS, FC2 );
   IF  FBCHECK( FC2, CEE000)  THEN  DO;
      PUT SKIP LIST( 'Storage block at location '
         || DECIMAL( UNSPEC( ADDRSS ) ) || ' freed');
      END;
   ELSE  DO;
      DISPLAY( 'CEEFRST failed with msg '
         || FC2.MsgNo );
      STOP;
      END;

END PLIFRST;
```

Figure 101. PL/I Example of CEEFRST (Part 2 of 2)

CEEFTDS—Format time and date into character string

CEEFTDS, analogous to the C function `strftime()`, converts the internal time and date to character strings according to the specifications passed to it by the TD_STRUCT. These specifications work in conjunction with the format conversions set in the current locale. The current locale's LC_TIME category affects the behavior of this service, including the actual values for the format specifiers.

CEEFTDS is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEEFTDS──(──omitted_parm──,──time_and_date──,──maxsize──,──format──,──────►
►──stringout──,──fc──)──────────────────────────────────────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parm, see "Invoking callable services" on page 107.

time_and_date (input)
Points to the time structure that is to be converted.

td_sec
A 4-byte integer that describes the number of seconds in the range of 0 through 59.

td_min
A 4-byte integer that describes the number of minutes in the range of 0 through 59.

td_hour
A 4-byte integer that describes the number of hours in the range of 0 through 23.

td_mday
A 4-byte integer that describes the day of the month in the range of 1 through 31.

td_mon
A 4-byte integer that describes the month of the year in the range of 0 through 12.

td_year
A 4-byte integer that describes the year of an era.

td_wday
A 4-byte integer that describes the day of the week in the range of 0 through 6.

td_yday
A 4-byte integer that describes the day of the year in the range of 0 through 365.

td_isdst
A 4-byte integer that is a flag for daylight savings time.

maxsize (input)
A 4-byte integer that specifies the maximum length (including the string terminator) of the string that can be placed in *stringout*.

format (input)
A halfword length-prefixed character string (VSTRING) of 256 bytes that contains the conversion specifications.

The format parameter is a character string containing two types of objects: plain characters that are placed in the output string and conversion specifications that convert information from *time_and_date* into readable form in the output string. Each conversion specification is a sequence of this form:

%[-][width][.precision]type

- A percent sign (%) introduces a conversion specification.
- An optional decimal digit string specifies a minimum field width. A converted value that has fewer characters than the field width is padded with spaces to the left. If the decimal digit string is preceded by a minus sign, padding with spaces occurs to the right of the converted value.

  If no width is given, for numeric fields the appropriate default width is used with the field padded on the left with zeros as required. For strings, the output field is made exactly wide enough to contain the string.

- An optional precision value gives the maximum number of characters to be printed for the conversion specification. The precision value is a decimal digit string preceded by a period. If the value to be output is longer than the precision, it is truncated on the right.
- The type of conversion is specified by one or two conversion characters. The characters and their meanings are:

%a The abbreviated weekday name (for example, Sun) defined by the *abday* statement in the current locale.

%A The full weekday name (for example, Sunday) defined by the *day* statement in the current locale.

%b The abbreviated month name (for example, Jan) defined by the *abmon* statement in the current locale.

%B The full month name (for example, January) defined by the *month* statement in the current locale.

%c The date and time format defined by the *d_t_fmt* statement in the current locale.

%d The day of the month as a decimal number (01 to 31).

%D The date in *%m/%d/%y* format (for example, 01/31/91).

%e The day of the month as a decimal number (1 to 31). The *%e* field descriptor uses a two-digit field. If the day of the month is not a two-digit number, the leading digit is filled with a space character.

%E The combined alternative era year and name, respectively, in *%o %N* format in the current locale.

%h The abbreviated month name (for example, Jan) defined by the *abmon* statement in the current locale. This field descriptor is a synonym for the *%b* field descriptor.

%H The 24-hour clock hour as a decimal number (00 to 23).

%I The 12-hour clock hour as a decimal number (01 to 12).

%j The day of the year as a decimal number (001 to 366).

%m The month of the year as a decimal number (01 to 12).

%M The minutes of the hour as a decimal number (00 to 59).

%n Specifies a new-line character.

%N The alternative era name in the current locale.

%o The alternative era year in the current locale.

%p The AM or PM string defined by the *am_pm* statement in the current locale.

%r The 12-hour clock time with AM/PM notation as defined by the *t_fmt_ampm* statement *(%I:%M:%S [AM|PM])* in the current locale.

%S The seconds of the minute as a decimal number (00 to 59).

%t Specifies a tab character.

%T Represents 24-hour clock time in the format *%H:%M:%S* (for example, 16:55:15).

%U The week of the year as a decimal number (00 to 53). Sunday, or its

equivalent as defined by the *day* statement, is considered the first day of the week for calculating the value of this field descriptor.

%w The day of the week as a decimal number (0 to 6). Sunday, or its equivalent as defined by the *.day* statement, is considered as 0 for calculating the value of this field descriptor.

%W The week of the year as a decimal number (00 to 53). Monday, or its equivalent as defined by the *day* statement, is considered the first day of the week for calculating the value of this field descriptor.

%x The date format defined by the *d_fmt* statement in the current locale.

%X The time format defined by the *t_fmt* statement in the current locale.

%y The year of the century (00 to 99).

%Y The year as a decimal number (for example, 1989).

%Z The time-zone name, if one can be determined (for example, EST); no characters are displayed if a time zone cannot be determined.

%% Specifies a percent sign (%) character.

stringout (output)
A halfword length-prefixed character string (VSTRING) of 256 bytes that contains the formatted time and date output of the CEEFTDS service.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.
CEE3VM	3	4086	Input Error: The number of characters to be formatted must be greater than zero.

Usage notes

- PL/I MTF consideration—CEEFTDS is not supported in PL/I MTF applications.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- For more information about the `setlocale()` function, see “COUNTRY” on page 22, “CEE3CTY—Set default country” on page 122, and “CEE3LNG—Set national language” on page 164.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 444.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTFTDS
************************************************
*  Example for callable service CEEFTDS        *
*  Function: Convert numeric time and date     *
*            values to a string using specified *
*            format string and locale format    *
*            conversions.                       *
*  Valid only for COBOL for MVS & VM Release 2  *
*  or later.                                   *
************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  MAINFTDS.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
* Use TD-Struct for CEEFTDS calls
 COPY CEEIGZTD.
*

 PROCEDURE DIVISION.
*  Subroutine needed for pointer addressing
     CALL "COBFTDS" USING TD-Struct.

     STOP RUN.
*
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBFTDS.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
* Use Locale category constants
 COPY CEEIGZLC.
*
 01  Ptr-FTDS  POINTER.
 01  Output-FTDS.
     02  O-Length  PIC S9(4)  BINARY.
     02  O-String  PIC X(72).
 01  Format-FTDS.
     02  F-Length  PIC S9(4)  BINARY.
     02  F-String  PIC X(64).
 01  Max-Size  PIC S9(9)  BINARY.
```

Figure 102. COBOL Example of CEEFTDS (Part 1 of 2)

```
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity  PIC S9(4) BINARY.
             04  Msg-No    PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl  PIC X.
         03  Facility-ID   PIC XXX.
     02  I-S-Info  PIC S9(9) BINARY.
 LINKAGE SECTION.
* Use TD-Struct for calls to CEEFTDS
 COPY CEEIGZTD.
*
 PROCEDURE DIVISION USING TD-Struct.
*  Set up time and date values
     MOVE 1 TO TM-Sec.
     MOVE 2 TO TM-Min.
     MOVE 3 TO TM-Hour.
     MOVE 9 TO TM-Day.
     MOVE 11 TO TM-Mon.
     MOVE 94 TO TM-Year.
     MOVE 5 TO TM-Wday.
     MOVE 344 TO TM-Yday.
     MOVE 1 TO TM-Is-DLST.

*  Set up format string for CEEFTDS call
     MOVE 72 TO Max-Size.
     MOVE 36 TO F-Length.
     MOVE "Today is %A, %b %d  Time:  %I:%M  %p"
        TO F-String (1:F-Length).

*  Set up pointer to structure for CEEFTDS call
     SET Ptr-FTDS TO ADDRESS OF TD-Struct.

*  Call CEEFTDS to convert numeric values
     CALL "CEEFTDS" USING OMITTED, Ptr-FTDS,
                          Max-Size, Format-FTDS,
                          Output-FTDS, FC.

*  Check feedback code and display result
     IF Severity = 0
        DISPLAY "Format " F-String (1:F-Length)
        DISPLAY "Result " O-String (1:O-Length)
     ELSE
        DISPLAY "Call to CEEFTDS failed. " Msg-No
     END-IF.

     EXIT PROGRAM.
 END PROGRAM COBFTDS.
*
 END PROGRAM MAINFTDS.
```

Figure 102. COBOL Example of CEEFTDS (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMFTDS                          */
 /****************************************************/
 /* Example for callable service CEEFTDS             */
 /* Function: Convert numeric time and date values   */
 /*  to a string based on a format specification     */
 /*  string parameter and locale format conversions  */
 /****************************************************/

 PLIFTDS: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */
 %INCLUDE CEEIBMTD; /* TD_STRUCT for CEEFTDS calls   */

 /* use explicit pointer to local TD_STRUCT structure*/
 DCL TIME_AND_DATE POINTER INIT(ADDR(TD_STRUCT));

 /* CEEFTDS service call arguments */
 DCL MAXSIZE_FTDS BIN FIXED(31); /* OUTPUT_FTDS size */
 DCL FORMAT_FTDS CHAR(64) VARYING;  /* format string */
 DCL OUTPUT_FTDS CHAR(72) VARYING;  /* output string */
```

Figure 103. PL/I Example of CEEFTDS (Part 1 of 2)

```
DCL 01 FC,                        /* Feedback token */
       03 MsgSev    REAL FIXED BINARY(15,0),
       03 MsgNo     REAL FIXED BINARY(15,0),
       03 Flags,
          05 Case      BIT(2),
          05 Severity  BIT(3),
          05 Control   BIT(3),
       03 FacID     CHAR(3),       /* Facility ID */
       03 ISI      /* Instance-Specific Information */
                    REAL FIXED BINARY(31,0);

  /* specify numeric input fields for conversion    */
  TD_STRUCT.TM_SEC=1;   /* seconds after min (0-61) */
  TD_STRUCT.TM_MIN=2;   /* minutes after hour (0-59)*/
  TD_STRUCT.TM_HOUR=3; /* hours since midnight(0-23)*/
  TD_STRUCT.TM_MDAY=9;  /* day of the month (1-31)  */
  TD_STRUCT.TM_MON=11;  /* months since Jan(0-11)   */
  TD_STRUCT.TM_YEAR=94; /* years since 1900         */
  TD_STRUCT.TM_WDAY=5;  /* days since Sunday (0-6)  */
  TD_STRUCT.TM_YDAY=344;/* days since Jan 1 (0-365) */
  TD_STRUCT.TM_ISDST=1; /* Daylight Saving Time flag*/

  /* specify format string for CEEFTDS call         */
  FORMAT_FTDS = 'Today is %A, %b %d  Time: %I:%M %p';

  MAXSIZE_FTDS = 72; /* specify output string size  */

  CALL CEEFTDS ( *, TIME_AND_DATE, MAXSIZE_FTDS,
                    FORMAT_FTDS, OUTPUT_FTDS, FC );

  /* FBCHECK macro used (defined in CEEIBMCT) */
  IF FBCHECK( FC, CEE000 ) THEN
    DO; /* CEEFTDS call is successful */
      PUT SKIP LIST('Format '||FORMAT_FTDS );
      PUT SKIP LIST('Results in '||OUTPUT_FTDS );
    END;
  ELSE
    DISPLAY ( 'Format '||FORMAT_FTDS||
              ' Results in '||FC.MsgNo );

END PLIFTDS;
```

Figure 103. PL/I Example of CEEFTDS (Part 2 of 2)

CEEGMT—Get current Greenwich Mean Time

CEEGMT returns the current Greenwich Mean Time (GMT) as both a Lilian date and as the number of seconds since 00:00:00 14 October 1582. The returned values are compatible with those generated and used by the other Language Environment date and time services.

In order for the results of this service to be meaningful, your system's TOD (time-of-day) clock must be set to Greenwich Mean Time and be based on the standard epoch. Use CEEGMTO to get the offset from GMT to local time.

The values returned by CEEGMT are handy for elapsed time calculations. For example, you can calculate the time elapsed between two calls to CEEGMT by calculating the differences between the returned values.

Language Environment treats Coordinated Universal Time (UTC) and Greenwich Mean Time (GMT) as the same. You can use the CEEUTC service, which is an alias of the CEEGMT service, to get the same value.

Syntax

```
►►──CEEGMT──(──output_GMT_Lilian──,──output_GMT_seconds──,──fc──)──────────►◄
```

output_GMT_Lilian (output)
A 32-bit binary integer representing the current time in Greenwich, England, in the Lilian format (the number of days since 14 October 1582).

For example, 16 May 1988 is day number 148138. If GMT is not available from the system, *output_GMT_Lilian* is set to 0 and CEEGMT terminates with a non-CEE000 symbolic feedback code.

output_GMT_seconds (output)
A 64-bit double floating-point number representing the current date and time in Greenwich, England, as the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds.

For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). 19:00:01.078 on 16 May 1988 is second number 12,799,191,601.078. If GMT is not available from the system, *output_GMT_seconds* is set to 0 and CEEGMT terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2E6	3	2502	The UTC/GMT was not available from the system.

Usage notes

- CEEDATE converts *output_GMT_Lilian* to a character date, and CEEDATM converts *output_GMT_seconds* to a character timestamp.
- CICS consideration—CEEGMT does not use the OS TIME macro.
- z/OS UNIX consideration—In multithread applications, CEEGMT affects only the calling thread.
- Setting the TOD (time-of-day) clock to anything before January 1, 1972 may produce unpredictable results in your applications.

For more information

- See “CEEGMTO—Get offset from Greenwich Mean Time to local time” on page 301 for more information about the CEEGMTO callable service.

Examples

```
/*Module/File Name: EDCGMT    */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4     lilGMT_date;
  _FLOAT8   secGMT_date;

  CEEGMT(&lilGMT_date,&secGMT_date,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEGMT failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  printf("The current Lilian date in Greenwich,");
  printf(" England is %d\n", lilGMT_date);
}
```

Figure 104. C/C++ Example of CEEGMT

```
CBL LIB,QUOTE
      *Module/File Name: IGZTGMT
      ************************************************
      **                                            **
      ** IGZTGMT - Call CEEGMT to get current       **
      **           Greenwich Mean Time              **
      **                                            **
      ** In this example, a call is made to CEEGMT  **
      ** to return the current GMT as a Lilian date **
      ** and as Lilian seconds. The results are     **
      ** displayed.                                 **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTGMT.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  LILIAN                  PIC S9(9) BINARY.
       01  SECS                    COMP-2.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLGMT.
           CALL "CEEGMT" USING LILIAN , SECS , FC.

           IF CEE000 of FC  THEN
               DISPLAY "The current GMT is also "
                   "known as Lilian day: " LILIAN
               DISPLAY "The current GMT in Lilian "
                   "seconds is: " SECS
           ELSE
               DISPLAY "CEEGMT failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 105. COBOL Example of CEEGMT

```
*PROCESS MACRO;
 /* Module/File Name: IBMGMT                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEGMT - get current Greenwich Mean  **/
 /**           Time                                 **/
 /** In this example, CEEGMT is called to return    **/
 /** the current Greenwich Mean Time as the number  **/
 /** of days and number of seconds since            **/
 /** 14 October 1582. The Lilian date is then       **/
 /**  printed.                                      **/
 /**                                                **/
 /****************************************************/

 PLICGMT: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL LILIAN   REAL FIXED BINARY(31,0);
    DCL SECONDS  REAL FLOAT DECIMAL(16);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Call CEEGMT to return current GMT as a        */
    /* Lilian date and Lilian seconds                */
    CALL CEEGMT ( LILIAN, SECONDS, FC );

    /* If CEEGMT ran successfully, print results     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( LILIAN ||
          ' days have passed since 14 October 1582.' );
       END;
    ELSE  DO;
       DISPLAY( 'CEEGMT  failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLICGMT;
```

Figure 106. PL/I Example of CEEGMT

CEEGMTO—Get offset from Greenwich Mean Time to local time

CEEGMTO returns values to the calling routine representing the difference between the local system time and Greenwich Mean Time (GMT).

Syntax

```
►►──CEEGMTO──(──offset_hours──,──offset_minutes──,──offset_seconds──,──────►
►─fc──)──────────────────────────────────────────────────────────────────►◄
```

offset_hours (output)
A 32-bit binary integer representing the offset from GMT to local time, in hours.

For example, for Pacific Standard Time, *offset_hours* equals −8.

The range of *offset_hours* is −12 to +13 (+13 = Daylight Savings Time in the +12 time zone).

If local time offset is not available, *offset_hours* equals 0 and CEEGMTO terminates with a non-CEE000 symbolic feedback code.

offset_minutes (output)
A 32-bit binary integer representing the number of additional minutes that local time is ahead of or behind GMT.

The range of *offset_minutes* is 0 to 59.

If the local time offset is not available, *offset_minutes* equals 0 and CEEGMTO terminates with a non-CEE000 symbolic feedback code.

offset_seconds (output)
A 64-bit double floating-point number representing the offset from GMT to local time, in seconds.

For example, Pacific Standard Time is eight hours behind GMT. If local time is in the Pacific time zone during standard time, CEEGMTO would return −28,800 (−8 * 60 * 60). The range of *offset_seconds* is −43,200 to +46,800. *offset_seconds* can be used with CEEGMT to calculate local date and time. See “CEEGMT—Get current Greenwich Mean Time” on page 297 for more information.

If the local time offset is not available from the system, *offset_seconds* is set to 0 and CEEGMTO terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2E7	3	2503	The offset from UTC/GMT to local time was not available from the system.

Usage notes

- CEEDATM is used to convert number of seconds to a character timestamp.
- CICS consideration—CEEGMTO does not use the OS TIME macro.
- z/OS UNIX consideration—In multithread applications, CEEGMTO affects only the calling thread.

For more information

- See “CEEDATM—Convert seconds to character timestamp” on page 235 for more information about the CEEDATM callable service.

Examples

```
/*Module/File Name: EDCGMTO   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4     GMT_hours,GMT_mins;
  _FLOAT8   GMT_secs;

  CEEGMTO(&GMT_hours,&GMT_mins,&GMT_secs,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEGMTO failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  printf("The difference between GMT and the local ");
  printf("time is:\n");
  printf("%d hours, %d minutes\n",GMT_hours,GMT_mins);
}
```

Figure 107. C/C++ Example of CEEGMTO

```
CBL LIB,QUOTE
      *Module/File Name: IGZTGMTO
      ************************************************
      **                                            **
      ** IGZTGMTO - Call CEEGMTO to get offset from  **
      **            Greenwich Mean Time to local     **
      **            time                             **
      **                                            **
      ** In this example, a call is made to CEEGMTO  **
      ** to return the offset from GMT to local time **
      ** as separate binary integers representing    **
      ** offset hours, minutes, and seconds. The     **
      ** results are displayed.                      **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTGMTO.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HOURS                   PIC S9(9) BINARY.
       01  MINUTES                 PIC S9(9) BINARY.
       01  SECONDS COMP-2.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLGMTO.
           CALL "CEEGMTO" USING HOURS , MINUTES ,
               SECONDS , FC.

           IF CEE000 of FC  THEN
               DISPLAY "Local time differs from GMT "
                   "by: " HOURS " hours, "
                   MINUTES " minutes, and "
                   SECONDS " seconds. "
           ELSE
               DISPLAY "CEEGMTO failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 108. COBOL Example of CEEGMTO

```
*PROCESS MACRO;
 /* Module/File Name: IBMGMTO                          */
 /*****************************************************/
 /**                                                 **/
 /** Function: CEEGMTO - get the offset from         **/
 /**                     Greenwich Mean Time         **/
 /**                     to local time               **/
 /**                                                 **/
 /*****************************************************/
 PLIGMTO: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL HOURS REAL FIXED BINARY(31,0);
    DCL MINUTES REAL FIXED BINARY(31,0);
    DCL SECONDS REAL FLOAT DECIMAL(16);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

   /* Call CEEGMTO to return hours, minutes, and     */
   /* seconds that local time is offset from GMT     */

    CALL CEEGMTO ( HOURS, MINUTES, SECONDS, FC );

   /* If CEEGMTO ran successfully, print results     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP EDIT('The difference between GMT and '
             || 'local time is ', HOURS, ':', MINUTES )
          (A, P'S99', A, P'99' );
       END;
    ELSE  DO;
       DISPLAY( 'CEEGMTO failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIGMTO;
```

Figure 109. PL/I Example of CEEGMTO

CEEGPID—Retrieve the Language Environment version and platform ID

CEEGPID retrieves the Language Environment version ID and the platform ID of the version and platform of Language Environment that is processing the currently active condition.

Syntax

```
►►──CEEGPID──(──CEE_Version_ID──,──Plat_ID──,──fc──)──────────────────────►◄
```

CEE_Version_ID **(output)**
A fullword integer representing the version of Language Environment that created this data block. The current value of this parameter is still a fullword, but can be interpreted as a four-byte hex number,

|PP|VV|RR|MM|
PP = Product Number
VV = Version
RR = Release
MM = Modification.

Plat_ID (output)
A fullword integer representing the platform used for processing the current condition.

The current values of this parameter are:

3 z/OS or VM

4 AS/400

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEEGPID affects only the calling thread.

Examples

```
/*Module/File Name: EDCGPID   */
/**************************************************/
/*                                                */
/*  Licensed Materials - Property of IBM          */
/*                                                */
/*  5647-A01 5688-198                             */
/*                                                */
/*  (C) Copyright IBM Corp. 1991, 2000            */
/*                                                */
/*  US Government Users Restricted Rights - Use,  */
/*  duplication or disclosure restricted by GSA   */
/*  ADP Schedule Contract with IBM Corp.          */
/*                                                */
/*  STATUS = HLE7703                              */
/**************************************************/
/**************************************************/
/* Note that the format of data returned by CEEGPID */
/* changed in OS/390 V2R10.  This sample tests the  */
/* version and chooses the appropriate format.      */
/**************************************************/
 include (stdio.h)
 include (string.h)
 include (stdlib.h)
 include (leawi.h)
 include (ceeedcct.h)
int main(void) {
  _INT4 cee_:ver_:id, plat_id;
  _FEEDBACK fc;
  int Vmask= 0x00FF0000;
  int Rmask= 0x0000FF00;
  int Mmask= 0x000000FF;
  /* get the LE version and the platform id */
  CEEGPID(cee_ver_id,plat_id,fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEGPID failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
  /* If platform is z/OS and LE is at release 2.10 or later, */
  /* use the new interface definition.                       */
  if ((plat_id == 3) & (cee_ver_id > 290)) {
      printf("The LE version id is %08X\n",cee_ver_id);
      printf("            Version:   %d\n",(Vmask & cee_ver_id)>>16);
      printf("            Release:    %d\n",(Rmask & cee_ver_id)>>8);
      printf("        Modification:       %d\n\n",Mmask & cee_ver_id);
      }
```

Figure 110. C/C++ Example of CEEGPID (Part 1 of 2)

```
   /* else use the old interface */
   else {
      printf("The LE version is %d\n",cee_ver_id);
  }
  printf("The current platform is ");
  switch(plat_id) {
     case 3: printf("z/OS\n");
             break;
     case 4: printf("AS/400\n");
             break;
    default: printf("unrecognized platform id\n");

  }
}
```

Figure 110. C/C++ Example of CEEGPID (Part 2 of 2)

```
CBL LIB,QUOTE
      ************************************************
      *                                              *
      *  IBM Language Environment                    *
      *                                              *
      *  Licensed Materials - Property of IBM        *
      *                                              *
      *  5694-A01 5688-198                           *
      *  (C) Copyright IBM Corp. 1991, 2000          *
      *  All Rights Reserved                         *
      *                                              *
      *  US Government Users Restricted Rights - Use, *
      *  duplication or disclosure restricted by GSA  *
      *  ADP Schedule Contract with IBM Corp.        *
      *                                              *
      ************************************************
      *Module/File Name: IGZTGPID
      ************************************************
      **                                            **
      ** IGZTGPID - Call CEEGPID to retrieve the     **
      **            LE version and platform ID       **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTGPID.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  VERSION                PIC S9(9) BINARY.
       01  VER-MAP REDEFINES VERSION.
           03 FILLER              PIC X(1).
           03 VER-VERSION         PIC X(1).
           03 VER-RELEASE         PIC X(1).
           03 VER-MOD             PIC X(1).
       01  WORK-AREA.
           03 WORK-BIN            PIC S9(4) BINARY.
           03 WORK-BIN-BY-BYTE REDEFINES WORK-BIN.

              05 WORK-BIN-BYTE1    PIC X(1).
              05 WORK-BIN-BYTE2    PIC X(1).
       01  VERSION-F              PIC 99.
       01  RELEASE-F              PIC 99.
       01  MOD-F                  PIC 99.
       01  PLATID                 PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
```

Figure 111. COBOL Example of CEEGPID (Part 1 of 2)

```
 PROCEDURE DIVISION.
 PARA-CBLGPID.
** Call CEEGPID to return the version and
**     platform ID
     CALL "CEEGPID" USING VERSION , PLATID , FC.
     IF  NOT CEE000 of FC  THEN
         DISPLAY "CEEGPID failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

** If platform is OS/390 or VM and version is greater than 290,
** then use different format of VERSION.
     IF PLATID = 3 AND
        VERSION > 290 THEN
** Format the version, release, and modification level
       MOVE 0 to WORK-BIN
       MOVE VER-VERSION TO WORK-BIN-BYTE2
       MOVE WORK-BIN TO VERSION-F
       MOVE VER-RELEASE TO WORK-BIN-BYTE2
       MOVE WORK-BIN TO RELEASE-F
       MOVE VER-MOD TO WORK-BIN-BYTE2
       MOVE WORK-BIN TO MOD-F
       DISPLAY "Currently running version " VERSION-F
                 " release " RELEASE-F " modification " MOD-F
             " of IBM Language Environment"
     ELSE
       DISPLAY "Currently running version " VERSION
             " of IBM Language Environment"
     END-IF

** Evaluate PLATID to display this platform
     EVALUATE PLATID
       WHEN 3
         DISPLAY "on OS/390 or VM"
       WHEN 4
         DISPLAY "on an AS/400"
     END-EVALUATE

     GOBACK.
```

Figure 111. COBOL Example of CEEGPID (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMGPID                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEGPID - Get LE/370 Version         **/
 /** and Platform ID                                **/
 /**                                                **/
 /** This example calls CEEGPID to get the          **/
 /** version and platform of Language               **/
 /** Environment that is currently running.         **/
 /** This information is then printed out.          **/
 /**                                                **/
 /****************************************************/
 PLIGPID: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL VERSION  REAL FIXED BINARY(31,0);
    DCL PLATID   REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Call CEEGPID to get the version and platform  */
    /*    of Language Environment that is currently  */
    /*    running                                    */
    CALL CEEGPID ( VERSION, PLATID, FC );

    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST
          ('Language Environment Version ' || VERSION);
       PUT LIST (' is running on system ');
       SELECT (PLATID);
          WHEN (2) PUT LIST( 'OS/2');
          WHEN (3) PUT LIST( 'MVS/VM/370');
          WHEN (4) PUT LIST( 'AS/400');
          END /* Case of PLATID */;
       END;
    ELSE  DO;
       DISPLAY( 'CEEGPID failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIGPID;
```

Figure 112. PL/I Example of CEEGPID

CEEGQDT—Retrieve q_data_token

CEEGQDT retrieves the *q_data_token* from the Instance-Specific Information (ISI). CEEGQDT is particularly useful when you have user-written condition handlers registered by CEEHDLR.

Syntax

```
►►──CEEGQDT──(──cond_rep──,──q_data_token──,──fc──)──────────────────────►◄
```

cond_rep (input)
A condition token defining the condition for which the *q_data_token* is retrieved.

q_data_token (output)
A pointer to the q_data associated with condition token *cond_rep*.

fc (output)
An optional 12-byte condition token returned by CEEGQDT indicating the result of the service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0EE	3	0462	Instance-specific information for the condition token with message number *message-number* and facility ID *facility-id* could not be found.
CEE0EG	3	0464	Instance-specific information for the condition token with message number *message-number* and facility ID *facility-id* did not exist.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEEGQDT affects only the calling thread.

For more information

- For more information on the various types of q_data structures, see *z/OS Language Environment Programming Guide*.
- For more information about the CEEHDLR callable service, see “CEEHDLR—Register User-written condition handler” on page 326.
- For more information about the CEESGL callable service, see “CEESGL—Signal a condition” on page 450.

Examples

```
/*Module/File Name: EDCGQDT   */
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>
#ifdef __cplusplus
  extern "C" {
#endif
  void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
  }
#endif

typedef struct {       /* condition info structure */
   int   error_value;
   char err_msg_80¨;
   int   retcode;
} info_struct;
int main(void) {
   _FEEDBACK fc,condtok;
  _ENTRY routine;
  _INT4 token,qdata;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;
  info_struct *info;
 /* .
    .
    . */
  /* register the condition handler */
  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;
  CEEHDLR(&routine,&token,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEHDLR failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
 /* .
    .
    . */
  /* set up the condition info structure */
  info = (info_struct *)malloc(sizeof(info_struct));
  if (info == NULL) {
     printf("error allocating info_struct\n");
     exit(2399);
  }
```

Figure 113. C/C++ Example of CEEGQDT (Part 1 of 2)

```
  info->error_value = 86;
  strcpy(info->err_msg,"Test message");
  info->retcode = 99;
  /* set qdata to be the condition info structure */
  qdata = (int)info;
  /* build the condition token */
  c_1 = 3;
  c_2 = 99;
  cond_case = 1;
  sev = 3;
  control = 0;
  memcpy(facid,"ZZZ",3);
  isi = 0;
  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  /* signal the condition */
  CEESGL(&condtok,&qdata,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESGL failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
 /* .
    .
    . */
}
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {
   _FEEDBACK qdatafc;
   _INT4 idata;
   info_struct *qdata;
 /* .
    .
    . */
   /* get the q_data_token from the ISI */
   CEEGQDT(fc, &idata, &qdatafc);
   if ( _FBCHECK ( qdatafc , CEE000 ) != 0 ) {
      printf("CEEGQDT failed with message number %d\n",
             qdatafc.tok_msgno);
      *result = 20; /* percolate */
      return;
   }
   /*************************************************/
   /* set info_struct pointer to address return by */
   /* CEEGQDT                                      */
   /*************************************************/
   qdata = (info_struct *) idata;
   /* use the condition info structure (qdata) */
   if (qdata->error_value == 86) {
      printf("%.12s\n",qdata->err_msg);
      printf("retcode = %d\n",qdata->retcode);
      *result = 10; /* resume this is what we want */
      return;
   }
 /* .
    .
    . */
   *result = 20; /* percolate */
}
```

Figure 113. C/C++ Example of CEEGQDT (Part 2 of 2)

```
CBL LIB,QUOTE
      *Module/File Name: IGZTGQDT
      ************************************************
      ** DRVGQDT - Drive sample program for CEEGQDT  **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRVGQDT.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE                 PROCEDURE-POINTER.
       01  TOKEN                   PIC S9(9) BINARY.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  QDATA                   PIC S9(9) BINARY.
       01  CONDTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
```

Figure 114. COBOL Example of CEEGQDT (Part 1 of 3)

```
 PROCEDURE DIVISION.
** Register handler
     SET ROUTINE TO ENTRY "CBLGQDT".
     CALL "CEEHDLR" USING ROUTINE , TOKEN , FC.
     IF  NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
** Signal a condition
     MOVE 1 TO QDATA.
     SET CEE001 of CONDTOK to TRUE.
     MOVE ZERO to I-S-Info of CONDTOK.
     CALL "CEESGL" USING CONDTOK , QDATA , FC.
     IF CEE000 of FC  THEN
         DISPLAY "**** Resumed execution in the "
           "routine which registered the handler"
     ELSE
         DISPLAY "CEESGL failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
** UNregister handler
     CALL "CEEHDLU" USING ROUTINE , TOKEN , FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.
 END PROGRAM DRVGQDT.
*****************************************
** CBLGQDT - Call CEEGQDT to get        **
**           the Q_DATA_TOKEN           **
*****************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. CBLGQDT.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  QDATA                   PIC S9(9) BINARY.
```

Figure 114. COBOL Example of CEEGQDT (Part 2 of 3)

```
LINKAGE SECTION.
01   CURCOND.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
01  TOKEN           PIC S9(9) BINARY.
01  RESULT          PIC S9(9) BINARY.
    88  RESUME          VALUE 10.
01  NEWCOND.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION
    USING CURCOND, TOKEN, RESULT, NEWCOND.
PARA-CBLGQDT.
** Obtain the Qdata for the current condition
    CALL "CEEGQDT" USING CURCOND , QDATA , FC.
    IF  CEE000 of FC  THEN
        DISPLAY "QDATA for " Facility-ID of
            CURCOND Msg-No of CURCOND
            " is " QDATA
    ELSE
        DISPLAY "CEEGQDT failed with msg "
            Msg-No of FC UPON CONSOLE
    END-IF.
     SET RESUME TO TRUE.
    GOBACK.
END PROGRAM CBLGQDT.
```

Figure 114. COBOL Example of CEEGQDT (Part 3 of 3)

The following example uses a COBOL program and handler to establish the condition handling environment prior to calling a PL/I subroutine to illustrate the use of the callable service from PL/I.

```
CBL LIB,QUOTE
      *Module/File Name: IGZTGQDP
      ************************************************
      ** IGZTGQDP - Drive sample program for CEEGQDT **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTGQDP.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE                 PROCEDURE-POINTER.
       01  TOKEN                   PIC S9(9) BINARY.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  QDATA                   PIC S9(9) BINARY.
       01  CONDTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
      ** Register handler
```

Figure 115. PL/I Example of CEEGQDT (Part 1 of 3)

```
     SET ROUTINE TO ENTRY "HDLGQDT".
     CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
     IF  NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
** Signal a condition
     MOVE 1 TO QDATA.
     SET CEE001 of CONDTOK to TRUE.
     MOVE ZERO to I-S-Info of CONDTOK.
     CALL "CEESGL" USING CONDTOK, QDATA, FC.
     IF CEE000 of FC  THEN
         DISPLAY "**** Resumed execution in the "
           "routine which registered the handler"
     ELSE
         DISPLAY "CEESGL failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
** UNregister handler
     CALL "CEEHDLU" USING ROUTINE, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.
 END PROGRAM IGZTGQDP.

**************************************************
** HDLGQDT -- COBOL condition handler to call  **
**            PL/I routine for actual work.    **
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. HDLGQDT.
 DATA DIVISION.
 LINKAGE SECTION.
 01   CURCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  TOKEN                   PIC S9(9) BINARY.
 01  RESULT                  PIC S9(9) BINARY.
 01  NEWCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
```

Figure 115. PL/I Example of CEEGQDT (Part 2 of 3)

```
                    REDEFINES Case-1-Condition-ID.
               04  Class-Code  PIC S9(4) BINARY.
               04  Cause-Code  PIC S9(4) BINARY.
           03  Case-Sev-Ctl    PIC X.
           03  Facility-ID     PIC XXX.
       02  I-S-Info           PIC S9(9) BINARY.
    PROCEDURE DIVISION
       USING CURCOND, TOKEN, RESULT, NEWCOND.
    PARA-CBLGQDT.

   ** Invoke the PL/I routine to handle condition

       CALL "IBMGQDT"
           USING ADDRESS OF CURCOND,
                 ADDRESS OF TOKEN,
                 ADDRESS OF RESULT,
                 ADDRESS OF NEWCOND.
       GOBACK.

    END PROGRAM HDLGQDT.
```

Figure 115. PL/I Example of CEEGQDT (Part 3 of 3)

```
*PROCESS OPT(0), MACRO;
 /* Module/File Name: IBMGQDT                          */
 /*****************************************************/
 /**                                                 **/
 /** Function:  CEEGQDT -- get qualifying data       **/
 /**                                                 **/
 /*****************************************************/
 IBMGQDT: PROC (@CONDTOK, @TOKEN, @RESULT, @NEWCOND)
              OPTIONS(COBOL);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    /* Parameters */
    DCL  @CONDTOK    POINTER;
    DCL  @TOKEN      POINTER;
    DCL  @RESULT     POINTER;
    DCL  @NEWCOND    POINTER;
    DCL  01 CONDTOK  BASED(@CONDTOK),
                                  /* Feedback token */
            03 MsgSev    REAL FIXED BINARY(15,0),
            03 MsgNo     REAL FIXED BINARY(15,0),
            03 Flags,
               05 Case      BIT(2),
               05 Severity  BIT(3),
               05 Control   BIT(3),
            03 FacID     CHAR(3),     /* Facility ID */
            03 ISI  /* Instance-Specific Information */
                         REAL FIXED BINARY(31,0);
    DCL  TOKEN     BASED(@TOKEN)  REAL FIXED BIN(31,0);
    DCL  RESULT    BASED(@RESULT) REAL FIXED BIN(31,0);

    DCL  01 NEWCOND      BASED(@NEWCOND),
                                  /* Feedback token */
            03 MsgSev    REAL FIXED BINARY(15,0),
            03 MsgNo     REAL FIXED BINARY(15,0),
            03 Flags,
               05 Case      BIT(2),
               05 Severity  BIT(3),
               05 Control   BIT(3),
            03 FacID     CHAR(3),     /* Facility ID */
            03 ISI  /* Instance-Specific Information */
                         REAL FIXED BINARY(31,0);
```

Figure 116. COBOL Example of CEEGQDT (Part 1 of 2)

```
   /* Local identifiers */
   DCL  QDATA       REAL FIXED BINARY(31,0);
   DCL  01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),     /* Facility ID */
           03 ISI  /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

   IF FBCHECK(CONDTOK, CEE001) THEN /* expected */ DO;

      /* Call CEEGQDT with condition token defined  */
      /*    above to retrieve associated q_data     */
      CALL CEEGQDT ( CONDTOK, QDATA, FC );
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST( 'Qualifying data for current '
            || ' condition is ' || QDATA );
         RESULT = 10 /* Resume */;
         END;
      ELSE  DO;
         DISPLAY('CEEGQDT failed with msg ' ||
                                            FC.MsgNo);
         NEWCOND = FC;
         RESULT = 30 /* Promote */;
         END;
      END;
   ELSE /* Unexpected condition -- percolate */ DO;
      DISPLAY( 'User condition handler entered for '
         || CONDTOK.FacID || ' condition...');
      DISPLAY( '... with message number ' ||
                                        CONDTOK.MsgNo);
      RESULT = 20 /* Percolate */;
      END;

   RETURN;

 END IBMGQDT;
```

Figure 116. COBOL Example of CEEGQDT (Part 2 of 2)

CEEGTST—Get heap storage

CEEGTST gets storage from a heap whose ID you specify. It is used to acquire both large and small blocks of storage. CEEGTST always allocates storage that is addressable by the caller. Therefore, if the caller is in 24-bit addressing mode, or if HEAP(,,BELOW) is in effect, the storage returned is always below the 16M line. Above-the-line storage is returned only if the caller is in 31-bit addressing mode and HEAP(,,ANY) is in effect.

All requests for storage are conditional. If storage is not available, the feedback code (*fc*) is set and returned to you, but the thread does **not** abend. When storage is not available, the appropriate action in the member environment should be taken. One option is to use the CEESGL callable service to signal the Language Environment condition handler with the returned feedback code.

Storage obtained by CEEGTST can be freed by a call to CEEFRST or CEEDSHP. You can also free storage by using a language intrinsic function. If storage is not explicitly freed, it is freed automatically at termination.

If you have specified a *heap_alloc_value* in the STORAGE run-time option, all storage allocated by CEEGTST is initialized to *heap_alloc_value*. Otherwise, it is left uninitialized.

If the value specified in the *size* parameter of CEEGTST is greater than the size of an increment (as specified in the HEAP run-time option), all of the requested storage (rounded up to the nearest doubleword) is allocated in a single system-level call.

Heap storage is acquired by a system-level get storage call in increments of *init_size* and *incr_size* bytes as specified by the HEAP run-time option, or in the CEECRHP callable service. If the increment size is chosen appropriately, only a few of the calls to CEEGTST result in a system call. The storage report generated when the RPTSTG run-time option is specified shows the number of system-level get storage calls required. This helps you tune the *init_size* and *incr_size* fields in order to minimize calls to the operating system.

Syntax

```
►►──CEEGTST──(──heap_id──,──size──,──address──,──fc──)──────────────────────►◄
```

heap_id (input)
A fullword binary signed integer. *heap_id* is a token denoting the heap in which the storage is allocated. A *heap_id* of 0 allocates storage from the initial heap (or user heap). Any other *heap_id* must be a value obtained from the CEECRHP callable service.

If the *heap_id* you specify is invalid, no storage is allocated. CEEGTST terminates with a non-CEE000 symbolic feedback code and the value of the *address* parameter is undefined.

size (input)
A fullword binary signed integer. *size* represents the amount of storage allocated, in bytes. If the specified amount of storage cannot be obtained, no storage is allocated, CEEGTST terminates with a non-CEE000 symbolic feedback code, and the value of the *address* parameter is undefined.

address (output)
A fullword address pointer. *address* is the main storage address of the first byte of allocated storage. If storage cannot be obtained, *address* remains undefined. Storage is always allocated on a doubleword boundary. This parameter contains an address that is returned as output to CEECZST.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Codes can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0P2	4	0802	Heap storage control information was damaged.

Code	Severity	Message Number	Message Text
CEE0P3	3	0803	The heap identifier in a get storage request or a discard heap request was unrecognized.
CEE0P8	3	0808	Storage size in a get storage request (CEEGTST) or a reallocate request (CEECZST) was not a positive number.
CEE0PD	3	0813	Insufficient storage was available to satisfy a get storage (CEECZST) request.

Usage notes

- COBOL considerations— If you want to use the CEEGTST callable service in a 24-bit addressing mode COBOL program to request 24-bit heap storage, you can make a static call to CEEGTST without any additional changes. If you want to call it dynamically (either by using the COBOL DYNAM compiler option, or using the ″CALL identifier″ statement, where identifier is a variable that holds the name of the program you want to call), you must also specify HEAP(,,BELOW,,,) as a run-time option.

  This run-time specification affects all programs in the enclave using the user heap, not just the 24-bit addressing mode program. If this is undesirable, one alternative is to use the CEECRHP callable service to create an additional heap, specifying for the options parameter a value that will create the heap BELOW. The 24-bit addressing mode COBOL program can then obtain storage from this additional heap using the CEEGTST callable service.
- PL/I considerations—Storage allocated within PL/I AREAs is managed by PL/I. Therefore, only PL/I language functions can allocate and free storage within a PL/I area.
- Based upon the layout of a PL/I structure, PL/I might adjust the starting byte of the PL/I structure to a non-doubleword aligned byte. The difference between the doubleword boundary and the first byte of such a structure is known as the *hang*. Because Language Environment callable storage services do not adjust the starting byte, you must be careful using callable services to allocate storage for PL/I structures. Use either the PL/I ALLOCATE statement or fully defined structures and aggregates to avoid this problem.
- CICS considerations—In a CICS environment, *size* should not exceed 1024M (1 gigabyte or X'40000000') when running in AMODE ANY, and 65,504 bytes when running in 24-bit addressing mode. These CICS restrictions are subject to change from one release of CICS to another. Portable applications should respect current CICS limitations.
- z/OS UNIX considerations—CEEGTST applies to the enclave. Any thread can free the allocated storage.

For more information

- See “HEAP” on page 33 for further information about the Language Environment HEAP run-time option.
- For more information about the CEESGL callable service, see “CEESGL—Signal a condition” on page 450.
- For more information about the CEEFRST callable service, see “CEEFRST—Free heap storage” on page 284.
- For more information about the CEEDSHP callable service, see “CEEDSHP—Discard heap” on page 257.

- For more information about the STORAGE run-time option, see “STORAGE” on page 79.
- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 216.
- For more information about the RPTSTG run-time option, see “RPTSTG” on page 62.
- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 216.
- For more information about the CEECZST callable service, see “CEECZST—Reallocate (change size of) storage” on page 221.

Examples

```
/*Module/File Name: EDCGTST   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

   _INT4 heapid, size;
   _POINTER address;
   _FEEDBACK fc;
  /* .
     .
     . */
   heapid = 0;    /* get storage from initial heap   */
   size = 4000;   /* number of bytes of heap storage */

   /* obtain the storage using CEEGTST */
   CEEGTST(&heapid,&size,&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEGTST failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
  /* .
     .
     . */
   /* free the storage that was previously obtained */
   /* using CEEGTST */
   CEEFRST(&address,&fc);

   /* check the first 4 bytes of the feedback token */
   /* (0 if successful) */
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEFRST failed with message number %d\n",
             fc.tok_msgno);
      exit(99);
   }
  /* .
     .
     . */
}
```

Figure 117. C/C++ Example of CEEGTST

```
CBL LIB,QUOTE
      *Module/File Name: IGZTGTST
      ************************************************
      **                                            **
      ** IGZTGTST - Call CEEGTST to get heap storage   **
      **                                            **
      ** In this example, a call is made to CEEGTST to **
      ** obtain 4000 bytes of storage from the initial **
      ** heap (HEAPID=0).                            **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IGZTGTST.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  HEAPID                 PIC S9(9) BINARY.
       01  STGSIZE                PIC S9(9) BINARY.
       01  ADDRSS                 POINTER.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
      ************************************************
      ** Specify 0 to get storage from initial heap. **
      ** Specify 4000 to get 4000 bytes of storage.  **
      ** Call CEEGTST to obtain storage.             **
      ************************************************
       PARA-CBLGTST.
           MOVE 0 TO HEAPID.
           MOVE 4000 TO STGSIZE.

           CALL "CEEGTST" USING HEAPID, STGSIZE,
                                ADDRSS, FC.
           IF CEE000 of FC  THEN
               DISPLAY "Obtained " STGSIZE " bytes of"
                   " storage at location " ADDRSS
                   " from heap number " HEAPID
           ELSE
               DISPLAY "CEEGTST failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 118. COBOL Example of CEEGTST

```
*PROCESS MACRO;
 /* Module/File Name: IBMGTST                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEGTST - Get Heap Storage           **/
 /**                                                **/
 /** In this example, a call is made to CEEGTST to  **/
 /** request 4000 bytes of storage from the         **/
 /** initial heap.                                  **/
 /**                                                **/
 /****************************************************/
 PLIGTST: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL HEAPID   REAL FIXED BINARY(31,0);
    DCL STGSIZE  REAL FIXED BINARY(31,0);
    DCL ADDRSS   POINTER;
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    HEAPID = 0; /* get storage from the initial heap */
    STGSIZE = 4000;   /* get 4000 bytes of storage   */

    /* Call CEEGTST to obtain the storage            */
    CALL CEEGTST ( HEAPID, STGSIZE, ADDRSS, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Obtained ' || STGSIZE
          || ' bytes of storage at location '
          || DECIMAL( UNSPEC( ADDRSS1 ) )
          || ' from heap ' || HEAPID );
       END;
    ELSE  DO;
       DISPLAY( 'CEEGTST failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIGTST;
```

Figure 119. PL/I Example

CEEHDLR—Register User-written condition handler

CEEHDLR registers a user-written condition handler for the current stack frame. The user condition handler is invoked when:

- It is registered for the current stack frame by CEEHDLR, and
- The Language Environment condition manager requests the condition handler associated with the current stack frame handle the condition.

Language Environment places the user-written condition handlers associated with each stack frame in a queue. The queue can be empty at any given time. The Language Environment condition manager invokes the registered condition handlers in LIFO (last in, first out) order to handle the condition.

The opposite of CEEHDLR, which registers a user-written condition handler, is CEEHDLU, which unregisters the handler. You do not necessarily need to use CEEHDLU to remove user-written condition handlers you registered with CEEHDLR. Any user-written condition handlers created through CEEHDLR and not unregistered by CEEHDLU are unregistered automatically by Language Environment, but only when the associated stack frame is removed from the stack.

Language Environment condition handlers are driven only for synchronous conditions.

Syntax

```
►►──CEEHDLR──(──routine──,──token──,──fc──)──────────────────────────►◄
```

routine (input)
An entry variable or entry constant for the routine called to process the condition. The entry variable or constant must be passed by reference. The routine must be an external routine; that is, it must not be a nested routine.

token (input)
A fullword integer of information you want passed to your user handler each time it is called. This can be a pointer or any other fullword integer you want to pass.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE080	1	0256	The user-written condition handler routine specified was already registered for this stack frame. It was registered again.
CEE081	3	0257	The routine specified contained an invalid entry variable.

Usage notes

- PL/I MTF consideration—CEEHDLR is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
- COBOL consideration—You should not call CEEHDLR from a nested COBOL program.
- z/OS UNIX consideration—In multithread applications, CEEHDLR affects only the calling thread.
- C consideration—The CEEHDLR service does not save Writeable Static Area (WSA) information about the user handler, so it's possible that the user handler will be given control with the wrong WSA. Specifically, the user handler(s) on the stack will be invoked with the WSA of the routine that incurred the condition. The preferred method of handling conditions from a C application is to use C signal handlers.

For more information

- For more information about the CEEHDLU callable service, see "CEEHDLU—Unregister user-written condition handler" on page 336.

Examples

```
/*Module/File Name: EDCHDLR   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

#ifdef __cplusplus
  extern "C" {
#endif
  void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
  }
#endif

int main(void) {

  _FEEDBACK fc;
  _ENTRY routine;
  _INT4 token;


  /* set the routine structure to point to the handler */
  /* and use CEEHDLR to register the user handler      */

  token = 99;
  routine.address = (_POINTER)&handler;
  routine.nesting = NULL;

  CEEHDLR(&routine,&token,&fc);

  /* verify that CEEHDLR was successful */
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEHDLR failed with message number %d\n",
            fc.tok_msgno);
     exit (2999);
  }
 /*
:
 */
}
/*******************************************************/
/* handler is a user condition handler                 */
/*******************************************************/
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {
 /*
:
 */
}
```

Figure 120. C/C++ Example of CEEHDLR

```
CBL LIB,QUOTE
      *Module/File Name: IGZTHDLR
      ***********************************************
      **                                           **
      ** CBLHDLR - Call CEEHDLR to register a user **
      **           condition handler               **
      **                                           **
      ***********************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLHDLR.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE  PROCEDURE-POINTER.
       01  TOKEN                  PIC S9(9) BINARY.
       01  SEV                    PIC S9(4) BINARY.
       01  MSGNO                  PIC S9(4) BINARY.
       01  CASE                   PIC S9(4) BINARY.
       01  SEV2                   PIC S9(4) BINARY.
       01  CNTRL                  PIC S9(4) BINARY.
       01  FACID                  PIC X(3).
       01  ISINFO                 PIC S9(9) BINARY.
       01  QDATA                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  CONDTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLHDLR.
           SET ROUTINE TO ENTRY "HANDLER".
           CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEEHDLR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
```

Figure 121. COBOL Program that Registers HANDLER Routine (Part 1 of 2)

```
*  RAISE A SIGNAL

 PARA-CBLSGL.
**************************************************
** Call CEENCOD with the values assigned above **
** to build a condition token "CONDTOK"        **
** Set CONDTOK to sev=3, msgno=1 facid=CEE. We **
** raise a sev 3 to ensure our handler is driven*
**************************************************
     MOVE 3 TO SEV.
     MOVE 1 TO MSGNO.
     MOVE 1 TO CASE.
     MOVE 3 TO SEV2.
     MOVE 1 TO CNTRL.
     MOVE "CEE" TO FACID.
     MOVE 0 TO ISINFO.

     CALL "CEENCOD" USING SEV, MSGNO, CASE,
         SEV2, CNTRL, FACID, ISINFO, CONDTOK, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEENCOD failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

**************************************************
** Call CEESGL to signal the condition with    **
**     the condition token and qdata described **
**     in CONDTOK and QDATA                    **
**************************************************
     MOVE 0 TO QDATA.
     CALL "CEESGL" USING CONDTOK, QDATA, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESGL  failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 121. COBOL Program that Registers HANDLER Routine (Part 2 of 2)

```
CBL LIB,QUOTE,NOOPT,NODYNAM
      *Module/File Name: IGZTHAND
      ************************************************
      **                                            **
      ** DRVHAND - Drive sample program for COBOL    **
      **           user-written condition handler.   **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRVHAND.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE             PROCEDURE-POINTER.
       01  DENOMINATOR         PIC S9(9) BINARY.
       01  NUMERATOR           PIC S9(9) BINARY.
       01  RATIO               PIC S9(9) BINARY.
       01  TOKEN               PIC S9(9) BINARY VALUE 0.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       REGISTER-HANDLER.
      ************************************************
      ** Register handler                           **
      ************************************************
           SET ROUTINE TO ENTRY "HANDLER".
           CALL "CEEHDLR" USING ROUTINE , TOKEN , FC.
           IF  NOT CEE000 of FC  THEN
               DISPLAY "CEEHDLR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

       RAISE-CONDITION.
      ************************************************
      ** Cause a zero-divide condition.             **
      ************************************************
           MOVE 0 TO DENOMINATOR.
           MOVE 1 TO NUMERATOR.
           DIVIDE NUMERATOR BY DENOMINATOR
                  GIVING RATIO.
```

Figure 122. COBOL User-Written Condition Handler Registered by CBLHDLR and Unregistered by CBLHDLU (Part 1 of 2)

```
     DISPLAY "Execution continues following "
         "divide-by-zero exception".
 UNREGISTER-HANDLER.
*************************************************
** UNregister handler                          **
*************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.
 END PROGRAM DRVHAND.

 IDENTIFICATION DIVISION.
 PROGRAM-ID. HANDLER.
 DATA DIVISION.
 WORKING-STORAGE SECTION.

 LINKAGE SECTION.
 01  TOKEN                  PIC S9(9) BINARY.
 01  RESULT                 PIC S9(9) BINARY.
     88 RESUME                  VALUE 10.
 01  CURCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  NEWCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION USING CURCOND, TOKEN,
                          RESULT, NEWCOND.

 PARA-HANDLER.
     DISPLAY "Entered user handler for condition"
        " with message number " Msg-No Of CURCOND
        " -- will resume execution".
     SET RESUME TO TRUE.

     GOBACK.
 END PROGRAM HANDLER.
```

Figure 122. COBOL User-Written Condition Handler Registered by CBLHDLR and Unregistered by CBLHDLU (Part 2 of 2)

```
*Process macro;
 /* Module/File Name: IBMHDLR                        */
 /****************************************************/
 /*                                                  */
 /*  EXCOND               .-> DIVZERO                */
 /*  - register handler   |   - force a divide-by-0  */
 /*  - call DIVZERO     --'                           */
 /*  ==> "resume point"                               */
 /*  - unregister handler                             */
 /*                         USRHDLR:                  */
 /*                         - if divide-by-zero then */
 /*                           - move resume cursor   */
 /*                           - resume at "resume"   */
 /*                                         point    */
 /*                                                  */
 /****************************************************/
 Excond :Proc Options(Main);

   /***************************************************/
   /* Important elements are found in these includes */
   /* - feedback declaration                          */
   /* - fbcheck macro call                            */
   /* - condition tokens such as CEE000               */
   /* - entry declarations such as ceehdlr            */
   /***************************************************/

   %include ceeibmct;
   %include ceeibmaw;

   dcl Usrhdlr external entry;

   dcl 1 fback feedback;
   dcl divisor fixed bin(31);
   dcl token   fixed bin(31);

   /*********************************************/
   /* Register a user-written condition handler */
   /*********************************************/
   token = 97;
   Call ceehdlr(Usrhdlr, token, fback);
   If fbcheck (fback, cee000) then
     display ('MAIN: registered USRHDLR');
   else
     do;
       display ('CEEHDLR failed with message number ' ||
                fback.MsgNo);
       stop;
     end;
```

Figure 123. EXCOND Program (PL/I) to Handle Divide-by-Zero Condition (Part 1 of 2)

```
  /*********************************************/
  /* Call DIVZERO to divide by zero            */
  /*  and drive USRHDLR                        */
  /*********************************************/
  divisor = 0;
  call divzero (divisor);
  display ('MAIN: resumption after DIVZERO');

  /*********************************************/
  /* Unregister the user condition handler     */
  /*********************************************/

  Call ceehdlu (Usrhdlr, fback);
  If fbcheck (fback, cee000) then
    display ('MAIN: unregistered USRHDLR');
  else
    do;
      display ('CEEHDLU failed with message number ' ||
                fback.MsgNo);
      stop;
    end;

    /*********************************************/
    /* Subroutine that simply raises ZERODIVIDE  */
    /*********************************************/
    divzero: proc (arg);
      dcl arg fixed bin(31);

      display('  DIVZERO: starting.');
      arg = 1 / arg;
      display('  DIVZERO: Returning to its caller');

    end divzero;

end Excond;
```

Figure 123. EXCOND Program (PL/I) to Handle Divide-by-Zero Condition (Part 2 of 2)

```
AHDL     TITLE 'Main program that registers a handler'
*
*        Symbolic Register Definitions and Usage
*
R0       EQU   0             Parm list addr (CMS only)
R1       EQU   1             Parm list addr, 0=no parms
R10      EQU   10            Base reg for executable code
R12      EQU   12            Language Environment Common Anchor Area addr
R13      EQU   13            Dynamic Storage Area addr
R14      EQU   14            Return point addr
R15      EQU   15            Entry point address
*
*        Prologue
*
CEEHDLRA CEEENTRY AUTO=DSASIZ,    Main memory to obtain   *
               MAIN=YES,     This program is a MAIN prog  *
               PPA=PPA1,     Our Program Prolog Area      *
               BASE=R10      Base reg for executable code
         USING CEECAA,R12    Addressing for LE/370 CAA
         USING CEEDSA,R13    Addressing for dynamic data
*
*        Announce ourselves
*
         WTO   'CEEHDLRA Says "HELLO"',ROUTCDE=11
*
*        Register User Handler
*
         LA    R1,USRHDLPP   Get addr of proc-ptr to Hdlr
         ST    R1,PARM1      Make it 1st parameter
         LA    R1,TOKEN      Get addr of 32-bit token
         ST    R1,PARM2      Make it 2nd parameter
         LA    R1,FEEDBACK   Get addr of Feedback Code
         ST    R1,PARM3      Make it 3rd parameter
         LA    R1,HDLRPLST   Point to CEEHDLR's parm list
         CALL  CEEHDLR       Invoke CEEHDLR service
         CLC   FEEDBACK,=XL12'00' Check for success..
         BE    HDLRGOOD      Skip diagnostics if success
*                            Failure.. issue diagnostics
         WTO   '**** Call to CEEHDLR failed ****',        *
                ROUTCDE=11
         ABEND 1,DUMP        Terminate program with Dump
```

Figure 124. PL/I Example of CEEHDLR (Part 1 of 2)

```
HDLRGOOD EQU   *             Handler registered OK
*  ... code covered by User-Written Handler goes here...
*        Un-Register User Handler
*
         LA    R1,USRHDLPP   Get addr of proc-ptr to Hdlr
         ST    R1,HDLUPRM1   Make it 1st parameter
         LA    R1,HDLUFBC    Address for Feedback Code
         ST    R1,HDLUPRM2   Make it 2nd parameter
         LA    R1,HDLUPLST   Point to CEEHDLU parm list
         CALL  CEEHDLU       Invoke CEEHDLU service
*        Bid a fond farewell
         WTO   'CEEHDLRA Says "GOOD-BYE"',ROUTCDE=11
*
*        Epilogue
*
         CEETERM RC=4,MODIFIER=1  Terminate program
*
*        Program Constants and Local Static Variables
*
USRHDLPP DC    V(USRHDLR),A(0)    Procedure-ptr to Handlr
*
         LTORG ,                  Place Literal Pool here
         EJECT
PPA1     CEEPPA ,            Our Program Prolog Area
         EJECT
         CEEDSA ,            Map CEE Dynamic Save Area
*
*        Local Automatic (Dynamic) Storage.
*
HDLRPLST DS    0F
PARM1    DS    A             Addr of User-written Handler
PARM2    DS    A             Addr of 32-bit Token
PARM3    DS    A             Addr of Feedback Code
*
HDLUPLST DS    0F
HDLUPRM1 DS    A             Addr of User-written Handler
HDLUPRM2 DS    A             Addr of Feedback Code
*
TOKEN    DS    F             32-bit Token: fullword whose
*                                *value* will be passed
*                                to the user handler
*                                each time it is called.
FEEDBACK DS    CL12          CEEHDLR Feedback code
*
HDLUFBC  DS    CL12          CEEHDLU Feedback code
*
DSASIZ   EQU   *-CEEDSA      Length of DSA
         EJECT
         CEECAA ,            Map LE370 Common Anchor Area
         END   CEEHDLRA
```

Figure 124. PL/I Example of CEEHDLR (Part 2 of 2)

CEEHDLU—Unregister user-written condition handler

CEEHDLU unregisters a user condition handler for the current stack frame.

You do not necessarily need to use CEEHDLU to remove user-written condition handlers you registered with CEEHDLR. Any user-written condition handlers created through CEEHDLR and not unregistered by CEEHDLU are unregistered automatically by Language Environment, but only when the associated stack frame is removed from the stack.

Note: For information about restrictions on the use of CEEHDLU with PL/I, see *z/OS Language Environment Programming Guide*.

Syntax

```
►►──CEEHDLU──(──routine──,──fc──)──────────────────────────────────►◄
```

routine (input)
An entry variable or constant for the routine to be unregistered as a user condition handler. This routine must be previously registered (with CEEHDLR) by the same stack frame that invokes CEEHDLU.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE07S	1	0252	CEEHDLU was unable to find the requested user-written condition handler routine.

Usage notes

- PL/I MTF consideration—CEEHDLU is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
- z/OS UNIX consideration—In multithread applications, CEEHDLU affects only the calling thread.

For more information

- See “CEEHDLR—Register User-written condition handler” on page 326 for further information about specifying the *routine* parameter.

Examples

```
/*Module/File Name: EDCHDLU   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

#ifdef __cplusplus
   extern "C" {
#endif
   void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
   }
#endif

int main(void) {

  _FEEDBACK fc;
  _ENTRY routine;
  _INT4 token;

  /* set the routine structure to point to the handler */
  /* and use CEEHDLR to register the user handler      */

  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;

  CEEHDLR(&routine,&token,&fc);

  /* verify that CEEHDLR was successful */
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEHDLR failed with message number %d\n",
            fc.tok_msgno);
     exit (2999);
  }
 /*
:
  */
  /* Unregister the condition handler */
  CEEHDLU(&routine,&fc);

  /* verify that CEEHDLU was successful */
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEHDLU failed with message number %d\n",
            fc.tok_msgno);
     exit (2999);
  }
 /*
:
  */
}

void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {
 /*
:
  */
}
```

Figure 125. C/C++ Example of CEEHDLU

```
CBL LIB,QUOTE
      *Module/File Name: IGZTHDLU
      ************************************************
      **                                            **
      ** CBLHDLU - Call CEEHDLU to unregister a user **
      **           condition handler                **
      **                                            **
      ** In this example, a call is made to CEEHDLU  **
      ** to unregister a user condition handler      **
      ** previously registered using CEEHDLR.        **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLHDLU.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE                 PROCEDURE-POINTER.
       01  TOKEN                   PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.
       PARA-CBLHDLR.
           SET ROUTINE TO ENTRY "HANDLER".
           CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEEHDLR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           ELSE
               DISPLAY "HANDLER REGISTERED"
           END-IF.

      *
⋮
```

Figure 126. COBOL Program that Unregisters User-Written Condition Handler (Part 1 of 2)

```
PARA-CBLHDLU.
    CALL "CEEHDLU" USING ROUTINE, FC.
    IF NOT CEE000 of FC  THEN
        DISPLAY "CEEHDLU failed with msg "
            Msg-No of FC UPON CONSOLE
        STOP RUN
    ELSE
        DISPLAY "HANDLER UNREGISTERED"
    END-IF.

    GOBACK.

END PROGRAM CBLHDLU.
```

Figure 126. COBOL Program that Unregisters User-Written Condition Handler (Part 2 of 2)

```
CBL LIB,QUOTE,NOOPT,NODYNAM
      *Module/File Name: IGZTHAND
      ************************************************
      **                                            **
      ** DRVHAND - Drive sample program for COBOL    **
      **           user-written condition handler.   **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRVHAND.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE             PROCEDURE-POINTER.
       01  DENOMINATOR         PIC S9(9) BINARY.
       01  NUMERATOR           PIC S9(9) BINARY.
       01  RATIO               PIC S9(9) BINARY.
       01  TOKEN               PIC S9(9) BINARY VALUE 0.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       REGISTER-HANDLER.
      ************************************************
      ** Register handler                           **
      ************************************************
           SET ROUTINE TO ENTRY "HANDLER".
           CALL "CEEHDLR" USING ROUTINE , TOKEN , FC.
           IF  NOT CEE000 of FC  THEN
               DISPLAY "CEEHDLR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

       RAISE-CONDITION.
      ************************************************
      ** Cause a zero-divide condition.             **
      ************************************************
           MOVE 0 TO DENOMINATOR.
           MOVE 1 TO NUMERATOR.
           DIVIDE NUMERATOR BY DENOMINATOR
                  GIVING RATIO.
```

Figure 127. COBOL User-Written Condition Handler Registered by CBLHDLR and Unregistered by CBLHDLU (Part 1 of 2)

```
     DISPLAY "Execution continues following "
         "divide-by-zero exception".
 UNREGISTER-HANDLER.
*************************************************
** UNregister handler                          **
*************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.
 END PROGRAM DRVHAND.

 IDENTIFICATION DIVISION.
 PROGRAM-ID. HANDLER.
 DATA DIVISION.
 WORKING-STORAGE SECTION.

 LINKAGE SECTION.
 01  TOKEN                  PIC S9(9) BINARY.
 01  RESULT                 PIC S9(9) BINARY.
     88 RESUME                  VALUE 10.
 01  CURCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  NEWCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION USING CURCOND, TOKEN,
                          RESULT, NEWCOND.

 PARA-HANDLER.
     DISPLAY "Entered user handler for condition"
        " with message number " Msg-No Of CURCOND
        " -- will resume execution".
     SET RESUME TO TRUE.

     GOBACK.
 END PROGRAM HANDLER.
```

Figure 127. COBOL User-Written Condition Handler Registered by CBLHDLR and Unregistered by CBLHDLU (Part 2 of 2)

CEEISEC—Convert integers to seconds

CEEISEC converts separate binary integers representing year, month, day, hour, minute, second, and millisecond to a number representing the number of seconds

since 00:00:00 14 October 1582. Use CEEISEC instead of CEESECS when the input is in numeric format rather than character format.

The inverse of CEEISEC is CEESECI, which converts number of seconds to integer year, month, day, hour, minute, second, and millisecond.

Syntax

```
►►─CEEISEC─(─input_year─,─input_months─,─input_day─,──────────────►
►─input_hours─,─input_minutes─,─input_seconds─,─input_milliseconds──►
►─,─output_seconds─,──────────────────────────────────────────────►
►─fc─)──────────────────────────────────────────────────────────►◄
```

input_year (input)
A 32-bit binary integer representing the year.

The range of valid *input_year*s is 1582 to 9999, inclusive.

input_month (input)
A 32-bit binary integer representing the month.

The range of valid *input_month* is 1 to 12.

input_day (input)
A 32-bit binary integer representing the day.

The range of valid *input_day*s is 1 to 31.

input_hours (input)
A 32-bit binary integer representing the hours.

The range of valid *input_hours* is 0 to 23.

input_minutes (input)
A 32-bit binary integer representing the minutes.

The range of valid *input_minutes* is 0 to 59.

input_seconds (input)
A 32-bit binary integer representing the seconds.

The range of valid *input_seconds* is 0 to 59.

input_milliseconds (input)
A 32-bit binary integer representing milliseconds.

The range of valid *input_milliseconds* is 0 to 999.

output_seconds (output)
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds.

For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range of *output_seconds* is 86,400 to 265,621,679,999.999 (23:59:59.999 31 December 9999). If any input values are invalid, *output_seconds* is set to zero. To convert *output_seconds* to a Lilian day number, divide *output_seconds* by 86,400 (the number of seconds in a day).

fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2EE	3	2510	The hours value in a call to CEEISEC or CEESECS was not recognized.
CEE2EF	3	2511	The day parameter passed in a CEEISEC call was invalid for year and month specified.
CEE2EH	3	2513	The input date passed in a CEEISEC, CEEDAYS, or CEESECS call was not within the supported range.
CEE2EI	3	2514	The year value passed in a CEEISEC call was not within the supported range.
CEE2EJ	3	2515	The milliseconds value in a CEEISEC call was not recognized.
CEE2EK	3	2516	The minutes value in a CEEISEC call was not recognized.
CEE2EL	3	2517	The month value in a CEEISEC call was not recognized.
CEE2EN	3	2519	The seconds value in a CEEISEC call was not recognized.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEEISEC affects only the calling thread.

For more information

- For more information about the CEESECS callable service, see “CEESECS—Convert timestamp to seconds” on page 436.
- See “CEESECI—Convert seconds to integers” on page 431 for more information about the CEESECI callable service.

Examples

```
/*Module/File Name: EDCISEC   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

  _INT4 year, month, day, hours, minutes, seconds,
        millisecs;
  _FLOAT8 output;
  _FEEDBACK fc;

  year = 1991;
  month = 9;
  day = 13;
  hours = 4;
  minutes = 34;
  seconds = 25;
  millisecs = 746;

  CEEISEC(&year,&month,&day,&hours,&minutes,&seconds,;
          &millisecs,&output,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEISEC failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  printf("The number of seconds between 00:00:00.00"
         " 10/14/1582 and 04:34:25.746 09/13/1991"
         " is %.3f\n",output);
}
```

Figure 128. C/C++ Example of CEEISEC

```
CBL LIB,QUOTE
      *Module/File Name: IGZTISEC
      ************************************************
      **                                            **
      ** CBLISEC - Call CEEISEC to convert integers  **
      **           to seconds                       **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLISEC.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  YEAR                    PIC S9(9) BINARY.
       01  MONTH                   PIC S9(9) BINARY.
       01  DAYS                    PIC S9(9) BINARY.
       01  HOURS                   PIC S9(9) BINARY.
       01  MINUTES                 PIC S9(9) BINARY.
       01  SECONDS                 PIC S9(9) BINARY.
       01  MILLSEC                 PIC S9(9) BINARY.
       01  OUTSECS                 COMP-2.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLISEC.
      ************************************************
      ** Specify seven binary integers representing  **
      ** the date and time as input to be converted  **
      ** to Lilian seconds                           **
      ************************************************
           MOVE 2000 TO YEAR.
           MOVE 1 TO MONTH.
           MOVE 1 TO DAYS.
           MOVE 0 TO HOURS.
           MOVE 0 TO MINUTES.
           MOVE 0 TO SECONDS.
           MOVE 0 TO MILLSEC.
```

Figure 129. COBOL Example of CEEISEC (Part 1 of 2)

```
*************************************************
** Call CEEISEC to convert the integers        **
** to seconds                                  **
*************************************************
     CALL "CEEISEC" USING YEAR, MONTH, DAYS,
                          HOURS, MINUTES, SECONDS,
                          MILLSEC, OUTSECS , FC.
*************************************************
** If CEEISEC runs successfully, display result**
*************************************************
     IF CEE000 of FC  THEN
         DISPLAY MONTH "/" DAYS "/" YEAR
             " AT " HOURS ":" MINUTES ":" SECONDS
             " is equivalent to " OUTSECS " seconds"
     ELSE
         DISPLAY "CEEISEC failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 129. COBOL Example of CEEISEC (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMISEC
 /*****************************************************/
 /**                                                 **/
 /** Function: CEEISEC - Convert integers to         **/
 /**                     seconds                     **/
 /**                                                 **/
 /** In this example, CEEISEC is called to convert  **/
 /** integers representing the date and time to the **/
 /** number of seconds since 00:00 14 October 1582. **/
 /**                                                 **/
 /*****************************************************/
 PLIISEC: PROC OPTIONS(MAIN);
    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL YEAR     REAL FIXED BINARY(31,0);
    DCL MONTH    REAL FIXED BINARY(31,0);
    DCL DAYS     REAL FIXED BINARY(31,0);
    DCL HOURS    REAL FIXED BINARY(31,0);
    DCL MINUTES  REAL FIXED BINARY(31,0);
    DCL SECONDS  REAL FIXED BINARY(31,0);
    DCL MILLSEC  REAL FIXED BINARY(31,0);
    DCL OUTSECS  REAL FLOAT DECIMAL(16);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
    /* Specify integers representing                */
    /*    00:00:00 1 January 2000                   */

    YEAR = 2000;
    MONTH = 1;
    DAYS = 1;
    HOURS = 0;
    MINUTES = 0;
    SECONDS = 0;
    MILLSEC = 0;
```

Figure 130. PL/I Example of CEEISEC (Part 1 of 2)

```
   /* Call CEEISEC to convert integers to Lilian     */
   /* seconds                                        */

    CALL CEEISEC ( YEAR, MONTH, DAYS, HOURS,
       MINUTES, SECONDS, MILLSEC, OUTSECS, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT EDIT( OUTSECS, ' seconds corresponds to ',
           MONTH, '/', DAYS, '/', YEAR, ' at ', HOURS,
           ':', MINUTES, ':', SECONDS, '.', MILLSEC )
           (SKIP, F(9), A, 2 (P'99',A), P'9999', A,
           3 (P'99', A), P'999' );
       END;
    ELSE  DO;
       DISPLAY( 'CEEISEC failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIISEC;
```

Figure 130. PL/I Example of CEEISEC (Part 2 of 2)

CEEITOK—Return initial condition token

CEEITOK returns the condition that initially triggered the current condition. The current condition might be different from the initial condition if the initial condition has been promoted by a user-written condition handler.

Syntax

```
►►──CEEITOK──(──i_ctok──,──fc──)──────────────────────────────────►◄
```

i_ctok(output)
A 12-byte condition token identifying the initial condition in the current active data block being processed.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE35S	1	3260	No condition was active when a call to a condition management routine was made.

Usage notes

- z/OS UNIX considerations—In multithread applications, CEEITOK affects only the calling thread. CEEITOK returns the initial token for the condition of the thread.

For more information

- See “CEENCOD—Construct a condition token” on page 401, for more information about the CEENCOD callable service.

Examples

```
/*Module/File Name: EDCITOK   */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

#ifdef __cplusplus
   extern "C" {
#endif
   void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
   }
#endif

int main(void) {

  _FEEDBACK fc,condtok;
  _ENTRY routine;
  _INT4 token,qdata;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;

  /* register condition handler */
  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;
  CEEHDLR(&routine,&token,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEHDLR failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
  /* .
     .
     . */
  /* build the condition token */
  c_1 = 1;
  c_2 = 99;
  cond_case = 1;
  sev = 1;
  control = 0;
  memcpy(facid,"ZZZ",3);
  isi = 0;
```

Figure 131. C/C++ Example of CEEITOK (Part 1 of 2)

```
  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /*
:
 */
  /* signal the condition */
  CEESGL(&condtok,&qdata,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEESGL failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
  /*
:
 */
}
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {

   _FEEDBACK orig_fc, itok_fc;
  /*
:
 */
   /* get the original condition token */
   CEEITOK(&orig_fc, &itok_fc);
  if ( _FBCHECK ( itok_fc , CEE000 ) != 0 ) {
      printf("CEEITOK failed with message number %d\n",
             itok_fc.tok_msgno);
      exit(2999);
   }
  /*
:
 */
  *result = 10;
}
```

Figure 131. C/C++ Example of CEEITOK (Part 2 of 2)

```
CBL LIB,QUOTE,NOOPT
      *Module/File Name: IGZTITOK
      ************************************************
      **                                            **
      ** Purpose:  Drive sample program for CEEITOK. **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRVITOK.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE           PROCEDURE-POINTER.
       01  DENOMINATOR       PIC S9(9) BINARY.
       01  NUMERATOR         PIC S9(9) BINARY.
       01  RATIO             PIC S9(9) BINARY.
       01  TOKEN             PIC S9(9) BINARY VALUE 0.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       REGISTER-HANDLER.
      ************************************************
      ** Register handler                           **
      ************************************************
           SET ROUTINE TO ENTRY "CBLITOK".
           CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
           IF  NOT CEE000 of FC  THEN
               DISPLAY "CEEHDLR failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

       RAISE-CONDITION.
      ************************************************
      ** Cause a zero-divide condition.              **
      ************************************************
           MOVE 0 TO DENOMINATOR.
           MOVE 1 TO NUMERATOR.
           DIVIDE NUMERATOR BY DENOMINATOR, GIVING RATIO.
```

Figure 132. COBOL Example of CEEITOK (Part 1 of 3)

```
 UNREGISTER-HANDLER.
**************************************************
** UNregister handler                           **
**************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.

 END PROGRAM DRVITOK.

**************************************************
**                                              **
** Function: CEEITOK - Return initial           **
**                     condition token          **
**                                              **
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. CBLITOK.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  ITOKEN.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
```

Figure 132. COBOL Example of CEEITOK (Part 2 of 3)

```
 LINKAGE SECTION.
 01  TOKEN                  PIC S9(9) BINARY.
 01  RESULT                 PIC S9(9) BINARY.
     88 RESUME                  VALUE 10.
 01  CURCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  NEWCOND.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.

 PROCEDURE DIVISION USING CURCOND, TOKEN,
                          RESULT, NEWCOND.
 PARA-CBLITOK.
     CALL "CEEITOK" USING ITOKEN, FC.
     IF  CEE000 of FC  THEN
         DISPLAY "Initial condition has msg "
             Msg-No of ITOKEN
     ELSE
         DISPLAY "CEEITOK failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
      PARA-HANDLER.
**************************************************
** In user handler - resume execution         **
**************************************************
     SET RESUME TO TRUE.

     GOBACK.

 END PROGRAM CBLITOK.
```

Figure 132. COBOL Example of CEEITOK (Part 3 of 3)

```
*PROCESS OPT(0), MACRO;
 /* Module/File Name: IBMITOK                          */
 /*****************************************************/
 /**                                                 **/
 /** Function: CEEITOK - example of CEEITOK          **/
 /**                    invoked from PL/I ON-unit    **/
 /**                                                 **/
 /*****************************************************/
 IBMITOK:  PROCEDURE  OPTIONS(MAIN);
   %INCLUDE CEEIBMAW;
   %INCLUDE CEEIBMCT;
   DECLARE
      01 ITOKEN,                   /* Feedback token */
         03 MsgSev    REAL FIXED BINARY(15,0),
         03 MsgNo     REAL FIXED BINARY(15,0),
         03 Flags,
            05 Case      BIT(2),
            05 Severity  BIT(3),
            05 Control   BIT(3),
         03 FacID     CHAR(3),        /* Facility ID */
         03 ISI     /* Instance-Specific Information */
                  REAL FIXED BINARY(31,0),
      01 FC,                       /* Feedback token */
         03 MsgSev    REAL FIXED BINARY(15,0),
         03 MsgNo     REAL FIXED BINARY(15,0),
         03 Flags,
            05 Case      BIT(2),
            05 Severity  BIT(3),
            05 Control   BIT(3),
         03 FacID     CHAR(3),        /* Facility ID */
         03 ISI     /* Instance-Specific Information */
                  REAL FIXED BINARY(31,0),
      divisor     FIXED BINARY(31) INITIAL(0);
   ON  ZERODIVIDE  BEGIN;
      CALL CEEITOK ( ITOKEN, FC );
      IF  FBCHECK( FC, CEE000)  THEN  DO;
         PUT SKIP LIST('The initial condition for the '
            || 'current active block was message '
            || ITOKEN.MsgNo
            || ' for facility '|| ITOKEN.FacID );
         END;
      ELSE  DO;
         DISPLAY( 'CEEITOK failed with msg '
            || FC.MsgNo );
         CALL  CEEMSG( FC, 2, * );
         END;
      END /* ON ZeroDivide */;
   divisor = 15 / divisor  /* signals ZERODIVIDE */;
 END IBMITOK;
```

Figure 133. PL/I Example of CEEITOK

CEELCNV—Query Locale numeric conventions

CEELCNV, analogous to the C function `localeconv()`, queries the numeric formatting information from the current locale and sets the components of a structure with values pertaining to the LC_NUMERIC and LC_MONETARY categories. It sets the components of an object of the type NM_STRUCT with the values appropriate for the formatting of the numeric quantities (monetary and otherwise) according to the rules of the current locale.

CEELCNV is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEELCNV──(──omitted_parm──,──num_and_mon──,──fc──)──────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parm, see “Invoking callable services” on page 107.

num_and_mon (output)
Points to the numeric and monetary structure that is filled in by this service. If the service fails, the contents of the structure are undefined.

num_and_mon has the following structure:

NM_STRUCT
A halfword length-prefixed character string (VSTRING). A pointer to the filled-in structure NM_STRUCT is returned. The structure pointed to by the return value should not be modified by the program but can be overridden by subsequent calls to CEELCNV. In addition, calls to CEESETL with the LC_ALL, LC_MONETARY or LC_NUMERIC categories can cause subsequent calls to CEELCNV to return different values based on the selection of the locale.

The members of the structure with the type VSTRING are strings, any of which (except decimal_point) can point to an empty string, to indicate that the value is not available in the current locale or is of zero length. The members with type VINT are non-negative numbers, any of which can be CHAR_MAX to indicate that the value is not available in the current locale. The members include the following:

VSTRING decimal_point
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the decimal-point character used to format non-monetary quantities.

VSTRING thousands_sep
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the character used to separate groups of digits to the left of the decimal point in formatted non-monetary quantities.

VSTRING grouping
A halfword length-prefixed character string (VSTRING) of 22 bytes whose elements indicate the size of each group of digits in formatted non-monetary quantities.

VSTRING int_curr_symbol
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the international currency symbol applicable to the current locale, left justified within a four-character space-padded field.

VSTRING currency_symbol
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the local currency symbol applicable to the current locale.

VSTRING mon_thousands_sep
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the separator for groups of digits to the left of the decimal point in formatted monetary quantities.

VSTRING mon_grouping
A halfword length-prefixed character string (VSTRING) of 22 bytes whose elements indicate the size of each group of digits in formatted monetary quantities.

VSTRING positive_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes that indicates a non-negative-formatted monetary quantity.

VSTRING negative_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes used to indicate a negative-formatted monetary quantity.

VINT int_frac_digits
A 1-byte integer that is the number of fractional digits (those to the right of the decimal point) to be displayed in an internationally-formatted monetary quantity.

VINT frac_digits
A 1-byte integer that is the number of fractional digits (those to the right of the decimal point) to be displayed in a formatted monetary quantity.

VINT p_cs_precedes
A 1-byte integer that is set to 1 if the *currency_symbol* precedes the value for a non-negative-formatted monetary quantity. It is set to 0 if it follows.

VINT p_sep_by_space
A 1-byte integer that is set to 1 if the *currency_symbol* is separated by a space from the value for a non-negative-formatted monetary quantity. It is set to 0 if it is not separated.

VINT n_cs_precedes
A 1-byte integer that is set to 1 if the *currency_symbol* precedes the value for a negative-formatted monetary quantity. It is set to 0 if it follows.

VINT n_sep_by_space
A 1-byte integer that is set to 1 if the *currency_symbol* is separated by a space from the value for a negative-formatted monetary quantity. It is set to 0 is it is not separated.

VINT p_sign_posn
A 1-byte integer that is set to a value indicating the positioning of the *positive_sign* for non-negative-formatted monetary quantity.

VINT n_sign_posn
A 1-byte integer that is set to a value indicating the position of the *negative_sign* for negative-formatted monetary quantity.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.

Usage Notes

- PL/I MTF consideration—CEELCNV is not supported in PL/I MTF applications.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.
- CEELCNV does not return all numeric conventions.
- CHAR_MAX determines when no further grouping is to be performed. The elements of *grouping* and *mon_grouping* are interpreted according to the following CHAR_MAX settings:
  - 0 specifies that the previous element is to be repeatedly used for the remainder of the digits. Indicates that no further grouping is to be performed.
  - Any other value represents the number of digits comprising the current group. The next element is examined to determine the size of the next group of digits to the left of the current group.
- The value of *p_sign_posn* and *n_sign_posn* is interpreted according to the following:

  0 Parentheses surround the quantity and *currency_symbol*.

  1 The sign string precedes the quantity and *currency_symbol*.

  2 The sign string follows the quantity and *currency_symbol*.

  3 The sign string immediately precedes the *currency_symbol*.

  4 The sign string immediately follows the *currency_symbol*.

For more information

- See “CEEQRYL—Query active locale environment” on page 417 for a description of LC_NUMERIC and LC_MONETARY catagories.
- See “CEESETL—Set locale operating environment” on page 444 for details on the CEESETL callable service.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTLCNV
************************************************
** Example for callable service CEELCNV        **
**  Function: Retrieve numeric and monetary    **
**             format for default locale and   **
**             print an item.                  **
**            Set locale to France, retrieve   **
**             structure, and print an item.   **
** Valid only for COBOL for MVS & VM Release 2 **
** or later.                                   **
************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  MAINLCNV.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
************************************************
** Use Locale NM-Struct for CEELCNV calls      **
************************************************
 COPY CEEIGZNM.
*
 PROCEDURE DIVISION.
************************************************
**  Subroutine needed for addressing           **
************************************************
     CALL "COBLCNV" USING NM-Struct.

     STOP RUN.
*
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBLCNV.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  Locale-Name.
     02  LN-Length  PIC S9(4) BINARY.
     02  LN-String  PIC X(256).
************************************************
** Use Locale category constants              **
************************************************
 COPY CEEIGZLC.
*
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
```

Figure 134. COBOL Example of CEELCNV (Part 1 of 2)

```
 LINKAGE SECTION.
**************************************************
** Use Locale NM-Struct for CEELCNV calls      **
**************************************************
 COPY CEEIGZNM.
*
 PROCEDURE DIVISION USING NM-Struct.
**************************************************
**  Call CEELCNV to retrieve values for locale**
**************************************************
     CALL "CEELCNV" USING OMITTED,
                    ADDRESS OF NM-Struct, FC.

**************************************************
**  Check feedback code and display result     **
**************************************************
     IF Severity = 0 THEN
        DISPLAY "Default decimal point is "
        DECIMAL-PT-String(1:DECIMAL-PT-Length)
     ELSE
        DISPLAY "Call to CEELCNV failed. " Msg-No
     END-IF.

**************************************************
** Set up locale for France                   **
**************************************************
     MOVE 4 TO LN-Length.
     MOVE "FRAN" TO LN-String (1:LN-Length).

**************************************************
**  Call CEESETL to set monetary locale        **
**************************************************
     CALL "CEESETL" USING Locale-Name,
           LC-MONETARY, FC.

**************************************************
**  Call CEESETL to set numeric locale         **
**************************************************
     CALL "CEESETL" USING Locale-Name,
           LC-NUMERIC, FC.
**************************************************
**  Check feedback code and call CEELCNV again **
**************************************************
     IF Severity = 0
        CALL "CEELCNV" USING OMITTED,
                       ADDRESS OF NM-Struct, FC
        IF Severity > 0
           DISPLAY "Call to CEELCNV failed. "
                   Msg-No
        ELSE
           DISPLAY "French decimal point is "
           DECIMAL-PT-String(1:DECIMAL-PT-Length)
        END-IF
     ELSE
        DISPLAY "Call to CEESETL failed. " Msg-No
     END-IF.

     EXIT PROGRAM.
 END PROGRAM COBLCNV.
*
 END PROGRAM MAINLCNV.
```

Figure 134. COBOL Example of CEELCNV (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMLCNV                          */
 /****************************************************/
 /* Example for callable service CEELCNV             */
 /* Function: Retrieve numeric and monetary format   */
 /*  structure for default locale and print an item. */
 /*  Set locale to France, retrieve structure and    */
 /*  print an item.                                  */
 /****************************************************/

 PLILCNV: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */
 %INCLUDE CEEIBMNM; /* NM_STRUCT for CEELCNV calls   */

 /* use explicit pointer for local NM_STRUCT struct  */
 DCL NUM_AND_MON POINTER INIT(ADDR(NM_STRUCT));

 /* CEESETL service call arguments */
 DCL LOCALE_NAME CHAR(256) VARYING;

 DCL 01 FC,                        /* Feedback token */
        03 MsgSev    REAL FIXED BINARY(15,0),
        03 MsgNo     REAL FIXED BINARY(15,0),
        03 Flags,
           05 Case      BIT(2),
           05 Severity  BIT(3),
           05 Control   BIT(3),
        03 FacID     CHAR(3),       /* Facility ID */
        03 ISI       /* Instance-Specific Information */
                     REAL FIXED BINARY(31,0);

   /* retrieve structure for default locale */
   CALL CEELCNV ( *, NUM_AND_MON, FC );

   PUT SKIP LIST('Default DECIMAL_POINT is ',
                 NM_STRUCT.DECIMAL_POINT);

   /* set locale for France */
   LOCALE_NAME = 'FRAN';

   /* use LC_NUMERIC category const from CEEIBMLC */
   CALL CEESETL ( LOCALE_NAME, LC_NUMERIC,  FC );

   /* use LC_MONETARY category const from CEEIBMLC */
   CALL CEESETL ( LOCALE_NAME, LC_MONETARY,  FC );

   /* FBCHECK macro used (defined in CEEIBMCT) */
   IF FBCHECK( FC, CEE000 ) THEN
     DO;
       /* retrieve active NM_STRUCT, France Locale */
       CALL CEELCNV ( *, NUM_AND_MON, FC );

       PUT SKIP LIST('French DECIMAL_POINT is ',
                     NM_STRUCT.DECIMAL_POINT);
     END;

 END PLILCNV;
```

Figure 135. PL/I Example of CEELCNV

CEELOCT—Get current local date or time

CEELOCT returns the current local date or time in three formats:

- Lilian date (the number of days since 14 October 1582)
- Lilian seconds (the number of seconds since 00:00:00 14 October 1582)

- Gregorian character string (in the form YYYYMMDDHHMISS999)

These values are compatible with other Language Environment date and time services, and with existing language intrinsic functions.

CEELOCT performs the same function as calling the CEEGMT, CEEGMTO, and CEEDATM date and time services separately. CEELOCT, however, performs the same services with much greater speed.

The character value returned by CEELOCT is designed to match that produced by existing language intrinsic functions. The numeric values returned can be used to simplify date calculations.

Syntax

```
►►──CEELOCT──(──output_Lilian──,──output_seconds──,──output_Gregorian──,──────►
►─fc──)──────────────────────────────────────────────────────────────────────►◄
```

output_Lilian (output)
A 32-bit binary integer representing the current local date in the Lilian format, that is, day 1 equals 15 October 1582, day 148,887 equals 4 June 1990. If the local time is not available from the system, *output_Lilian* is set to 0 and CEELOCT terminates with a non-CEE000 symbolic feedback code.

output_seconds (output)
A 64-bit double-floating point number representing the current local date and time as the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). 19:00:01.078 on 4 June 1990 is second number 12,863,905,201.078.

If the local time is not available from the system, *output_seconds* is set to 0 and CEELOCT terminates with a non-CEE000 symbolic feedback code.

output_Gregorian (output)
A 17-byte fixed-length character string in the form YYYYMMDDHHMISS999 representing local year, month, day, hour, minute, second, and millisecond.

If the format of *output_Gregorian* does not meet your needs, you can use the CEEDATM callable service to convert *output_seconds* to another format.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2F3	3	2531	The local time was not available from the system.

Usage notes

- z/OS consideration—The MVS command SET DATE will not affect the value returned by CEELOCT.

- CICS consideration—CEELOCT does not use the OS TIME macro.
- z/OS UNIX consideration—In multithread applications, CEELOCT affects only the calling thread.

For more information

- See “CEEDATM—Convert seconds to character timestamp” on page 235 for more information about the CEEDATM callable service.

Examples

```
/*Module/File Name: EDCLOCT   */

#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc;
  _INT4     lil_date;
  _FLOAT8   local_date;
  _CHAR17   gregorian_date;

  CEELOCT(&lil_date,&local_date,gregorian_date,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEELOCT failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  printf("The current date is YYYYMMDDHHMISS999\n");
  printf("                    %.17s\n",gregorian_date);
}
```

Figure 136. C/C++ Example of CEELOCT

```
CBL LIB,QUOTE
      *Module/File Name: IGZTLOCT
      ************************************************
      **                                            **
      ** CBLLOCT - Call CEELOCT to get current      **
      **           local time                       **
      **                                            **
      ** In this example, a call is made to CEELOCT **
      ** to return the current local time in Lilian **
      ** days (the number of days since 14 October  **
      ** 1582), Lilian seconds (the number of       **
      ** seconds since 00:00:00 14 October 1582),   **
      ** and a Gregorian string (in the form        **
      ** YYYMMDDMISS999). The Gregorian character   **
      ** string is then displayed.                  **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLLOCT.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  LILIAN                  PIC S9(9) BINARY.
       01  SECONDS                 COMP-2.
       01  GREGORN                 PIC X(17).
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLLOCT.
           CALL "CEELOCT" USING LILIAN, SECONDS,
                                GREGORN, FC.
      ************************************************
      ** If CEELOCT runs successfully, display      **
      **     Gregorian character string             **
      ************************************************
           IF CEE000 of FC  THEN
               DISPLAY "Local Time is " GREGORN
           ELSE
               DISPLAY "CEELOCT failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 137. COBOL Example of CEELOCT

```
*PROCESS MACRO;
 /* Module/File Name: IBMLOCT                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEELOCT - get current local time     **/
 /**                                                **/
 /** In this example, CEELOCT is called to return   **/
 /** the current local time as a Lilian date,       **/
 /** Lilian timestamp, and Gregorian character      **/
 /** string.                                        **/
 /**                                                **/
 /****************************************************/
 PLILOCT: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL LILIAN   REAL FIXED BINARY(31,0);
    DCL SECONDS  REAL FLOAT DECIMAL(16);
    DCL GREGORN  CHARACTER ( 17 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

   /* Call CEELOCT to return local time in 3 formats */
    CALL CEELOCT ( LILIAN, SECONDS, GREGORN, FC );

    /* If CEELOCT ran successfully, print Gregorian  */
    /* result                                        */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'The local date and time are '
          || GREGORN || '.' );
       END;
    ELSE  DO;
       DISPLAY( 'CEELOCT failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLILOCT;
```

Figure 138. PL/I Example of CEELOCT

CEEMGET—Get a message

CEEMGET retrieves, formats, and stores in a passed message area a message corresponding to a condition token that is either returned from a callable service or passed to a user-written condition handler. The caller can later retrieve the message to change or to write as output.

Syntax

```
►►──CEEMGET──(──cond_token──,──message_area──,──msg_ptr──,──fc──)──────────►◄
```

cond_token (input)
A 12-byte condition token received as the result of a Language Environment callable service.

message_area (input/output)
A fixed-length 80-character string (VSTRING), where the message is placed.

The message is left-justified and padded on the right with blanks.

msg_ptr (input/output)
A 4-byte binary integer returned to the calling routine.

The *msg_ptr* should be passed a value of zero on the initial call to CEEMGET. If a message is too large to be contained in the *message_area, msg_ptr* (containing the index) is returned into the message. This index is used on subsequent calls to CEEMGET to retrieve the remaining portion of the message. A feedback code is also returned, indicating the message has been truncated. When the entire message is returned, *msg_ptr* is zero.

msg_ptr contains different results based on the length of the message:

- If a message contains fewer than 80 characters, the entire message is returned on the first call. *msg_ptr* contains 0.
- If a message contains exactly 80 characters, the entire message is returned on the first call. *msg_ptr* contains 0.
- If the message is too long, CEEMGET splits it into segments. The *msg_ptr* does not contain the cumulative index for the entire message returned so far, but contains only the index into the segment that was just returned. It is up to the user of CEEMGET to maintain the cumulative count if needed. When a message is too long, the following can occur:
  - If a message contains more than 80 characters and at least one blank is contained in the first 80 characters, the string up to and including the last blank is returned on the first call.
  - If the 80th character is nonblank (even if the 81st character is a blank), *msg_ptr* contains the index of the last blank (something less than 80), and the next call starts with the next character.
  - If the 80th character is a blank, *msg_ptr* contains 80 and the next call starts with the 81st character, blank or nonblank.
  - If a message contains more than 80 characters and at least the first 80 are all nonblank, the first 80 are returned and the next call does not add any blanks and starts with the 81st character. *msg_ptr* contains 80.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE036	3	0102	An unrecognized condition token was passed to *routine* and could not be used.
CEE0E2	3	0450	The message inserts for the condition token with message number *message-number* and facility ID *facility-id* could not be located.
CEE0E6	3	0454	The message number *message-number* could not be found for facility ID *facility-id*.

Code	Severity	Message Number	Message Text
CEE0E7	1	0455	The message with message number *message-number* and facility ID *facility-id* was truncated.
CEE0EA	3	0458	The message repository *repository-name* could not be located.

Usage notes

- z/OS UNIX considerations—In multithread applications, CEEMGET affects only the calling thread. However, CEEMGET uses the NATLANG value of the enclave. Any subsequent calls to CEEMGET, for a given condition, use the NATLANG value in effect at the time of the first call.

For more information

- See “CEENCOD—Construct a condition token” on page 401 for a description of the 12-byte condition token constructed by the CEENCOD callable service.

Examples

```
/*Module/File Name: EDCMGET   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>


int main(void) {

  _VSTRING message;
  _INT4 dest,msgindx;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;
  _CHAR80 msgarea;
  _FEEDBACK fc,token;

  /* construct a token for CEE message 2523 */
  c_1 = 1;
  c_2 = 2523;
  cond_case = 1;
  sev = 1;
  control = 1;
  memcpy(facid,"CEE",3);
  isi = 0;

  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&token,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  msgindx = 0;
  memset(msgarea,' ',79);/* initialize the message area */
  msgarea_80¨ = '\0';

  /* use CEEMGET until all the message has been */
  /* retrieved */
  /* msgindx will be zero when all the message has */
  /* been retrieved */
  do {
     CEEMGET(&token,msgarea,&msgindx,&fc);

     if (fc.tok_sev > 1 ) {
        printf("CEEMGET failed with message number %d\n",
               fc.tok_msgno);
        exit(2999);
     }
```

Figure 139. C/C++ Example of CEEMGET (Part 1 of 2)

```
     /* put out the message using CEEMOUT */
     memcpy(message.string,msgarea,80);
     message.length = 80;
     dest = 2;
     CEEMOUT(&message,&dest,&fc);

     if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEMOUT failed with message number %d\n",
               fc.tok_msgno);
        exit(2999);
     }
  } while (msgindx != 0);
}
```

Figure 139. C/C++ Example of CEEMGET (Part 2 of 2)

```
CBL LIB,QUOTE
      *Module/File Name: IGZTMGET
      ****************************************
      **                                    **
      ** CBLMGET - Call CEEMGET to get a      **
      **           message.  First set up a   **
      **           condition token using      **
      **           CEENCOD.                   **
      **                                    **
      ****************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLMGET.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  MSGBUF                  PIC X(80).
       01  MSGPTR                  PIC S9(9) BINARY.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.
       01  NEWTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLMGET.
```

Figure 140. COBOL Example of CEEMGET (Part 1 of 2)

```
*********************************************
** Give contok value of                    **
** sev = 0, msgno = 1 facid = CEE          **
*********************************************
     MOVE 0 TO SEV.
     MOVE 1 TO MSGNO.
     MOVE 1 TO CASE.
     MOVE 0 TO SEV2.
     MOVE 1 TO CNTRL.
     MOVE "CEE" TO FACID.
     MOVE 0 TO ISINFO.

**************************************************
** Call CEENCOD with the values assigned above **
** to build a condition token "NEWTOK"         **
**************************************************
     CALL "CEENCOD" USING SEV, MSGNO, CASE,
                          SEV2, CNTRL, FACID,
                          ISINFO, NEWTOK, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEENCOD failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

**************************************************
** Always pass 0 in MSGPTR on the initial      **
** call to CEEMGET.  If the message is too     **
** long to be returned in a single call,       **
** MSGPTR will be returned containing an       **
** index to the message that can be used on    **
** subsequent calls to CEEMGET.                **
**************************************************
     MOVE 0 TO MSGPTR.
**************************************************
** Call CEEMGET to get the message associated  **
** with the condition token                    **
**************************************************
     CALL "CEEMGET" USING NEWTOK, MSGBUF,
                          MSGPTR , FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEMGET failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     ELSE
         DISPLAY "The message is: " MSGBUF
     END-IF.

     GOBACK.
```

Figure 140. COBOL Example of CEEMGET (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMMGET                          */
 /****************************************************/
 /**                                                **/
 /**Function       : CEEMGET - Get a Message        **/
 /**                                                **/
 /****************************************************/
 PLIMGET: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL 01 CONTOK,                 /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
    DCL MSGBUF      CHAR(80);
    DCL MSGPTR      REAL FIXED BINARY(31,0);

    /* Give CONTOK value of condition CEE001         */
    ADDR( CONTOK ) -> CEEIBMCT = CEE001;
    MSGPTR = 0;

    /* Call CEEMGET to retrieve msg corresponding    */
    /*    to condition token                         */
    CALL CEEMGET ( CONTOK, MSGBUF, MSGPTR, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Message text for message number'
          || CONTOK.MsgNo || ' is "' || MSGBUF || '"');
       END;
    ELSE  DO;
       DISPLAY( 'CEEMGET failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIMGET;
```

Figure 141. PL/I Example of CEEMGET

CEEMOUT—Dispatch a message

CEEMOUT dispatches a user-defined message string to the message file.

Syntax

```
►►──CEEMOUT──(──message_string──,──destination_code──,──fc──)──────────────►◄
```

message_string (input)
A halfword-prefixed printable character string containing the message. DBCS characters must be enclosed within shift-out (byte X'0F') shift-in (X'0E') characters.

Insert data cannot be placed in the message with CEEMOUT. The halfword-prefixed message string (input) must contain only printable characters. For length greater than zero, unpredictable results will occur if the byte following the halfword prefix is *X'00"*

destination_code (input)
A 4-byte binary integer. The only accepted value for *destination_code* is 2. Under systems other than CICS, Language Environment writes the message to the *ddname* of the file specified in the MSGFILE run-time option. Under CICS, the message is written to a transient data queue named CESE.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0E3	3	0451	An invalid destination code *destination-code* was passed to routine *routine-name*.
CEE0E9	3	0457	The message file destination *ddname* could not be located.

Usage notes

- z/OS UNIX considerations—In multithread applications, CEEMOUT affects only the calling thread. When multiple threads write to the message file, the output is interwoven by line. To group lines of output, serialize MSGFILE access (by using a mutex, for example).

For more information

- See “MSGFILE” on page 43 for more information about the MSGFILE run-time option.
- See *z/OS Language Environment Programming Guide* for more information on CESE.

Examples

```
/*Module/File Name: EDCMOUT   */

#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _VSTRING message;
  _INT4 dest;
  _FEEDBACK fc;

  strcpy(message.string,"This is a test message");
  message.length = strlen(message.string);
  dest = 2;

  CEEMOUT(&message,&dest,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEMOUT failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  /* .
     .
     . */
}
```

Figure 142. C/C++ Example of CEEMOUT

```
CBL LIB,QUOTE
      *Module/File Name: IGZTMOUT
      ************************************************
      ** CBLMOUT - Call CEEMOUT to dispatch a msg.  **
      ** In this example, a call is made to CEEMOUT **
      ** to dispatch a user-defined message string  **
      ** to the ddname specified defaulted in the   **
      ** MSGFILE run-time option.                   **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLMOUT.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  MSGSTR.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of MSGSTR.
       01  DESTIN                  PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLMOUT.
      ************************************************
      ** Create message string and specify length    **
      ************************************************
           MOVE 25 TO Vstring-length of MSGSTR.
           MOVE "CEEMOUT ran successfully"
                TO Vstring-text of MSGSTR.
      ************************************************
      ** Specify 2 to send the message to the ddname **
      **     specified or defaulted in the MSGFILE   **
      **     run-time option.                        **
      ************************************************
           MOVE 2 TO DESTIN.
           CALL "CEEMOUT" USING MSGSTR, DESTIN, FC.
           IF  NOT CEE000 of FC  THEN
               DISPLAY "CEEMOUT failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
           GOBACK.
```

Figure 143. COBOL Example of CEEMOUT

```
*PROCESS MACRO;
 /* Module/File Name: IBMMOUT                          */
 /****************************************************/
 /** Function: CEEMOUT - Dispatch a message         **/
 /**                                                **/
 /** In this example, CEEMOUT is called to dispatch **/
 /** a user-defined message string to the ddname    **/
 /** specified or defaulted in the MSGFILE run-time **/
 /** option.                                        **/
 /****************************************************/
 PLIMOUT: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL MSGSTR CHAR(255) VARYING;
    DCL DESTIN REAL FIXED BINARY(31,0);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    MSGSTR = 'CEEMOUT ran successfully.';
                          /* Set message string     */
    DESTIN = 2;           /* Send to MSGFILE ddname */

    /* Dispatch message to destination by a  */
    /*    call to CEEMOUT                    */
    CALL CEEMOUT ( MSGSTR, DESTIN, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Message "' || MSGSTR
          || '" sent to destination ' || DESTIN );
       END;
    ELSE  DO;
       DISPLAY( 'CEEMOUT failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIMOUT;
```

Figure 144. PL/I Example of CEEMOUT

CEEMRCE—Move resume cursor explicit

The CEEMRCE service resumes execution of a user routine at the location established by CEE3SRP. CEEMRCE is designed to be called from a user condition handler and works only in conjunction with the CEE3SRP service.

Syntax

```
►►──CEEMRCE──(──resume_token──,──fc──)──────────────────────────────►◄
```

resume_token (input)
An INT4 data type that contains a token, returned from the CEE3SRP service, representing the resume point in the user routine.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE07V	2	0255	The first parameter passed to CEEMRCE was an unrecognized label.

Usage notes

- Exit DSA routines are invoked as the resume cursor is moved back across stack frames.
- When a resume is requested, the state of the machine indicated in the machine state block is established prior to entry at the resume point.

For more information

- See *z/OS Language Environment Programming Guide* for more information about the CEEMRCE callable service.

Examples

```
 CBL NODYNAM APOST
 IDENTIFICATION DIVISION.
 PROGRAM-ID. PGM2.
*Module/File Name: IGZTMRCE
*_________________________________________*
*                                         *
* Sample program using CEE3SRP and CEEMRCE.*
* PGM2 registers user-written condition    *
* handler UCH1 using CEEHDLR.  It          *
* sets a resume point using CEE3SRP. After *
* incurring a condition and returning      *
* to PGM2, PGM3 is called.  PGM3 sets up   *
* new resume point, does a divide-by-zero, *
* and after resuming in PGM3, resets the   *
* resume point to PGM2 and does a GOBACK.  *
*_________________________________________*

 DATA DIVISION.
 WORKING-STORAGE SECTION.

 01  RECOVERY-AREA EXTERNAL.
     05  RECOVERY-POINT            POINTER.
     05  ERROR-INDICATOR           PIC X(01).

 01 UCH-ROUTINE      PROCEDURE-POINTER.

 01  FIELDS.
     05  FIRST-TIME-SW    PIC X(03) VALUE ' ON'.
         88 FIRST-TIME-88           VALUE ' ON'.
     05  ANSWER    PIC S9(02) COMP-3 VALUE 0.
     05  UCH1      PIC  X(08) VALUE 'UCH1    '.
     05  PGM3      PIC  X(08) VALUE 'PGM3    '.
     05  CEEHDLR   PIC  X(08) VALUE 'CEEHDLR '.
     05  CEE3SRP   PIC  X(08) VALUE 'CEE3SRP '.
     05  TOKEN     PIC S9(09) BINARY.
     05  FC.
         10  CASE-1.
             15  SEVERITY PIC S9(04) BINARY.
             15  MSG-NO   PIC S9(04) BINARY.
         10  SEV-CTL      PIC  X(01).
         10  FACILITY-ID  PIC  X(03).
         10  I-S-INFO     PIC S9(09) BINARY.


 PROCEDURE DIVISION.

     SET UCH-ROUTINE TO ENTRY 'UCH1'.
*_________________________________________*
*                                         *
* Register the condition handler, UCH1.    *
*_________________________________________*

     CALL CEEHDLR USING UCH-ROUTINE, TOKEN, FC.
     IF CASE-1 NOT = LOW-VALUE
         GOBACK.
     PERFORM COMPUTE-LOOP 3 TIMES.
     CALL PGM3 USING RECOVERY-AREA.
     SET RECOVERY-POINT TO NULL.
     GOBACK.
```

Figure 145. COBOL Example of CEEMRCE (Part 1 of 4)

```
 COMPUTE-LOOP.
     IF FIRST-TIME-88
         MOVE 'OFF' TO FIRST-TIME-SW
*_________________________________________*
*                                         *
* Set up a new resume point.              *
*_________________________________________*

         CALL CEE3SRP USING RECOVERY-POINT,
                            CASE-1
         IF CASE-1 NOT = LOW-VALUE
             GOBACK.

     IF ERROR-INDICATOR = 'E'
         MOVE SPACE TO ERROR-INDICATOR
         MOVE 1 TO ANSWER.

* Application code may go here.

     COMPUTE ANSWER = 1 / ANSWER.

* Put application code here.



 CBL NODYNAM APOST
 IDENTIFICATION DIVISION.
 PROGRAM-ID. PGM3.
*_________________________________________*
*                                         *
* Sample program using CEE3SRP and CEEMRCE.*
* PGM2 registered UCH1. This program sets a*
* new resume point, does a divide-by-zero, *
* and after resuming in PGM3, resets the   *
* resume point to PGM2 and does a GOBACK.  *
*_________________________________________*

 DATA DIVISION.
 WORKING-STORAGE SECTION.

 01  RECOVERY-AREA EXTERNAL.
     05  RECOVERY-POINT            POINTER.
     05  ERROR-INDICATOR           PIC X(01).

 01 UCH-ROUTINE      PROCEDURE-POINTER.
```

Figure 145. COBOL Example of CEEMRCE (Part 2 of 4)

```
 01  FIELDS.
     05  FIRST-TIME-SW    PIC X(03) VALUE ' ON'.
         88 FIRST-TIME-88           VALUE ' ON'.
     05  ANSWER    PIC S9(02) COMP-3 VALUE 0.
     05  CEEHDLR   PIC  X(08) VALUE 'CEEHDLR '.
     05  CEE3SRP   PIC  X(08) VALUE 'CEE3SRP '.
     05  TOKEN     PIC S9(09) BINARY.
     05  SEV PIC -9(05).
     05  MSG PIC -9(05).
     05  FC.
         10  CASE-1.
             15  SEVERITY PIC S9(04) BINARY.
             15  MSG-NO   PIC S9(04) BINARY.
         10  SEV-CTL      PIC  X(01).
         10  FACILITY-ID  PIC  X(03).
         10  I-S-INFO     PIC S9(09) BINARY.


 PROCEDURE DIVISION.

     PERFORM COMPUTE-LOOP 3 TIMES.
     SET RECOVERY-POINT TO NULL.
     GOBACK.

 COMPUTE-LOOP.
     IF FIRST-TIME-88
         MOVE 'OFF' TO FIRST-TIME-SW
*_________________________________________*
*                                         *
* Set new resume point.                   *
*_________________________________________*

         CALL CEE3SRP USING RECOVERY-POINT, FC
         IF CASE-1 NOT = LOW-VALUE
             GOBACK.

     IF ERROR-INDICATOR = 'E'
         MOVE SPACE TO ERROR-INDICATOR
         MOVE 1 TO ANSWER.

* Application code may go here.

     COMPUTE ANSWER = 1 / ANSWER.

* Put application code here.



 CBL NODYNAM APOST
 IDENTIFICATION DIVISION.
 PROGRAM-ID. UCH1.
```

Figure 145. COBOL Example of CEEMRCE (Part 3 of 4)

```
*_________________________________________*
*                                         *
* Sample user condition handler using     *
* CEEMRCE.  This program sets an error    *
* flag for the program-in-error to query  *
* and issues a call to CEEMRCE to return  *
* control to the statement following the  *
* call to CEE3SRP.                        *
*_________________________________________*

 DATA DIVISION.
 WORKING-STORAGE SECTION.

 01  RECOVERY-AREA EXTERNAL.
     05 RECOVERY-POINT         POINTER.
     05 ERROR-INDICATOR        PIC X(01).

 01  FC.
     10  CASE-1.
         15  SEVERITY PIC S9(04) BINARY.
         15  MSG-NO   PIC S9(04) BINARY.
     10  SEV-CTL      PIC  X(01).
     10  FACILITY-ID  PIC  X(03).
     10  I-S-INFO     PIC S9(09) BINARY.

 01 CEEMRCE       PIC X(08) VALUE 'CEEMRCE '.
 LINKAGE SECTION.

 01  CURRENT-CONDITION         PIC  X(12).
 01  TOKEN                     PIC  X(04).
 01  RESULT-CODE             PIC S9(09) BINARY.
     88  RESUME                  VALUE +10.
     88  PERCOLATE               VALUE +20.
     88  PERC-SF                 VALUE +21.
     88  PROMOTE                 VALUE +30.
     88  PROMOTE-SF              VALUE +31.
 01  NEW-CONDITION             PIC  X(12).

 PROCEDURE DIVISION  USING CURRENT-CONDITION,
                           TOKEN,
                           RESULT-CODE,
                           NEW-CONDITION.

     MOVE 'E' TO ERROR-INDICATOR.

*_________________________________________*
*                                         *
* Call CEEMRCE to return control to the   *
* last resume point.                      *
*_________________________________________*

     CALL CEEMRCE USING RECOVERY-POINT,
                        FC.
     IF CASE-1 NOT = LOW-VALUE
         GOBACK.
     MOVE +10 TO RESULT-CODE.

     GOBACK.
```

Figure 145. COBOL Example of CEEMRCE (Part 4 of 4)

```
*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
 DRV3SRP: Proc Options(Main);

   /*Module/File Name: IBM3SRP                      */
   /**************************************************
    **                                               *
    ** DRV3SRP - Set an explicit resume point by      *
    **           calling CEE3SRP then registering a   *
    **           condition handler that calls CEEMRCE *
    **           to resume at the explicitly set      *
    **           resume point.                        *
    **                                               *
    **************************************************/

    %include CEEIBMCT;
    %include CEEIBMAW;
    declare 01 FBCODE   feedback;  /* Feedback token */
    declare DENOMINATOR fixed binary(31,0);
    declare NUMERATOR   fixed binary(31,0);
    declare RATIO       fixed binary(31,0);
    declare PLI3SRP     external entry;
    declare U_PTR       pointer;
    declare 01 U_DATA,
              03 U_CNTL fixed binary(31),
              03 U_TOK  pointer;

         U_PTR = addr(U_DATA);
         U_CNTL = 0;

         /* Set Resume Point                */

         Display('Setting resume point via CEE3SRP');
         Call CEE3SRP(U_TOK,FBCODE);
         Display('After CEE3SRP ... Resume point');
         If U_CNTL = 0 Then
           Do;
             Display('First time through...');

             Display('Registering user handler');
             Call CEEHDLR(PLI3SRP, U_PTR, FBCODE);
             If FBCHECK(FBCODE, CEE000) Then
               Do;
                 /* Cause a zero-divide condition  */

                 DENOMINATOR = 0;
                 NUMERATOR = 1;
                 RATIO = NUMERATOR / DENOMINATOR;
               End;
             Else
               Do;
                 Display('CEEHDLR failed with msg ');
                 Display(MsgNo);
               End;
           End;
         Else
           Display('Second time through...');

         /* Unregister handler                */
```

Figure 146. PL/I Example of CEEMRCE (Part 1 of 2)

```
        Call CEEHDLU(PLI3SRP, FBCODE);
        If FBCHECK(FBCODE, CEE000) Then
          Display('Main: unregistered PLI3SRP');
        Else
          Do;
            Display('CEEHDLU failed with msg ');
            Display(MsgNo);
          End;
 End DRV3SRP;




*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
 PLI3SRP: Proc (PTR1,PTR2,PTR3,PTR4) Options(byvalue);
   /**************************************************
    **                                              *
    ** PLI3SRP - Call CEEMCRE to resume at the resume *
    **           point explicitly set in user        *
    **           program.                            *
    **                                              *
    **************************************************/

    %include CEEIBMCT;
    %include CEEIBMAW;
    declare (PTR1,PTR2,PTR3,PTR4) pointer;
    declare 01 CURCOND  based(PTR1) feedback;
    declare TOKEN       pointer based(PTR2);
    declare RESULT      fixed bin(31,0) based(PTR3);
    declare 01 NEWCOND  based(PTR4) feedback;
    declare 01 U_DATA   based(TOKEN),
              03 U_CNTL fixed binary(31,0),
              03 U_TOK  pointer;
    declare 01 FBCODE   feedback;

    Display('In user handler');
    RESULT = 10;
    Call CEEMRCE(U_TOK,FBCODE);
    Display(U_CNTL);
    U_CNTL = 1;
    Return;
 End PLI3SRP;
```

Figure 146. PL/I Example of CEEMRCE (Part 2 of 2)

CEEMRCR—Move resume cursor

CEEMRCR moves the resume cursor to a position relative to the current position of the handle cursor. The actions supported are:

- Moving the resume cursor to the call return point of the routine registering the executing condition handler.
- Moving the resume cursor to the caller of the routine registering the executing condition handler.

Initially, the resume cursor is placed after the instruction that caused the condition. Whenever CEEMRCR moves the resume cursor and passes stack frames, associated exit routines are invoked. Note that “exit routine” refers to user condition handlers as well as language-specific condition handlers. In addition, any associated user condition handlers are unregistered. The movement direction is always toward earlier stack frames, never toward more recent stack frames. The movement occurs only after the condition handler returns to the Language Environment condition manager.

Multiple calls to CEEMRCR yield the net results of the calls; that is, if two calls move the resume cursor to different places for the same stack frame, the most restrictive call (that closest to the earliest stack frame) is used for that stack frame.

Moving the resume cursor to a particular stack frame:

- Cancels all stack frames from the previous resume point up to but not including the new resume point
- Unregisters any user condition handlers registered for the canceled stack frames

Syntax

```
►►──CEEMRCR──(──type_of_move──,──fc──)──────────────────────────────►◄
```

type_of_move (input)
A fullword binary signed integer indicating the target of the resume cursor movement. The possible values for *type_of_move* are:

0 Move the resume cursor to the call return point of the stack frame associated with the handle cursor.

1 Move the resume cursor to the call return point of the stack frame prior to the stack frame associated with the handle cursor. The handle cursor is moved to the most recently established condition handler of the stack frame. The new resume cursor position now points to this condition handler for the stack frame.

Do not use a *type_of_move* value of 1 if the caller of the stack frame associated with the handle cursor is a nested COBOL program.

Modifying the resume cursor to point to stack frame 0 is not allowed. You cannot move the resume cursor beyond the earliest stack frame.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE07U	1	0254	The first parameter passed to CEEMRCR was not 0 or 1.
CEE083	3	0259	A move to stack frame zero using CEEMRCR was attempted from a MAIN routine.
CEE084	3	0260	No condition was active when a call to a condition management routine was made. The requested function was not performed.
CEE08L	1	0277	CEEMRCR was called to perform an unnecessary move.

Usage notes

- PL/I MTF consideration—CEEMRCR is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
- z/OS UNIX considerations—In multithread applications, CEEMRCR affects only the calling thread. You can use CEEMRCR only within the thread's call chain.

Illustration of CEEMRCR Usage

The following three figures illustrate how you can move the resume cursor by using the CEEMRCR service.

In Figure 147 on page 386, routine A calls routine B, which in turn calls C, which calls D. User condition handlers are registered in routines B and C.

When a condition is raised in routine D, the Language Environment condition manager passes control to the user condition handler established for routine C. The handle cursor now points to the stack frame for routine C. Routine C percolates the condition.

The handle cursor now points to the stack frame for routine B. The next user condition handler to gain control is that one established for routine B; it recognizes the condition and issues a resume by calling CEEMRCR.

A 0 *type_of_move*, meaning move the resume cursor to the stack frame associated with the handle cursor, causes control to resume at the call return point in routine B, the instruction immediately following the call to routine C. A 1 *type_of_move*, meaning move the resume cursor to the call return point of the stack frame immediately preceding the one to which the handle cursor points, moves the resume cursor to the instruction immediately following a call in routine A to routine B.

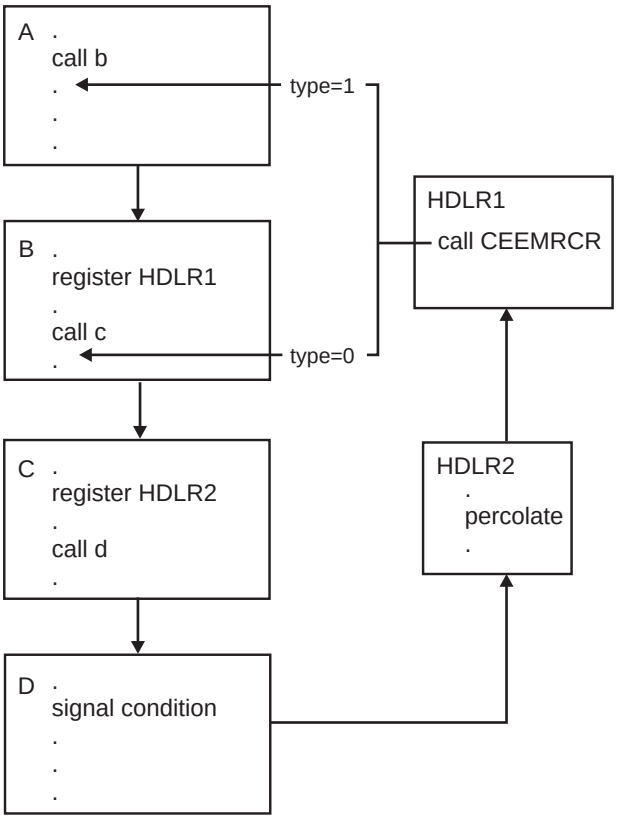

Figure 147. First Example Moving Resume Cursor Using CEEMRCR

The same scenario is illustrated in Figure 148 on page 387, except that HDLR2 issues a resume for the signaled condition rather than percolating it. HDLR1 never gains control. Because the handle cursor now points to the stack frame for routine C, a 0 *type_of_move* causes control to resume at the call return point in routine C, the instruction immediately following the call to routine D. A 1 *type_of_move* moves the resume cursor to the instruction immediately following a call in routine B to routine C.

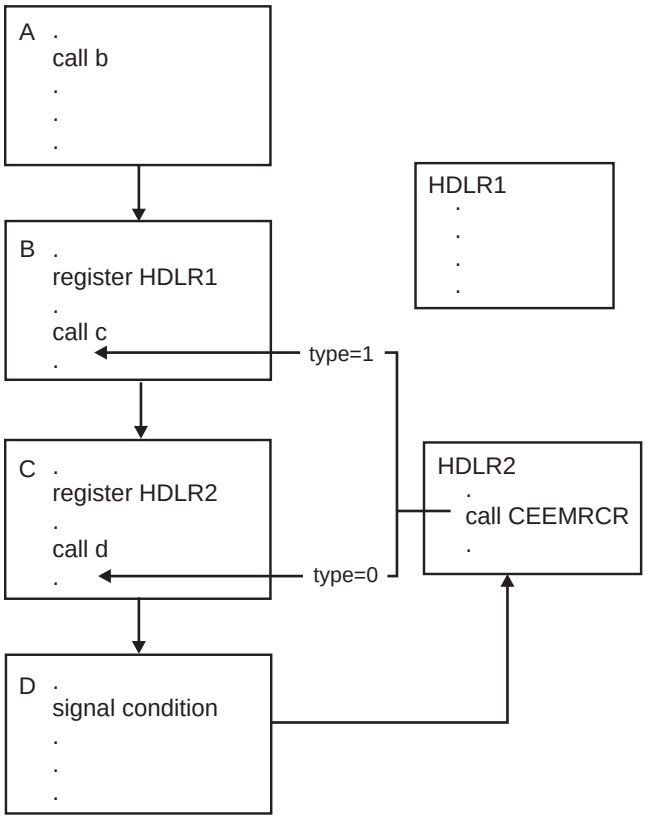

Figure 148. Second Example Moving Resume Cursor Using CEEMRCR

In Figure 149 on page 388, the user condition handlers are established for routines C and D. When a condition is raised in routine D, only a 1 *type_of_move* is permitted. A 0 *type_of_move* results in error warning message CEE0277.

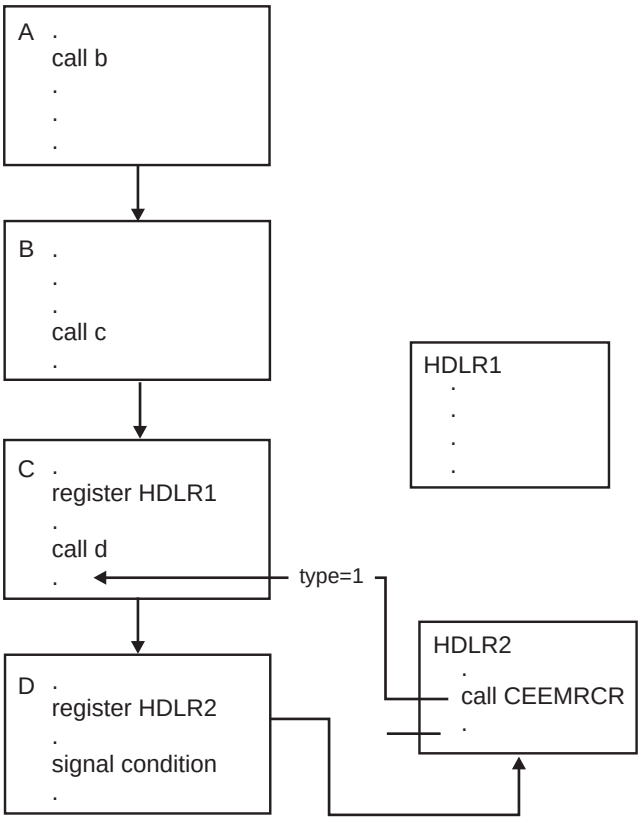

Figure 149. Third Example Moving Resume Cursor Using CEEMRCR

Examples

```
/*Module/File Name: EDCMRCR   */

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

#ifdef __cplusplus
extern "C" {
#endif
void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
}
#endif

void b(void);

int main(void) {
/*  .
    .
    . */
  b();
  /* the CEEMRCR call in the handler will place the */
  /* resume cursor at this point.  */
/*  .
    .
    . */
}

void b(void) {

  _FEEDBACK fc,condtok;
  _ENTRY routine;
  _INT4 token,qdata;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;

  /* register the condition handler */
  token = 99;
  routine.address = (_POINTER)&handler;;
  routine.nesting = NULL;
```

Figure 150. C/C++ Example of CEEMRCR (Part 1 of 2)

```
  CEEHDLR(&routine,&token,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEHDLR failed with message number %d\n",
            fc.tok_msgno);
    exit (2999);
  }
/*  .
    .
    . */
  /* set up the condition using CEENCOD */
  c_1 = 3;
  c_2 = 2523;
  cond_case = 1;
  sev = 3;
  control = 0;
  memcpy(facid,"CEE",3);
  isi = 0;

  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /* signal the condition */
  CEESGL(&condtok,&qdata,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESGL failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
/*  .
    .
    . */
}

void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
             _FEEDBACK *newfc) {

   _FEEDBACK cursorfc, orig_fc;
   _INT4 type;
/*  .
    .
    . */
   /* move the resume cursor to the caller of the  */
   /* routine that registered the condition handler */
   type = 1;
   CEEMRCR(&type,&cursorfc);
   if ( _FBCHECK ( cursorfc , CEE000 ) != 0 ) {
      printf("CEEMRCR failed with message number %d\n",
              cursorfc.tok_msgno);
      exit (2999);
   }
   printf("condition handled\n");
   *result = 10;
   return;
}
```

Figure 150. C/C++ Example of CEEMRCR (Part 2 of 2)

```
CBL LIB,QUOTE
      *Module/File Name: IGZTMRCR
      ************************************************
      **                                            **
      ** CBLMAIN - Main for sample program for      **
      **           CEEMRCR.                         **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLMAIN.
       PROCEDURE DIVISION.
           CALL "DRVMRCR"
           DISPLAY "Resumed execution in the CALLER "
               "of the routine which registered the "
               "handler"
           GOBACK.
       END PROGRAM CBLMAIN.

      ************************************************
      **                                            **
      ** DRVMRCR - Drive sample program CEEMRCR.    **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. DRVMRCR.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  ROUTINE              PROCEDURE-POINTER.
       01  TOKEN                PIC S9(9) BINARY.
       01  SEV                  PIC S9(4) BINARY.
       01  MSGNO                PIC S9(4) BINARY.
       01  CASE                 PIC S9(4) BINARY.
       01  SEV2                 PIC S9(4) BINARY.
       01  CNTRL                PIC S9(4) BINARY.
       01  FACID                PIC X(3).
       01  ISINFO               PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  QDATA                   PIC S9(9) BINARY.
```

Figure 151. COBOL Example of CEEMRCR (Part 1 of 4)

```
 01  CONDTOK.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION.
************************************************
** Register handler                           **
************************************************
     SET ROUTINE TO ENTRY "CBLMRCR".
     CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
     IF  NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLR failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

************************************************
** Signal a condition                         **
************************************************
     MOVE 1 TO QDATA.
     SET CEE001 of CONDTOK to TRUE.
     MOVE ZERO to I-S-Info of CONDTOK.
     CALL "CEESGL" USING CONDTOK, QDATA, FC.
     IF CEE000 of FC  THEN
         DISPLAY "**** Resumed execution in the "
           "routine which registered the handler"
     ELSE
         DISPLAY "CEESGL failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
************************************************
** UNregister handler                         **
************************************************
     CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEEHDLU failed with msg "
             Msg-No of FC UPON CONSOLE
     END-IF.
     STOP RUN.
 END PROGRAM DRVMRCR.
```

Figure 151. COBOL Example of CEEMRCR (Part 2 of 4)

```
************************************************
**                                            **
** CBLMRCR - Invoke CEEMRCR to Move resume    **
**           cursor relative to handle cursor **
**                                            **
************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. CBLMRCR.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  MOVETYP           PIC S9(9) BINARY.
 01  DEST              PIC S9(9) BINARY VALUE 2.
 01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 01  FC2.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
```

Figure 151. COBOL Example of CEEMRCR (Part 3 of 4)

```
LINKAGE SECTION.
01  CURRENT-CONDITION.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
01  TOKEN                   PIC X(4).
01  RESULT-CODE             PIC S9(9) BINARY.
    88  RESUME              VALUE +10.
    88  PERCOLATE           VALUE +20.
    88  PROMOTE             VALUE +30.
01  NEW-CONDITION.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
        03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
        03  Case-2-Condition-ID
                  REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
        03  Case-Sev-Ctl    PIC X.
        03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION USING CURRENT-CONDITION,
                         TOKEN, RESULT-CODE,
                         NEW-CONDITION
************************************************
** Move the resume cursor to the caller of    **
** the routine that registered the condition  **
** handler                                    **
************************************************
    MOVE 1 TO MOVETYP.
    CALL "CEEMRCR" USING MOVETYP , FC.
    IF  NOT CEE000 of FC  THEN
        DISPLAY "CEEMRCR failed with msg "
            Msg-No of FC UPON CONSOLE
        CALL "CEEMSG" USING FC, DEST, FC2
        IF  NOT CEE000 of FC2  THEN
          DISPLAY "CEEMSG failed with msg "
               Msg-No of FC2 UPON CONSOLE
        MOVE FC TO NEW-CONDITION
        SET PROMOTE TO TRUE
        GOBACK
    END-IF.

    SET RESUME TO TRUE.

    GOBACK.

END PROGRAM CBLMRCR.
```

Figure 151. COBOL Example of CEEMRCR (Part 4 of 4)

```
*Process macro;
 /* Module/File Name: IBMMRCR                          */
 /*****************************************************/
 /*                                                   */
 /* Usrhdlr - the user handler routine.               */
 /* Handle DIVIDE-BY-ZERO conditions,                 */
 /*     percolate all others.                         */
 /*                                                   */
 /*****************************************************/
 Usrhdlr:  Proc (@condtok, @token, @result, @newcond)
           options(byvalue);

   %include ceeibmct;
   %include ceeibmaw;

   /* Parameters */
   dcl  @condtok    pointer;
   dcl  @token      pointer;
   dcl  @result     pointer;
   dcl  @newcond    pointer;
   dcl 1 condtok based(@condtok) feedback;
   dcl token  fixed bin(31) based(@token);
   dcl result fixed bin(31) based(@result);
   dcl 1 newcond based(@newcond) feedback;
   dcl 1 fback feedback;
   dcl move_type fixed bin(31);
   dcl resume     fixed bin(31) static initial(10);
   dcl percolate  fixed bin(31) static initial(20);
   dcl promote    fixed bin(31) static initial(30);
   dcl promote_sf fixed bin(31) static initial(31);
   display ('>>> USRHDLR: Entered user handler');
   display ('>>> USRHDLR: passed token value is ' ||
            token);

   /* Check if this is the divide-by-zero token */
   if fbcheck (condtok, cee349) then
     do;
       move_type = 0;
       call ceemrcr (move_type, fback);
       If fbcheck (fback, cee000) then
         do;
           result = resume;
           display ('>>> USRHDLR: Resuming execution');
         end;
       else
         do;
           display
           ('CEEMRCR failed with message number ' ||
             fback.MsgNo);
           stop;
         end;
     end;
   else     /* something besides div-zero token */
     do;
       result = percolate;
       display ('>>> USRHDLR: Percolating it');
     end;
 end Usrhdlr;
```

Figure 152. EXCOND Program (PL/I) to Handle Divide-by-Zero Condition

CEEMSG—Get, format, and dispatch a message

CEEMSG gets, formats, and dispatches a message corresponding to an input condition token received from a callable service or passed to a user-written condition handler. You can use this service to print a message after a call to any Language Environment service that returns a condition token.

Syntax

```
►►──CEEMSG──(──cond_token──,──destination_code──,──fc──)──────────────────►◄
```

cond_token (input)
A 12-byte condition token received as the result of a Language Environment callable service.

destination_code (input)
A 4-byte binary integer. *destination_code* can be specified only as 2, meaning write the message to the *ddname* of the file specified in the MSGFILE run-time option.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0E2	3	0450	The message inserts for the condition token with message number *message-number* and facility ID *facility-id* could not be located.
CEE0E3	3	0451	An invalid destination code *destination-code* was passed to routine *routine-name*.
CEE0E6	3	0454	The message number *message-number* could not be found for facility ID *facility-id*.
CEE0E9	3	0457	The message file destination *ddname* could not be located.
CEE0EA	3	0458	The message repository *repository-name* could not be located.
CEE3CT	3	3485	An internal message services error occurred while locating the message number within a message file.
CEE3CU	3	3486	An internal message services error occurred while formatting a message.
CEE3CV	3	3487	An internal message services error occurred while locating a message number within the ranges specified in the repository.

Usage notes

- z/OS UNIX considerations—In multithread applications, CEEMSG affects only the calling thread. When multiple threads write to the message file, the output is interwoven by line. To group lines of output, serialize MSGFILE access (by using a mutex, for example).

For more information

- See “CEENCOD—Construct a condition token” on page 401 for more information about the CEENCOD callable service.

- See “MSGFILE” on page 43 for more information about the MSGFILE run-time option.

Examples

```
/*Module/File Name: EDCMSG    */

#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _VSTRING message;
  _INT4 dest,msgindx;
  _CHAR80 msgarea;
  _FEEDBACK fc,token;

  strcpy(message.string,"This is a test message");
  message.length = strlen(message.string);
  dest = 5; /* invalid dest so CEEMOUT will fail */

  CEEMOUT(&message,&dest,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     /* put the message if CEEMOUT failed */
     dest = 2;
     CEEMSG(&fc,&dest,NULL);
     exit(2999);
  }
}
```

Figure 153. C/C++ Example of CEEMSG

```
CBL LIB,QUOTE
      *Module/File Name: IGZTMSG
      ************************************************
      **                                            **
      ** CBLMSG - Call CEEMSG to get, format and    **
      **                    dispatch a message      **
      **                                            **
      ** In this example, CEE3MDS is called with an  **
      ** invalid country code so that a condition    **
      ** token would be returned to use as input to  **
      ** Any Lang Env service could have been called.**
      ** CEEMSG uses the condition token to get,     **
      ** format and dispatch the message associated  **
      ** with the condition that occurred in CEE3MDS.**
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLMSG.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  COUNTRY                PIC X(2).
       01  DECSEP                 PIC X(2).
       01  MSGDEST                PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  FC2.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBL3MDS.
```

Figure 154. COBOL Example of CEEMSG (Part 1 of 2)

```
**************************************************
** Call a Lang Env svc, CEE3MDS in this case,  **
** to receive a condition token that CEEMSG    **
** can format as a message.  Specify an        **
** invalid value for country code so that a    **
** condition will be built                     **
**************************************************
     MOVE "LN" TO COUNTRY.
     CALL "CEE3MDS" USING COUNTRY, DECSEP, FC.
 PARA-CBLMSG.
**************************************************
** Specify 2 for destination, so message will  **
** be written to the ddname specified or       **
** defaulted in the MSGFILE run-time option.   **
**************************************************
     MOVE 2 TO MSGDEST.
**************************************************
** Call CEEMSG using the FC returned from      **
**     CEE3MDS as the input condition token.   **
**************************************************
     CALL "CEEMSG" USING FC, MSGDEST, FC2.
     IF NOT CEE000 of FC2 THEN
         DISPLAY "CEEMSG  failed with msg "
             Msg-No of FC2 UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 154. COBOL Example of CEEMSG (Part 2 of 2)

```
*PROCESS LANGLVL(SAA), MACRO;
 /* Module/File Name: IBMMSG                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEEMSG  - get, format and dispatch   **/
 /**                     a message                  **/
 /**                                                **/
 /** In this example, CEE3MDS is called with an     **/
 /** invalid country code so that a condition token **/
 /** would be returned to use as input to CEEMSG.   **/
 /** Any LE/370 could have been called. CEEMSG uses **/
 /** the condition to get, format and dispatch the  **/
 /** message associated with the condition that     **/
 /** occurred in CEE3MDS                            **/
 /**                                                **/
 /****************************************************/
 PLIMSG: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL COUNTRY  CHARACTER ( 2 );
    DCL DECSEP   CHARACTER ( 2 );
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 155. PL/I Example of CEEMSG (Part 1 of 2)

```
   DCL MSGDEST  REAL FIXED BINARY(31,0);
   DCL 01 FC2,                    /* Feedback token */
          03 MsgSev    REAL FIXED BINARY(15,0),
          03 MsgNo     REAL FIXED BINARY(15,0),
          03 Flags,
             05 Case      BIT(2),
             05 Severity  BIT(3),
             05 Control   BIT(3),
          03 FacID     CHAR(3),      /* Facility ID */
          03 ISI   /* Instance-Specific Information */
                       REAL FIXED BINARY(31,0);

   COUNTRY = 'LN';  /* Specify an invalid country   */
                    /* code to receive a non-zero   */
                    /* feedback code                */

   /* Call any service (CEE3MDS in this case) to    */
   /* receive a condition token that CEEMSG will    */
   /* format and dispatch a message                 */
   CALL CEE3MDS ( COUNTRY, DECSEP, FC );

   MSGDEST = 2; /* Specify 2 as destination, so     */
                /* message will go to ddname speci- */
                /* fied in MSGFILE run-time option  */

   CALL CEEMSG ( FC, MSGDEST, FC2 );
   IF  ¬ FBCHECK( FC2, CEE000)  THEN  DO;
      DISPLAY( 'CEEMSG  failed with msg '
         || FC.MsgNo );
      STOP;
      END;

END PLIMSG;
```

Figure 155. PL/I Example of CEEMSG (Part 2 of 2)

CEENCOD—Construct a condition token

CEENCOD dynamically constructs a 12-byte condition token that communicates a condition in Language Environment.

The condition token communicates with the Language Environment message and condition handling callable services, and user routines. Also, all Language Environment callable services use the condition-token data type to return information to the user as a feedback code.

Syntax

```
►►──CEENCOD──(──c_1──,──c_2──,──case──,──severity──,──control──,──────────────►
►──facility_ID──,──i_s_info──,──cond_token──,──────────────────────────────►
►──fc──)──────────────────────────────────────────────────────────────────►◄
```

c_1 (input)
c_1 and *c_2* together make up the condition_ID portion of the condition token. *c_1* is a 2-byte binary integer representing the value of the first 2 bytes of the 4-byte condition_ID.

For case 1, *c_1* represents the severity; for case 2, it is the class_code.

c_2 (input)
A 2-byte binary integer representing the value of the second 2 bytes of the condition_ID.

For case 1, this is the Msg_No; for case 2, it is the cause_code.

case (input)
A 2-byte binary integer defining the format of the condition_ID portion of the token.

severity (input)
A 2-byte binary integer indicating the condition's severity. For case 1 conditions, the value of this field is the same as the severity value specified in the condition_ID.

For case 1 and 2 conditions, this field is also used to test the condition's severity. *severity* can be specified with the following values:

0 Information only (or, if the entire token is 0, no information).

1 Warning—service completed, probably correctly.

2 Error detected—correction attempted; service completed, perhaps incorrectly.

3 Severe error—service not completed.

4 Critical error—service not completed; condition signaled. A critical error is a condition jeopardizing the environment. If a critical error occurs during a Language Environment callable service, it is always signaled to the condition manager instead of returning synchronously to the caller.

control (input)
A 2-byte binary integer containing flags describing or controlling various aspects of condition handling. Valid values for the control field are 1 and 0. 1 indicates the *facility_ID* is assigned by IBM. 0 indicates the *facility_ID* is assigned by the user.

facility_ID (input)
A 3-character field containing three alphanumeric characters (A-Z, a-z and 0-9) identifying the product or component of a product generating this condition or feedback information, for example, CEE.

The *facility_ID* is associated with the repository (for example, a file) of the run-time messages. If a unique ID is required (for IBM and non-IBM products), an ID can be obtained by contacting an IBM project office.

If you create a new *facility_ID* to use with a message file you created by using the CEEBLDTX utility, be aware that the *facility_ID* must be part of the message file name. It is therefore important to follow the naming guidelines described below in order to have a module name that does not cause your application to abend.

Begin a non-IBM assigned product *facility_ID* with letters J through Z. (See the *control* (input) parameter, above, on how to indicate whether the *facility_ID* has been assigned by IBM.) Special characters, including blank spaces, cannot be used in a *facility_ID*. There are no other constraints (besides the alphanumeric requirement) on a non-IBM assigned *facility_ID*.

i_s_info (input)
A fullword binary integer identifying the ISI, that contains insert data.

Whenever a condition is detected by the Language Environment condition manager, insert data is generated describing the particular instance of its occurrence is generated. This insert data is used, for example, to write to a file a message associated with that particular instance or occurrence of the condition.

cond_token (output)
The 12-byte representation of the constructed condition token.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE0CH	3	0401	An invalid case code *case-code* was passed to routine *routine-name*.
CEE0CI	3	0402	An invalid control code *control-code* was passed to routine *routine-name*.
CEE0CJ	3	0403	An invalid severity code *severity-code* was passed to routine *routine-name*.
CEE0CK	1	0404	Facility ID *facility-id* with non-alphanumeric characters was passed to routine *routine-name*.
CEE0E4	3	0452	An invalid facility ID *facility-id* was passed to routine *routine-name*.

Usage notes

- C/C++ considerations—The structure of the condition token (type_FEEDBACK) is described in the `leawi.h` header file shipped with Language Environment. You can assign values directly to the fields of the token in the header file without using the CEENCOD service.

  The layout of the type_FEEDBACK condition token in the header file is:

```
typedef struct {
   short     tok_sev     ; /* severity            */
   short     tok_msgno   ; /* message number      */
   int       tok_case :2,  /* flags-case/sev/cont */
             tok_sever:3,
             tok_ctrl :3 ;
   char      tok_facid[3]; /* fac ID    */
   int       tok_isi     ; /* index in ISI block  */
        }                 _FEEDBACK;
```

Figure 156. type_FEEDBACK Data Type as Defined in the leawi.h Header File

- z/OS UNIX consideration—In multithread applications, CEENCOD affects only the calling thread.

For more information

- For more information about case 1 and case 2, see CEENCOD “Usage notes”.

Examples

```
/*Module/File Name: EDCNCOD   */

/*********************************************************/
/* Note that it is not necessary to use this service.    */
/* The fields may be manipulated directly.               */
/*********************************************************/

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc,condtok;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;

  c_1 = 1;
  c_2 = 99;
  cond_case = 1;
  sev = 1;
  control = 0;
  memcpy(facid,"ZZZ",3);
  isi = 0;

  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
 /* .
    .
    . */
}
```

Figure 157. C/C++ Example of CEENCOD

```
CBL LIB,QUOTE
      *Module/File Name: IGZTNCOD
      ************************************************
      **                                            **
      ** CBLNCOD - Call CEENCOD to construct a      **
      ** condition token                            **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLNCOD.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  SEV                    PIC S9(4) BINARY.
       01  MSGNO                  PIC S9(4) BINARY.
       01  CASE                   PIC S9(4) BINARY.
       01  SEV2                   PIC S9(4) BINARY.
       01  CNTRL                  PIC S9(4) BINARY.
       01  FACID                  PIC X(3).
       01  ISINFO                 PIC S9(9) BINARY.
       01  NEWTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLNCOD.
```

Figure 158. COBOL Example of CEENCOD (Part 1 of 2)

```
************************************************
** Set severity portion of Condition-ID to 0,  **
**     or information only.                    **
** Set msg number portion of Condition-ID to 1.**
** Set case to 1. This is a service condition. **
** Set severity to 0, for information only.    **
** Set control to 1, for Facility-ID has been  **
**     assigned by IBM.                        **
** Set Facility-ID to CEE for a Language       **
**     Environment condition token.            **
** Set I-S-Info to 0, indicating that no       **
**     Instance Specific Information (ISI) is  **
**     to be supplied.                         **
************************************************
     MOVE 0 TO SEV.
     MOVE 1 TO MSGNO.
     MOVE 1 TO CASE.
     MOVE 0 TO SEV2.
     MOVE 1 TO CNTRL.
     MOVE "CEE" TO FACID.
     MOVE 0 TO ISINFO.

************************************************
** Call CEENCOD with the values assigned above **
** to build a condition token "NEWTOK"         **
************************************************
     CALL "CEENCOD" USING SEV, MSGNO, CASE, SEV2,
                          CNTRL, FACID, ISINFO,
                          NEWTOK, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEENCOD failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 158. COBOL Example of CEENCOD (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMNCOD                          */
 /****************************************************/
 /**                                                  */
 /** Function: CEENCOD - construct a condition token */
 /**                                                  */
 /****************************************************/
 PLINCOD: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL SEV        REAL FIXED BINARY(15,0);
    DCL MSGNO      REAL FIXED BINARY(15,0);
    DCL CASE       REAL FIXED BINARY(15,0);
    DCL SEV2       REAL FIXED BINARY(15,0);
    DCL CNTRL      REAL FIXED BINARY(15,0);
    DCL FACID      CHARACTER ( 3 );
    DCL ISINFO     REAL FIXED BINARY(31,0);
    DCL 01 NEWTOK,                 /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
```

Figure 159. PL/I Example of CEENCOD (Part 1 of 2)

```
   SEV = 0;       /* Set severity portion of        */
                  /* Condition_ID to 0, or          */
                  /* information only.              */
   MSGNO = 1;     /* Set msg number portion of      */
                  /* Condition_ID to 1.             */
   CASE = 1;      /* Set case to 1. This is a       */
                  /* service condition.             */
   SEV2 = 0;      /* Set severity to 0, or          */
                  /* information only.              */
   CNTRL = 0;     /* Set control to 0, or Facility  */
                  /* ID has been assigned by user   */
   FACID = 'USR'; /* Set Facility_ID to USR for a   */
                  /* user condition token.          */
   ISINFO = 0;    /* Set I_S_Info to 0, indicating  */
                  /* that no Instance Specific      */
                  /* Information is to be supplied. */
   EENCOD ( SEV, MSGNO, CASE, SEV2,
   CALL CEENCOD ( SEV, MSGNO, CASE, SEV2,
      CNTRL, FACID, ISINFO, NEWTOK, FC );
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'CEENCOD created token for msg '
         || NEWTOK.MsgNo || ' and facility '
         || NEWTOK.FacID );
      END;
   ELSE  DO;
      DISPLAY( 'CEENCOD failed with msg '
         || FC.MsgNo );
      STOP;
      END;
END PLINCOD;
```

Figure 159. PL/I Example of CEENCOD (Part 2 of 2)

CEEQCEN—Query the century window

CEEQCEN queries the century in which Language Environment contains the 2-digit year value. When you want to change the setting, use CEEQCEN to get the setting and then use CEESCEN to save and restore the current setting.

Syntax

```
►►──CEEQCEN──(──century_start──,──fc──)──────────────────────────────►◄
```

century_start (output)
An integer between 0 and 100 indicating the year on which the century window is based.

For example, if the Language Environment default is in effect, all 2-digit years lie within the 100-year window starting 80 years prior to the system date. CEEQCEN then returns the value 80. An 80 value indicates to Language Environment that, in 1995, all 2-digit years lie within the 100-year window starting 80 years before the system date (between 1915 and 2014, inclusive).

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

Usage notes

- z/OS UNIX considerations—CEEQCEN applies to the enclave, as does the century window.

For more information

- See “CEESCEN—Set the century window” on page 422 for more information about the CEESCEN callable service.

Examples

```
/*Module/File Name: EDCQCEN   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {

  _INT4 century_start;
  _FEEDBACK fc;

  /* query the century window */
  CEEQCEN(&century_start,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEEQCEN failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /* if the century window is not 50 set it to 50 */
  if (century_start != 50) {
     century_start = 50;

     CEESCEN(&century_start,&fc);
     if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEESCEN failed with message number %d\n",
               fc.tok_msgno);
        exit(2999);
     }
  }
}
```

Figure 160. C/C++ Example of CEEQCEN

```
CBL LIB,QUOTE
      *Module/File Name: IGZTQCEN
      ************************************************
      ** CBLQCEN - Call CEEQCEN to query the Lang Env**
      **           century window                   **
      ** In this example, CEEQCEN is called to query **
      ** the date at which the century window starts **
      ** The century window is the 100-year window   **
      ** within which Lang Envir                   **
      ** assumes all two-digit years lie.            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLQCEN.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  STARTCW                PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLQCEN.
      ************************************************
      ** Call CEEQCEN to return the start of the     **
      **     century window                         **
      ************************************************
           CALL "CEEQCEN" USING STARTCW, FC.
      ************************************************
      ** CEEQCEN has no non-zero feedback codes to   **
      **     check, so just display result.          **
      ************************************************
           IF CEE000 of FC  THEN
               DISPLAY "The start of the century "
                   "window is: " STARTCW
           ELSE
               DISPLAY "CEEQCEN failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.

           GOBACK.
```

Figure 161. COBOL Example of CEEQCEN

```
*PROCESS MACRO;
 /* Module/File Name: IBMQCEN                          */
 /*****************************************************/
 /**                                                 **/
 /** Function: CEEQCEN - query the century window    **/
 /**                                                 **/
 /** In this example, CEEQCEN is called to query     **/
 /** The date at which the century window starts.    **/
 /** The century window is the 100-year window       **/
 /** within which Language Environment assumes       **/
 /** all two-digit years lie.                        **/
 /**                                                 **/
 /*****************************************************/
 PLIQCEN: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL STARTCW REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Call CEEQCEN to return the start of the       */
    /*    century window                             */
    CALL CEEQCEN ( STARTCW, FC );

    /* CEEQCEN has no non-zero feedback codes        */
    /* to check, so print result                     */
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST ( 'The century window starts '
          || STARTCW || ' years before today.');
       END;
    ELSE  DO;
       DISPLAY( 'CEEQCEN failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIQCEN;
```

Figure 162. PL/I Example of CEEQCEN

CEEQDTC—Query locale date and time conventions

CEEQDTC, analogous to the C language function `localdtconv()`, queries the date and time conventions from the current locale and sets the components of a structure with values appropriate to the settings for the LC_TIME category.

CEEQDTC is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEEQDTC──(──omitted_parm──,──localdt──,──fc──)──────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parm, see “Invoking callable services” on page 107.

localdt (output)
A pointer to the data structure containing the date and time formatting information from the current, active locale. The fields used to populate the structure come from the LC_TIME category.

The LC_TIME category structure fields used to retrieve the date and time values are:

Keyword	Meaning
abmon	Abbreviated month names (12 instances of a halfword length-prefixed character string, VSTRING, of 22 bytes)
mon	Month names (12 instances of a halfword length-prefixed character string, VSTRING, of 62 bytes)
abday	Abbreviated day names (7 instances of a halfword length-prefixed character string, VSTRING, of 22 bytes)
day	Day names (7 instances of a halfword length-prefixed character string, VSTRING, of 62 bytes)
d_t_fmt	Date and time format (1 instance of a halfword length-prefixed character string, VSTRING, of 82 bytes)
d_fmt	Date format (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)
t_fmt	Time format (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)
am_fmt	AM string (1 instance of a halfword length-prefixed character string, VSTRING, of 22 bytes)
pm_fmt	PM string (1 instance of a halfword length-prefixed character string, VSTRING, of 22 bytes)
t_fmt_ampm	Time format ampm (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.

Usage notes

- PL/I MTF consideration—CEEQDTC is not supported in PL/I MTF applications.
- If no call to CEESETL has been made, the default locale values to be used are determined at installation time for Language Environment.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- See “CEESETL—Set locale operating environment” on page 444 for more information about the current locale.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTQDTC
**************************************************
*  Example for callable service CEEQDTC          *
*  MAINQDTC - Retrieve date and time convention  *
*             structures for two countries and   *
*             compare an item.                   *
*  Valid only for COBOL for MVS & VM Release 2   *
*  or later.                                     *
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  MAINQDTC.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
* Use DTCONV structure for CEEQDTC calls
 COPY CEEIGZDT.
*
 PROCEDURE DIVISION.
*  Subroutine needed for addressing
     CALL "COBQDTC" USING DTCONV.

     STOP RUN.
*
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBQDTC.

 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  Locale-Name.
     02  LN-Length  PIC S9(4) BINARY.
     02  LN-String  PIC X(256).
* Use Locale category constants
 COPY CEEIGZLC.
*
 01  Test-Length1 PIC S9(4) BINARY.
 01  Test-String1 PIC X(80).
 01  Test-Length2 PIC S9(4) BINARY.
 01  Test-String2 PIC X(80).
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity  PIC S9(4) BINARY.
             04  Msg-No    PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl  PIC X.
         03  Facility-ID   PIC XXX.
     02  I-S-Info  PIC S9(9) BINARY.
*
 LINKAGE SECTION.
* Use Locale structure DTCONV for CEEQDTC calls
 COPY CEEIGZDT.
*
 PROCEDURE DIVISION USING DTCONV.
*  Set up locale for France
     MOVE 4 TO LN-Length.
     MOVE "FFEY" TO LN-String (1:LN-Length).
```

Figure 163. COBOL Example of CEEQDTC (Part 1 of 2)

```
*  Call CEESETL to set all locale categories
     CALL "CEESETL" USING Locale-Name, LC-ALL,
                          FC.

*  Check feedback code
     IF Severity > 0
        DISPLAY "Call to CEESETL failed. " Msg-No
        EXIT PROGRAM
     END-IF.

*  Call CEEQDTC for French values
     CALL "CEEQDTC" USING OMITTED,
                          ADDRESS OF DTCONV, FC.

*  Check feedback code
     IF Severity > 0
        DISPLAY "Call to CEEQDTC failed. " Msg-No
        EXIT PROGRAM
     END-IF.

*  Save date and time format for FFEY locale
     MOVE D-T-FMT-Length IN DTCONV TO Test-Length1
     MOVE D-T-FMT-String IN DTCONV TO Test-String1

*  Set up locale for French Canadian
     MOVE 4 TO LN-Length.
     MOVE "FCEY" TO LN-String (1:LN-Length).

*  Call CEESETL to set locale for all categories
     CALL "CEESETL" USING Locale-Name, LC-ALL,
                          FC.

*  Check feedback code
     IF Severity > 0
        DISPLAY "Call to CEESETL failed. " Msg-No
        EXIT PROGRAM
     END-IF.

*  Call CEEQDTC again for French Canadian values
     CALL "CEEQDTC" USING OMITTED,
                          ADDRESS OF DTCONV, FC.

*  Check feedback code and display results
     IF Severity = 0
*  Save date and time format for FCEY locale
        MOVE D-T-FMT-Length IN DTCONV
                             TO Test-Length2
        MOVE D-T-FMT-String IN DTCONV
                             TO Test-String2
        IF Test-String1(1:Test-Length1) =
           Test-String2(1:Test-Length2)
           DISPLAY "Same date and time format."
        ELSE
           DISPLAY "Different formats."
           DISPLAY  Test-String1(1:Test-Length1)
           DISPLAY  Test-String2(1:Test-Length2)
        END-IF
     ELSE
        DISPLAY "Call to CEEQDTC failed. " Msg-No
     END-IF.

     EXIT PROGRAM.
 END PROGRAM COBQDTC.
*
 END PROGRAM MAINQDTC.
```

Figure 163. COBOL Example of CEEQDTC (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMQDTC                          */
 /****************************************************/
 /* Example for callable service CEEQDTC             */
 /* Function: Retrieve date and time convention      */
 /*  structures for two countries, compare an item.  */
 /****************************************************/

 PLIQDTC: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */
 %INCLUDE CEEIBMDT; /* DTCONV for CEEQDTC calls      */

 /* use explicit pointer to local DTCONV structure */
 DCL LOCALDT POINTER INIT(ADDR(DTCONV));

 /* CEESETL service call arguments */
 DCL LOCALE_NAME CHAR(256) VARYING;

 DCL 1 DTCONVC LIKE DTCONV; /* Def Second Structure  */

 DCL 1 FC,                        /* Feedback token */
        3 MsgSev    REAL FIXED BINARY(15,0),
        3 MsgNo     REAL FIXED BINARY(15,0),
        3 Flags,
           5 Case      BIT(2),
           5 Severity  BIT(3),
           5 Control   BIT(3),
        3 FacID     CHAR(3),       /* Facility ID */
        3 ISI       /* Instance-Specific Information */
                     REAL FIXED BINARY(31,0);
```

Figure 164. PL/I Example of CEEQDTC (Part 1 of 2)

```
   /* set locale with IBM default for France         */
   LOCALE_NAME = 'FFEY';   /* or Fr_FR.IBM-1047      */

   /* use LC_ALL category constant from CEEIBMLC */
   CALL CEESETL ( LOCALE_NAME, LC_ALL,  FC );

   /* retrieve date and time structure, France Locale*/
   CALL CEEQDTC ( *, LOCALDT, FC );

   /* set locale with French Canadian(FCEY) defaults */
   /* literal constant -1 used to set all categories */
   CALL CEESETL ( 'FCEY', -1,  FC );

   /* retrieve date and time tables for French Canada*/
   /* example of temp pointer used for service call  */
   CALL CEEQDTC ( *, ADDR(DTCONVC), FC );

   /* compare date and time formats for two countries*/
   IF DTCONVC.D_T_FMT = DTCONV.D_T_FMT THEN
     DO;
       PUT SKIP LIST('Countries have same D_T_FMT' );
     END;
   ELSE
     DO;
       PUT SKIP LIST('Date and Time Format ',
                     DTCONVC.D_T_FMT||' vs '||
                     DTCONV.D_T_FMT );
     END;

 END PLIQDTC;
```

Figure 164. PL/I Example of CEEQDTC (Part 2 of 2)

CEEQRYL—Query active locale environment

CEEQRYL, analogous to the C language function `localename=setlocale(`*`category`*`, NULL)`, queries the environment for which locale defines the current setting for the locale category.

CEEQRYL is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEEQRYL──(──category──,──localename──,──fc──)──────────────────────────►◄
```

category (input)

A symbolic integer number that represents all or part of the locale for a program. Depending on the value of the *localename*, these categories can be initiated by the values of global categories of corresponding names. The following values for the *category* parameter are valid:

LC_ALL

A 4-byte integer (with a value of -1) that affects all locale categories associated with a program's locale.

LC_COLLATE
A 4-byte integer (with a value of 0) that affects the behavior of regular expression and collation subroutines.

LC_CTYPE
A 4-byte integer (with a value of 1) that affects the behavior of regular expression, character classification, case conversion, and wide character subroutines.

LC_MESSAGES
A 4-byte integer (with a value of 6) that affects the format and values for positive and negative responses.

LC_MONETARY
A 4-byte integer (with a value of 3) that affects the behavior of subroutines that format monetary values.

LC_NUMERIC
A 4-byte integer (with a value of 2) that affects the behavior of subroutines that format non-monetary numeric values.

LC_TIME
A 4-byte integer (with a value of 4) that affects the behavior of time conversion subroutines.

Language Environment locale callable services do not support the LC_TOD and LC_SYNTAX categories.

localename (output)
Returns the name of the locale that describes the current setting of the category requested.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2KD	3	2701	An invalid category parameter was passed to a locale function.
CEE3T1	3	4001	General Failure: Service could not be completed.

Usage notes

- PL/I MTF consideration—CEEQRYL is not supported in PL/I MTF applications.
- CEEQRYL does not change the status of the active locales.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.
- If the active locale is not explicitly set with CEESETL or `setlocale(`*`category`*`,` *`localename`*`)`, then the locale chosen is as follows:
  - With POSIX(OFF), the `SAA C` locale is chosen, and querying the locale with CEEQRYL returns “C” as the locale name.
  - With POSIX(ON), the `POSIX C` locale is chosen, and querying the locale with CEEQRYL returns “POSIX” as the locale name.

The `SAA C` locale provides compatibility with previous releases of C/370. The `POSIX C` locale provides consistency with POSIX requirements and supports the z/OS UNIX System Services environment.

For more information

- See “CEESETL—Set locale operating environment” on page 444 for more information about the current locale.
- For more information about LC_TIME, see “CEEQDTC—Query locale date and time conventions” on page 411.
- For information on the definition of the `SAA C` and `POSIX C` locales and the differences between them, see *z/OS C/C++ Programming Guide*.

Examples

For examples of how to use CEEQRYL in combination with other Language Environment locale callable services, see “CEESETL—Set locale operating environment” on page 444.

CEERAN0—Calculate uniform random numbers

CEERAN0 generates a sequence of uniform pseudo-random numbers between 0.0 and 1.0 using the multiplicative congruential method with a user-specified seed.

The uniform (0,1) pseudo-random numbers are generated using the multiplicative congruential method:

```
seed(i) = (950706376 * seed(i-1)) mod 2147483647;

randomno(i) = seed(i) / 2147483647;
```

Syntax

```
►►──CEERAN0──(──seed──,──random_no──,──fc──)──────────────────────────►◄
```

seed (input/output)
A fullword binary signed integer representing an initial value used to generate random numbers.

seed must be a variable; it cannot be an input-only parameter. The valid range is 0 to +2,147,483,646.

If *seed* equals 0, the seed is generated from the current Greenwich Mean Time.

On return to the calling routine, CEERAN0 changes the value of *seed* so that it can be used as the new seed in the next call.

random_no(output)
An 8-byte double precision floating-point number with a value between 0 and 1, exclusive.

If *seed* is invalid, *random_no* is set to −1 and CEERAN0 terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2ER	1	2523	The system time was not available when CEERAN0 was called. A seed value of 1 was used to generate a random number and a new seed value.
CEE2ES	3	2524	An invalid seed value was passed to CEERAN0. The random number was set to -1.

Usage notes

- z/OS UNIX considerations—In multithread applications, CEERAN0 affects only the calling thread. The seed is unique to the thread.

Examples

```
/*Module/File Name: EDCRAN0   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {

   _INT4 seed;
   _FLOAT8 random;
   _FEEDBACK fc;
   int number;

   seed = 0;
   CEERAN0(&seed,&random,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEERAN0 failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }
   number = random * 1000;
   printf("The 3 digit random number is %d\n",number);
}
```

Figure 165. C/C++ Example of CEERAN0

```
CBL LIB,QUOTE
      *Module/File Name: IGZTRAN0
      ************************************************
      ** CBLRAN0 - Call CEERAN0 to generate uniform **
      **                     random numbers         **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLRAN0.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  SEED                    PIC S9(9) BINARY.
       01  RANDNUM                 COMP-2.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.

       PROCEDURE DIVISION.

       PARA-CBLRAN0.
      ************************************************
      ** Specify 0 for SEED, so the seed will be
      ** derived from the current Greenwich Mean Time
      ************************************************
           MOVE 0 TO SEED.
      ************************************************
      ** Call CEERAN0 to return random number between
      **     0.0 and 1.0
      ************************************************
           CALL "CEERAN0" USING SEED , RANDNUM , FC.
      ************************************************
      ** If CEERAN0 runs successfully, display result.
      ************************************************
           IF CEE000 of FC  THEN
               DISPLAY "The random number is: " RANDNUM
           ELSE
               DISPLAY "CEERAN0 failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
           GOBACK.
```

Figure 166. COBOL Example of CEERAN0

```
*PROCESS MACRO;
 /* Module/File Name: IBMRAN0                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEERAN0 - calculate uniform random   **/
 /** numbers                                        **/
 /**                                                **/
 /****************************************************/
 PLIRAN0: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL SEED     REAL FIXED BINARY(31,0);
    DCL RANDNUM  REAL FLOAT DECIMAL(16);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    SEED = 7; /* Specify an integer as the initial   */
              /* value used to calculate the random  */
              /* numbers                             */


   /* Call CEERAN0 to generate random number between */
   /*    0.0 and 1.0                                 */
    CALL CEERAN0 ( SEED, RANDNUM, FC );

    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST ( 'The random number is '
          || RANDNUM );
       END;
    ELSE  DO;
       DISPLAY( 'CEERAN0 failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLIRAN0;
```

Figure 167. PL/I Example of CEERAN0

CEESCEN—Set the century window

CEESCEN sets the century in which Language Environment contains the 2-digit year value. Use it in conjunction with CEEDAYS or CEESECS when:

- You process date values containing 2-digit years (for example, in the YYMMDD format).
- The Language Environment default century interval does not meet the requirements of a particular application.

Century intervals are kept as thread-level data, so changing the interval in one thread does not affect the interval in another thread. To query the century window, use CEEQCEN.

CEEQCEN affects and is affected by only the Language Environment NLS and date and time services, not the Language Environment locale callable services or the C locale-sensitive functions.

Syntax

```
►►──CEERAN0──(──century_start──,──fc──)──────────────────────────────►◄
```

century_start
An integer between 0 and 100, setting the century window.

A value of 80, for example, places all two-digit years within the 100-year window starting 80 years before the system date. In 1995, therefore, all two-digit years are assumed to represent dates between 1915 and 2014, inclusive.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2E6	3	2502	The UTC/GMT was not available from the system.

Usage notes

- z/OS UNIX considerations—CEESCEN applies to the enclave. The century window applies to the enclave.

For more information

- See “CEEDAYS—Convert date to Lilian format” on page 243 for more information about the CEEDAYS callable service.
- See “CEESECS—Convert timestamp to seconds” on page 436 for more information about the CEESECS callable service.
- See “CEEQCEN—Query the century window” on page 408 for more information about the CEEQCEN callable service.

Examples

```
/*Module/File Name: EDCSCEN   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {

  _INT4 century_start;
  _FEEDBACK fc;

  century_start = 50;

  CEESCEN(&century_start,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESCEN failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
}
```

Figure 168. C/C++ Example of CEESCEN

```
CBL LIB,QUOTE
      *Module/File Name: IGZTSCEN
      ************************************************
      **                                            **
      ** CBLSCEN - Call CEESCEN to set the Lang. Env. **
      **           century window                   **
      **                                            **
      ** In this example, CEESCEN is called to change **
      ** the start of the century window to 30 years  **
      ** before the system date. CEEQCEN is then      **
      ** called to query that the change made.  A     **
      ** message that this has been done is then      **
      ** displayed.                                   **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLSCEN.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  STARTCW                PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLSCEN.
      ************************************************
      ** Specify 30 as century start, and two-digit
      **     years will be assumed to lie in the
      **     100-year window starting 30 years before
      **     the system date.
      ************************************************
           MOVE 30 TO STARTCW.

      ************************************************
      ** Call CEESCEN to change the start of the century
      **     window.
      ************************************************
```

Figure 169. COBOL Example of CEESCEN (Part 1 of 2)

```
     CALL "CEESCEN" USING STARTCW, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESCEN failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
PARA-CBLQCEN.
**************************************************
** Call CEEQCEN to return the start of the century
**     window
**************************************************
     CALL "CEEQCEN" USING STARTCW, FC.

**************************************************
** CEEQCEN has no non-zero feedback codes to
**     check, so just display result.
**************************************************
         DISPLAY "The start of the century "
             "window is: " STARTCW
     GOBACK.
```

Figure 169. COBOL Example of CEESCEN (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMSCEN                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEESCEN - set the century window     **/
 /**                                                **/
 /****************************************************/
 PLISCEN: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL STARTCW  REAL FIXED BINARY(31,0);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    STARTCW = 20; /* Set 20 as century start */

   /* Call CEESCEN to request that two-digit years   */
   /*    lie in the 100-year window starting 20      */
   /*    years before the system date                */
    CALL CEESCEN ( STARTCW, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST ( 'The century window now starts '
          || STARTCW || ' years before today.');
       END;
    ELSE  DO;
       DISPLAY( 'CEESCEN failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLISCEN;
```

Figure 170. PL/I Example of CEESCEN

CEESCOL—Compare collation weight of two strings

CEESCOL, analogous to the C language function `strcoll()`, compares two character strings based on the collating sequence specified in the LC_COLLATE category of the current locale.

CEESCOL associates a collation weight with every character in the code set for the locale. The characters in the input strings are converted to their collation weights and then compared on the basis of these weights.

CEESCOL is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEESCOL──(──omitted_parm──,──string1──,──string2──,──result──,──fc──────►
►─)──────────────────────────────────────────────────────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parameter, see “Invoking callable services” on page 107.

string1 (input)
A halfword length-prefixed character string (VSTRING) with a maximum length of 4K bytes. *string1* points to a string of characters that are to be compared against *string2*.

string2 (input)
A halfword length-prefixed character string (VSTRING) with a maximum length of 4K bytes. *string2* points to a string of characters that *string1* is compared against.

result (output)
Specifies the result of the string comparison.

- If successful, the following values are returned:
  - Less than 0 if *string1* is less than *string2*
  - Equal to 0 if *string1* is equal to *string2*
  - Greater than 0 if *string1* is greater than *string2*

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.

Usage notes

- PL/I MTF consideration—CEESCOL is not supported in PL/I MTF applications.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- See “CEESETL—Set locale operating environment” on page 444 for more information about the CEESETL callable service.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTSCOL
**************************************************
*  Example for callable service CEESCOL         *
*   COBSCOL - Compare two character strings     *
*              and print the result.            *
*  Valid only for COBOL for MVS & VM Release 2  *
*  or later.                                    *
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBSCOL.

 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  String1.
     02  Str1-Length  PIC S9(4) BINARY.
     02  Str1-String.
         03  Str1-Char  PIC X
                        OCCURS 0 TO 256 TIMES
                        DEPENDING ON Str1-Length.
 01  String2.
     02  Str2-Length  PIC S9(4) BINARY.
     02  Str2-String.
         03  Str2-Char  PIC X
                        OCCURS 0 TO 256 TIMES
                        DEPENDING ON Str2-Length.
 01  Result  PIC S9(9)  BINARY.
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
*
 PROCEDURE DIVISION.
**************************************************
*  Set up two strings for comparison
**************************************************
     MOVE 9 TO Str1-Length.
     MOVE "12345a789"
        TO Str1-String (1:Str1-Length)
     MOVE 9 TO Str2-Length.
     MOVE "12346$789"
        TO Str2-String (1:Str2-Length)
```

Figure 171. COBOL Example of CEESCOL (Part 1 of 2)

```
*************************************************
*  Call CEESCOL to compare the strings
*************************************************
     CALL "CEESCOL" USING OMITTED, String1,
                          String2, Result, FC.

*************************************************
*  Check feedback code
*************************************************
     IF Severity > 0
        DISPLAY "Call to CEESCOL failed. " Msg-No
        STOP RUN
     END-IF.

*************************************************
*  Check result of compare
*************************************************
     EVALUATE TRUE
        WHEN Result < 0
           DISPLAY "1st string < 2nd string."
        WHEN Result > 0
           DISPLAY "1st string > 2nd string."
        WHEN OTHER
           DISPLAY "Strings are identical."
     END-EVALUATE.

     STOP RUN.
 END PROGRAM COBSCOL.
```

Figure 171. COBOL Example of CEESCOL (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMSCOL                          */
 /****************************************************/
 /* Example for callable service CEESCOL             */
 /* Function: Compare two character strings and      */
 /*  print the result.                               */
 /****************************************************/

 PLISCOL: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs for Language Environment */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants                     */
 %INCLUDE CEEIBMLC; /* Locale category constants                       */

 /* CEESCOL service call arguments */
 DCL STRING1 CHAR(256) VARYING;/* first string       */
 DCL STRING2 CHAR(256) VARYING;/* second string      */
 DCL RESULT_SCOL BIN FIXED(31);/* result of compare  */

 DCL 01 FC,                        /* Feedback token */
        03 MsgSev    REAL FIXED BINARY(15,0),
        03 MsgNo     REAL FIXED BINARY(15,0),
        03 Flags,
           05 Case      BIT(2),
           05 Severity  BIT(3),
           05 Control   BIT(3),
        03 FacID     CHAR(3),         /* Facility ID */
        03 ISI      /* Instance-Specific Information */
                     REAL FIXED BINARY(31,0);

   STRING1 = '12345a789';
   STRING2 = '12346$789';

   CALL CEESCOL( *, STRING1, STRING2, RESULT_SCOL,FC);

   /* FBCHECK macor used (defined in CEEIBMCT) */
   IF FBCHECK( FC, CEE3T1 ) THEN
     DO;
       DISPLAY ('CEESCOL not completed '||FC.MsgNo );
       STOP;
     END;

   SELECT;
   WHEN( RESULT_SCOL < 0 )
     PUT SKIP LIST(
       '"firststring" is less than "secondstring" ');
   WHEN( RESULT_SCOL > 0 )
     PUT SKIP LIST(
     '"firststring" is greater than "secondstring" ');
   OTHERWISE
     PUT SKIP LIST( 'Strings are identical' );
   END;  /* END SELECT */

 END PLISCOL;
```

Figure 172. PL/I Example of CEESCOL

CEESECI—Convert seconds to integers

CEESECI converts a number representing the number of seconds since 00:00:00 14 October 1582 to seven separate binary integers representing year, month, day, hour, minute, second, and millisecond. Use CEESECI instead of CEEDATM when the output is needed in numeric format rather than in character format.

The inverse of CEESECI is CEEISEC, which converts integer year, month, day, hour, second, and millisecond to number of seconds. If the input value is a Lilian date instead of seconds, multiply the Lilian date by 86,400 (number of seconds in a day), and pass the new value to CEESECI.

Syntax

```
►►──CEESECI──(──input_seconds──,──output_year──,──output_month──,──────────►
►──output_day──,──output_hours──,──output_minutes──,──output_seconds──,─────►
►──output_milliseconds──,──────────────────────────────────────────────────►
►──fc──)──────────────────────────────────────────────────────────────────►◄
```

input_seconds
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds.

For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range for *input_seconds* is 86,400 to 265,621,679,999.999 (23:59:59.999 31 December 9999).

If *input_seconds* is invalid, all output parameters except the feedback code are set to 0.

output_year (output)
A 32-bit binary integer representing the year.

The range of valid *output_year*s is 1582 to 9999, inclusive.

output_month (output)
A 32-bit binary integer representing the month.

The range of valid *output_month*s is 1 to 12.

output_day (output)
A 32-bit binary integer representing the day.

The range of valid *output_day*s is 1 to 31.

output_hours (output)
A 32-bit binary integer representing the hour.

The range of valid *output_hours* is 0 to 23.

output_minutes (output)
A 32-bit binary integer representing the minutes.

The range of valid *output_minutes* is 0 to 59.

output_seconds (output)
A 32-bit binary integer representing the seconds.

The range of valid *output_seconds* is 0 to 59.

output_milliseconds (output)
A 32-bit binary integer representing milliseconds.

The range of valid *output_milliseconds* is 0 to 999.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2E9	3	2505	The input_seconds value in a call to CEEDATM or CEESECI was not within the supported range.

Usage notes

- z/OS UNIX consideration—In multithread applications, CEESECI affects only the calling thread.

For more information

- For more information about the CEEISEC callable service, see “CEEISEC—Convert integers to seconds” on page 342.

Examples

```
/*Module/File Name: EDCSECI   */

#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _INT4 year, month, day, hours, minutes, seconds,
        millisecs;
  _FLOAT8 input;
  _FEEDBACK fc;

  input = 13166064000.0;
  CEESECI(&input,&year,&month,&day,&hours,&minutes,;
          &seconds,&millisecs,&fc);

  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESECI failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
  printf("%f seconds corresponds to the date"
         " %d:%d:%d.%d %d/%d/%d\n",input,hours,minutes,
          seconds,millisecs,month,day,year);
}
```

Figure 173. C/C++ Example of CEESECI

```
CBL LIB,QUOTE
      *Module/File Name: IGZTSECI
      ************************************************
      **                                            **
      ** CBLSECI - Call CEESECI to convert seconds   **
      **           to integers                      **
      **                                            **
      ** In this example a call is made to CEESECI   **
      ** to convert a number representing the number **
      ** of seconds since 00:00:00 14 October 1582   **
      ** to seven binary integers representing year, **
      ** month, day, hour, minute, second, and       **
      ** millisecond.  The results are displayed in  **
      ** this example.                               **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLSECI.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  INSECS                  COMP-2.
       01  YEAR                    PIC S9(9) BINARY.
       01  MONTH                   PIC S9(9) BINARY.
       01  DAYS                    PIC S9(9) BINARY.
       01  HOURS                   PIC S9(9) BINARY.
       01  MINUTES                 PIC S9(9) BINARY.
       01  SECONDS                 PIC S9(9) BINARY.
       01  MILLSEC                 PIC S9(9) BINARY.
       01  IN-DATE.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                               of IN-DATE.
       01  PICSTR.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of PICSTR.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-CBLSECS.
```

Figure 174. COBOL Example of CEESECI (Part 1 of 2)

```
*************************************************
** Call CEESECS to convert timestamp of 6/2/88
**     at 10:23:45 AM to Lilian representation
*************************************************
     MOVE 20 TO Vstring-length of IN-DATE.
     MOVE "06/02/88 10:23:45 AM"
             TO Vstring-text of IN-DATE.
     MOVE 20 TO Vstring-length of PICSTR.
     MOVE "MM/DD/YY HH:MI:SS AM"
             TO Vstring-text of PICSTR.
     CALL "CEESECS" USING IN-DATE, PICSTR,
                          INSECS, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESECS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
 PARA-CBLSECI.
*************************************************
** Call CEESECI to convert seconds to integers
*************************************************
     CALL "CEESECI" USING INSECS, YEAR, MONTH,
                          DAYS, HOURS,  MINUTES,
                          SECONDS, MILLSEC, FC.
*************************************************
** If CEESECI runs successfully, display results
*************************************************
     IF CEE000 of FC  THEN
         DISPLAY "Input seconds of " INSECS
             " represents:"
         DISPLAY "   Year......... " YEAR
         DISPLAY "   Month........ " MONTH
         DISPLAY "   Day.......... " DAYS
         DISPLAY "   Hour......... " HOURS
         DISPLAY "   Minute....... " MINUTES
         DISPLAY "   Second....... " SECONDS
         DISPLAY "   Millisecond.. " MILLSEC
     ELSE
         DISPLAY "CEESECI failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 174. COBOL Example of CEESECI (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMSECI                        */
 /****************************************************/
 /**                                                 */
 /** Function: CEESECI - convert seconds to integers */
 /**                                                 */
 /****************************************************/
 PLISECI: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL INSECS   REAL FLOAT DECIMAL(16);
    DCL YEAR     REAL FIXED BINARY(31,0);
    DCL MONTH    REAL FIXED BINARY(31,0);
    DCL DAYS     REAL FIXED BINARY(31,0);
    DCL HOURS    REAL FIXED BINARY(31,0);
    DCL MINUTES  REAL FIXED BINARY(31,0);
    DCL SECONDS  REAL FIXED BINARY(31,0);
    DCL MILLSEC  REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    INSECS = 13166064060; /* number of seconds since */
                          /* 14 October 1582         */

    /* Call CEESECI to convert INSECS to separate    */
    /*    binary integers representing the year,     */
    /*    month, day, hours, minutes, seconds and    */
    /*    milliseconds.                              */
    CALL CEESECI ( INSECS, YEAR, MONTH, DAYS,
       HOURS, MINUTES, SECONDS, MILLSEC, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT EDIT( INSECS, ' seconds corresponds to ',
           MONTH, '/', DAYS, '/', YEAR, ' at ', HOURS,
           ':', MINUTES, ':', SECONDS, '.', MILLSEC )
           (SKIP, F(9), A, 2 (P'99',A), P'9999', A,
           3 (P'99', A), P'999' );
       END;
    ELSE  DO;
       DISPLAY( 'CEESECI failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLISECI;
```

Figure 175. PL/I Example of CEESECI

CEESECS—Convert timestamp to seconds

CEESECS converts a string representing a timestamp into the number of Lilian seconds (number of seconds since 00:00:00 14 October 1582). This service makes it easier to perform time arithmetic, such as calculating the elapsed time between two timestamps.

CEESECS is affected only by the country code setting of the COUNTRY run-time option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.

The inverse of CEESECS is CEEDATM, which converts *output_seconds* to character format. By default, 2-digit years lie within the 100 year range starting 80 years prior to the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. You can change this range by using the callable service CEESCEN.

Syntax

```
►►──CEESECS──(──input_timestamp──,──picture_string──,──output_seconds──,──────►
►──fc──)──────────────────────────────────────────────────────────────────►◄
```

input_timestamp (input)
A length-prefixed character string representing a date or timestamp in a format matching that specified by *picture_string*.

The character string must contain between 5 and 80 picture characters, inclusive. *input_timestamp* can contain leading or trailing blanks. Parsing begins with the first nonblank character (unless the picture string itself contains leading blanks; in this case, CEESECS skips exactly that many positions before parsing begins).

After a valid date is parsed, as determined by the format of the date you specify in *picture_string*, all remaining characters are ignored by CEESECS. Valid dates range between and including the dates 15 October 1582 to 31 December 9999. A full date must be specified. Valid times range from 00:00:00.000 to 23:59:59.999.

If any part or all of the time value is omitted, zeros are substituted for the remaining values. For example:

```
1992-05-17-19:02 is equivalent to 1992-05-17-19:02:00
1992-05-17       is equivalent to 1992-05-17-00:00:00
```

picture_string (input)
A halfword length-prefixed character string (VSTRING), indicating the format of the date or timestamp value specified in *input_timestamp*.

Each character in the *picture_string* represents a character in *input_timestamp*. For example, if you specify MMDDYY HH.MI.SS as the *picture_string*, CEESECS reads an *input_char_date* of 060288 15.35.02 as 3:35:02 PM on 02 June 1988. If delimiters such as the slash (/) appear in the picture string, leading zeros can be omitted. For example, the following calls to CEESECS all assign the same value to variable *secs*:

```
CALL CEESECS('92/06/03 15.35.03', 'YY/MM/DD
             HH.MI.SS', secs, fc);
CALL CEESECS('92/6/3 15.35.03'  , 'YY/MM/DD
             HH.MI.SS', secs, fc);
CALL CEESECS('92/6/3 3.35.03 PM', 'YY/MM/DD
             HH.MI.SS AP', secs, fc);
CALL CEESECS('92.155 3.35.03 pm', 'YY.DDD
             HH.MI.SS AP', secs, fc);
```

If picture string is left null or blank, CEESECS gets *picture_string* based on the current value of the COUNTRY run-time option. For example, if the current value of the COUNTRY run-time option is FR (France), the date format would be DD.MM.YYYY.

If *picture_string* includes a Japanese era symbol `<JJJJ>`, the `YY` position in *input_timestamp* represents the year number within the Japanese era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 30 on page 518 for a list of Japanese eras supported by CEESECS.

If *picture_string* includes era symbol `<CCCC>` or `<CCCCCCCC>`, the `YY` position in *input_timestamp* represents the year number within the era.

See Table 28 on page 517 for a list of valid picture characters, and Table 29 on page 518 for examples of valid picture strings.

output_seconds (output)
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second 86,401 (24*60*60 + 01) in the Lilian format. 19:00:01.12 on 16 May 1988 is second 12,799,191,601.12.

The largest value represented is 23:59:59.999 on 31 December 9999, which is second 265,621,679,999.999 in the Lilian format.

A 64-bit double floating-point value can accurately represent approximately 16 significant decimal digits without loss of precision. Therefore, accuracy is available to the nearest millisecond (15 decimal digits).

If *input_timestamp* does not contain a valid date or timestamp, *output_seconds* is set to 0 and CEESECS terminates with a non-CEE000 symbolic feedback code.

Elapsed time calculations are performed easily on the *output_seconds*, because it represents elapsed time. Leap year and end-of-year anomalies do not affect the calculations.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2EB	3	2507	Insufficient data was passed to CEEDAYS or CEESECS. The Lilian value was not calculated.
CEE2EC	3	2508	The date value passed to CEEDAYS or CEESECS was invalid.
CEE2ED	3	2509	The era passed to CEEDAYS or CEESECS was not recognized.
CEE2EE	3	2510	The hours value in a call to CEEISEC or CEESECS was not recognized.
CEE2EH	3	2513	The input date passed in a CEEISEC, CEEDAYS, or CEESECS call was not within the supported range.
CEE2EK	3	2516	The minutes value in a CEEISEC call was not recognized.

Code	Severity	Message Number	Message Text
CEE2EL	3	2517	The month value in a CEEISEC call was not recognized.
CEE2EM	3	2518	An invalid picture string was specified in a call to a date/time service.
CEE2EN	3	2519	The seconds value in a CEEISEC call was not recognized.
CEE2EP	3	2521	The year-within-era value passed to CEEDAYS or CEESECS was zero.
CEE2ET	3	2525	CEESECS detected non-numeric data in a numeric field, or the timestamp string did not match the picture string.

Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- z/OS UNIX consideration—In multithread applications, CEESECS affects only the calling thread.

For more information

- See “CEESCEN—Set the century window” on page 422 for more information about the CEESCEN callable service.
- See “COUNTRY” on page 22 for more information about the COUNTRY run-time option.

Examples

```
/*Module/File Name: EDCSECS   */

#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

   _FEEDBACK fc;
   _FLOAT8 seconds1, seconds2;
   _VSTRING date,date_pic;

   /* use CEESECS to convert to seconds timestamp */
   strcpy(date.string,"09/13/91 23:23:23");
   date.length = strlen(date.string);
   strcpy(date_pic.string,"MM/DD/YY HH:MI:SS");
   date_pic.length = strlen(date_pic.string);

   CEESECS(&date,&date_pic,&seconds1,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEESECS failed with message number %d\n",
           fc.tok_msgno);
      exit(2999);
   }

   strcpy(date.string,
            "December 15, 1992 at 8:23:45 AM");
   date.length = strlen(date.string);
   strcpy(date_pic.string,
              "Mmmmmmmmmmmz DD, YYYY at ZH:MI:SS AP");
   date_pic.length = strlen(date_pic.string);

   CEESECS(&date,&date_pic,&seconds2,&fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEESECS failed with message number %d\n",
             fc.tok_msgno);
      exit(2999);
   }

   printf("The number of seconds between:\n");
   printf(" September 13, 1991 at 11:23:23 PM");
   printf(
    " and December 15, 1992 at 8:23:45 AM is:\n  %f\n",
                 seconds2 - seconds1);
}
```

Figure 176. C/C++ Example of CEESECS

```
CBL LIB,QUOTE
      *Module/File Name: IGZTSECS
      ************************************************
      ** CBLSECS - Call CEESECS to convert          **
      **           timestamp to number of seconds   **
      **                                            **
      ** In this example, calls are made to CEESECS **
      ** to convert two timestamps to the number of **
      ** seconds since 00:00:00 14 October 1582.    **
      ** The Lilian seconds for the earlier         **
      ** timestamp are then subtracted from the     **
      ** Lilian seconds for the later timestamp     **
      ** to determine the number of between the     **
      ** two.  This result is displayed.            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLSECS.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  SECOND1                 COMP-2.
       01  SECOND2                 COMP-2.
       01  TIMESTP.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of TIMESTP.
       01  TIMESTP2.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of TIMESTP2.
       01  PICSTR.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char        PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of PICSTR.
       01  FC.
           02  Condition-Token-Value.
```

Figure 177. COBOL Example of CEESECS (Part 1 of 3)

```
     COPY  CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION.
 PARA-SECS1.
**************************************************
** Specify first timestamp and a picture string
**     describing the format of the timestamp
**     as input to CEESECS
**************************************************
     MOVE 25 TO Vstring-length of TIMESTP.
     MOVE "1969-05-07 12:01:00.000"
             TO Vstring-text of TIMESTP.
     MOVE 25 TO Vstring-length of PICSTR.
     MOVE "YYYY-MM-DD HH:MI:SS.999"
             TO Vstring-text of PICSTR.

**************************************************
** Call CEESECS to convert the first timestamp
** to Lilian seconds
**************************************************
     CALL "CEESECS" USING TIMESTP, PICSTR,
                          SECOND1, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESECS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
```

Figure 177. COBOL Example of CEESECS (Part 2 of 3)

```
 PARA-SECS2.
**************************************************
** Specify second timestamp and a picture string
**     describing the format of the timestamp as
**     input to CEESECS.
**************************************************
     MOVE 25 TO Vstring-length of TIMESTP2.
     MOVE "2000-01-01 00:00:01.000"
             TO Vstring-text of TIMESTP2.
     MOVE 25 TO Vstring-length of PICSTR.
     MOVE "YYYY-MM-DD HH:MI:SS.999"
             TO Vstring-text of PICSTR.

**************************************************
** Call CEESECS to convert the second timestamp
**     to Lilian seconds
**************************************************
     CALL "CEESECS" USING TIMESTP2, PICSTR,
                          SECOND2, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESECS failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

 PARA-SECS2.
**************************************************
** Subtract SECOND2 from SECOND1 to determine the
**     number of seconds between the two timestamps
**************************************************
     SUBTRACT SECOND1 FROM SECOND2.
     DISPLAY "The number of seconds between "
         Vstring-text OF TIMESTP " and "
         Vstring-text OF TIMESTP2 " is: " SECOND2.

     GOBACK.
```

Figure 177. COBOL Example of CEESECS (Part 3 of 3)

```
*PROCESS MACRO;
 /* Module/File Name: IBMSECS                        */
 /****************************************************/
 /**                                                 */
 /** Function: CEESECS - Change timestamp to seconds */
 /**                                                 */
 /** In this example, CEESECS is called to return an */
 /** input timestamp as the number of seconds since  */
 /** 14 October 1582.                                */
 /**                                                 */
 /****************************************************/
 PLISECS: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL TIMESTP CHAR(255) VARYING;
    DCL PICSTR CHAR(255) VARYING;
    DCL SECONDS REAL FLOAT DECIMAL(16);
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    TIMESTP = '10 November 1992'; /* Specify input   */
                                  /* date as timestamp */
    PICSTR  = 'ZD Mmmmmmmmmmmmmmz YYYY';
           /* Picture string that descibes timestamp */

    /* Call CEESECS to return the input date as      */
    /*    Lilian seconds                             */
    CALL CEESECS ( TIMESTP, PICSTR, SECONDS, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'There were ' || SECONDS
          || ' seconds between 14 Oct 1582 and '
          || TIMESTP );
       END;
    ELSE  DO;
       DISPLAY( 'CEESECS failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLISECS;
```

Figure 178. PL/I Example of CEESECS

CEESETL—Set locale operating environment

CEESETL, analogous to the C language function `setlocale()`, establishes a global locale operating environment, which determines the behavior of character collation, character classification, date and time formatting, numeric punctuation, and positive/negative response patterns.

CEESETL is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEESETL──(──localename──,──category──,──fc──)──────────────────────►◄
```

localename (input)
A halfword length-prefixed character string (VSTRING) with a maximum of 256 bytes. *localename* is a valid locale name known to the locale model. The category named in the call is set according to the named locale. If *localename* is null or blank, CEESETL sets the locale environment according to the environment variables. This is the equivalent to specifying `setlocale(LC_ALL,"")`. If these environment variables are defined, you can locate them in the following order:

- LC_ALL if it is defined and not null
- LANG if it is defined and not null
- The default C locale

category (input)
A symbolic integer number that represents all or part of the locale for a program. Depending on the value of the *localename*, these categories can be initiated by the values of global categories of corresponding names. The following values for the *category* parameter are valid:

LC_ALL
A 4-byte integer (with a value of -1) that affects all locale categories associated with a program's locale.

LC_COLLATE
A 4-byte integer (with a value of 0) that affects the behavior of regular expression and collation subroutines.

LC_CTYPE
A 4-byte integer (with a value of 1) that affects the behavior of regular expression, character classification, case conversion, and wide character subroutines.

LC_MESSAGES
A 4-byte integer (with a value of 6) that affects the format and values for positive and negative responses.

LC_MONETARY
A 4-byte integer (with a value of 3) that affects the behavior of subroutines that format monetary values.

LC_NUMERIC
A 4-byte integer (with a value of 2) that affects the behavior of subroutines that format non-monetary numeric values.

LC_TIME
A 4-byte integer (with a value of 4) that affects the behavior of time conversion subroutines.

Language Environment locale callable services do not support the LC_TOD and LC_SYNTAX categories.

fc (output/optional)

A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2KD	3	2701	An invalid category parameter was passed to a locale function.
CEE2KE	3	2702	An invalid locale name parameter was passed to a locale function.
CEE3T1	3	4001	General Failure: Service could not be completed.

Usage notes

- PL/I MTF consideration—CEESETL is not supported in PL/I MTF applications.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.
- The LC_ALL category indicates that all categories are to be changed with regard to the specific locale. The LC_ALL value, when set by CEESETL, becomes the current values for all six LC_* categories.
- If the active locale is not explicitly set with CEESETL or `setlocale(`*`category`*`,` *`localename`*`)`, then the locale chosen is as follows:
  - With POSIX(OFF), the `SAA C` locale is chosen, and querying the locale with CEEQRYL returns “C” as the locale name.
  - With POSIX(ON), the `POSIX C` locale is chosen, and querying the locale with CEEQRYL returns “POSIX” as the locale name.

  The `SAA C` locale provides compatibility with previous releases of C/370. The `POSIX C` locale provides consistency with POSIX requirements and supports the z/OS UNIX environment.

For more information

- See *z/OS C/C++ Run-Time Library Reference* for details of how various locale categories affect C/C++ language functions.
- For more information about specifying environment variables to set the locale, see *z/OS C/C++ Programming Guide*.
- For information on the definition of the `SAA C` and `POSIX C` locales and the differences between them, see *z/OS C/C++ Programming Guide*.
- For more information about LC_TIME, see “CEEQDTC—Query locale date and time conventions” on page 411.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTSETL
************************************************
*  Example for callable service CEESETL        *
*   COBSETL - Set all global locale environment *
*              categories to country Sweden.    *
*             Query one category.               *
************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBSETL.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  Locale-Name.
     02  LN-Length  PIC S9(4) BINARY.
     02  LN-String  PIC X(256).
 01  Locale-Time.
     02  LT-Length  PIC S9(4) BINARY.
     02  LT-String  PIC X(256).
* Use Locale category constants
 COPY CEEIGZLC.
*
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
*
```

Figure 179. COBOL Example of CEESETL (Part 1 of 2)

```
 PROCEDURE DIVISION.
**************************************************
*  Set up locale name for Sweden
**************************************************
     MOVE 14 TO LN-Length.
     MOVE 'Sv_SE.IBM-1047'
             TO LN-String (1:LN-Length).

**************************************************
*  Set all locale categories to Sweden
*  Use LC-ALL category constant from CEEIGZLC
**************************************************
     CALL 'CEESETL' USING Locale-Name, LC-ALL,
                          FC.

**************************************************
*  Check feedback code
**************************************************
     IF Severity > 0
        DISPLAY 'Call to CEESETL failed. ' Msg-No
        STOP RUN
     END-IF.

**************************************************
*  Retrieve active locale for LC-TIME category
**************************************************
     CALL 'CEEQRYL' USING LC-TIME, Locale-Time,
                          FC.

**************************************************
*  Check feedback code and correct locale
**************************************************
     IF Severity = 0
        IF LT-String(1:LT-Length) =
                LN-String(1:LN-Length)
           DISPLAY 'Successful query.'
        ELSE
           DISPLAY 'Unsuccessful query.'
        END-IF
     ELSE
        DISPLAY 'Call to CEEQRYL failed. ' Msg-No
     END-IF.

     STOP RUN.
 END PROGRAM COBSETL.
```

Figure 179. COBOL Example of CEESETL (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMSETL                          */
 /****************************************************/
 /* Example for callable service CEESETL             */
 /* Function: Set all global locale environment      */
 /*  categories to country. Query one category.      */
 /****************************************************/

 PLISETL: PROC OPTIONS(MAIN);

 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */

 /* CEESETL service call arguments */
 DCL LOCALE_NAME CHAR(14) VARYING;

 /* CEEQRYL service call arguments */
 DCL LOCALE_NAME_TIME CHAR(256) VARYING;

 DCL 01 FC,                        /* Feedback token */
        03 MsgSev    REAL FIXED BINARY(15,0),
        03 MsgNo     REAL FIXED BINARY(15,0),
        03 Flags,
           05 Case      BIT(2),
           05 Severity  BIT(3),
           05 Control   BIT(3),
        03 FacID     CHAR(3),       /* Facility ID */
        03 ISI      /* Instance-Specific Information */
                     REAL FIXED BINARY(31,0);
```

Figure 180. COBOL Example of CEESETL (Part 1 of 2)

```
   /* init locale name with IBM default for Sweden  */
   LOCALE_NAME = 'Sv_SE.IBM-1047';

   /* use LC_ALL category const from CEEIBMLC */
   CALL CEESETL ( LOCALE_NAME, LC_ALL, FC );

   /* FBCHECK macro used (defined in CEEIBMCT) */
   IF FBCHECK( FC, CEE2KE ) THEN
     DO;  /* invalid locale name */
       DISPLAY ( 'Locale LC_ALL Call '||FC.MsgNo );
       STOP;
     END;

   /* retrieve active locale for LC_TIME category */
   /* use LC_TIME category const from CEEIBMLC */
   CALL CEEQRYL ( LC_TIME, LOCALE_NAME_TIME, FC );

   IF FBCHECK( FC, CEE000 ) THEN
     DO;  /* successful query, check category name */
       IF LOCALE_NAME_TIME ¬= LOCALE_NAME THEN
         DO;
           DISPLAY ( 'Invalid LOCALE_NAME_TIME ' );
           STOP;
         END;
       ELSE
         DO;
           PUT SKIP LIST('Successful query LC_TIME',
                         LOCALE_NAME_TIME);
         END;
     END;
   ELSE
     DO;
       DISPLAY ( 'LC_TIME Category Call '||FC.MsgNo );
       STOP;
     END;

 END PLISETL;
```

Figure 180. COBOL Example of CEESETL (Part 2 of 2)

CEESGL—Signal a condition

CEESGL raises, or signals, a condition to the Language Environment condition manager. It also provides qualifying data and creates an ISI for a particular instance of the condition. The ISI contains information used by the Language Environment condition manager to identify and react to conditions.

CEESGL is typically used to generate application-specific conditions that are recognized by condition handlers registered via CEEHDLR. Conditions can also be selected to simulate a Language Environment or system condition. If you plan on using a routine that signals a new condition with a call to CEESGL, you should first call the CEECMI callable service to copy any insert information into the ISI associated with the condition.

CEESGL generates a Language Environment condition. You can map some of the Language Environment condition tokens to POSIX signals.

Unique conditions signaled by CEESGL are considered to be enabled under Language Environment. Therefore, they undergo Language Environment condition handling.

CEESGL can signal a POSIX condition. If CEESGL signals a POSIX condition and the signal is blocked at the time of the generation but later unblocked and delivered, the POSIX signal processing semantics are applied. The Language Environment synchronous condition manager semantics do not apply.

Severity 0 and 1 conditions are considered safe conditions. They can be ignored if they are not handled and if no feedback token is passed when the condition is raised.

Each signaled condition (of severity 2 or above) increments the error count by one. If the error count exceeds the error count limit (as specified by the ERRCOUNT run-time option—see “ERRCOUNT” on page 28) the condition manager terminates the enclave with abend code 4091, reason code 11. T_I_U (Termination Imminent due to an Unhandled Condition) is not issued. Promoted conditions do not increment the error count. A program established using the CEEHDLR callable service or one of the HLL condition handlers, can then process the raised condition.

ERRCOUNT applies to CEESGL only if the condition generated by CEESGL is delivered synchronously. POSIX signal handling semantics are then applied to the condition.

Table 23 on page 193 contains a list of the S/370 program interrupt codes and their corresponding Language Environment condition token names and message numbers.

Syntax

```
►►──CEESGL──(──cond_rep──,──┬──────────────────┬──fc──)──────────────►◄
                            └─q_data_token──,──┘
```

cond_rep (input)
A 12-byte condition token representing the condition to be signaled.

You can either construct your own condition token or use one that Language Environment has already defined.

Conditions signaled by CEESGL are not necessarily handled by Language Environment. If you call CEESGL with a *cond_rep*, Language Environment passes control to the language in which the routine is written. The condition manager then determines whether it should handle the condition. If so, the HLL handles the condition. If not, control returns to Language Environment. The condition might also be ignored or blocked, or might result in enclave termination.

q_data_token (input/output)
An optional 32-bit data object placed in the ISI to access the qualifying data (q_data) associated with the given instance of the condition. The *q_data_token* is a list of information addresses a user condition handler uses to specifically identify and, if necessary, react to, a given condition. The information in the *q_data_token* provides a mechanism by which user-written condition handlers can provide a complete fix-up of some conditions.

q_data tokens associated with a condition using CEESGL can be extracted later using the CEEGQDT callable service.

fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE069	0	0201	An unhandled condition was returned in a feedback code.
CEE0CE	1	0398	Resume with new input.
CEE0CF	1	0399	Resume with new output.
CEE0EB	3	0459	Not enough storage was available to create a new instance specific information block.
CEE0EE	3	0462	Instance specific information for the condition token with message number *message-number* and facility ID *facility-id* could not be found.

Usage notes

- PL/I consideration—Conditions with a facility_ID of IBM cannot be used in CEESGL.
- z/OS UNIX consideration—In multithread applications, CEESGL affects only the calling thread. Delivery of a CEESGL generated condition is limited to the thread that generated the condition. However, if the condition is a severity 2 or higher, and is not handled by the application, the default action of terminate applies to the enclave, not just the calling thread.

For more information

- See “CEECMI—Store and load message insert data” on page 209 for more information about the CEECMI callable service.
- See *z/OS Language Environment Programming Guide* for more information about mapping Language Environment condition tokens to POSIX signals.
- See “ERRCOUNT” on page 28 for more information about the ERRCOUNT run-time option.
- To construct your own condition token, see “CEENCOD—Construct a condition token” on page 401.
- For more information about condition handling, see *z/OS Language Environment Programming Guide*.
- See “CEEGQDT—Retrieve q_data_token” on page 310 for more information about the CEEGQDT callable service.

Examples

```
/*Module/File Name: EDCSGL    */

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

  _FEEDBACK fc,condtok;
  _ENTRY routine;
  _INT4 token,qdata;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi;

 /* .
    .
    . */
  /* build the condition token */
  c_1 = 1;
  c_2 = 99;
  cond_case = 1;
  sev = 1;
  control = 0;
  memcpy(facid,"ZZZ",3);
  isi = 0;

  CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
          facid,&isi,&condtok,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEENCOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  /* signal the condition */
  CEESGL(&condtok,&qdata,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf("CEESGL failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }
 /* .
    .
    . */
}
```

Figure 181. C/C++ Example of CEESGL

```
CBL LIB,QUOTE
      *Module/File Name: IGZTSGL
      ************************************************
      **                                            **
      ** CBLSGL - Call CEESGL to signal a condition **
      **                                            **
      ************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBLSGL.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  CONDTOK.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  QDATA                   PIC S9(9) BINARY.
       01  FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       01  SEV                     PIC S9(4) BINARY.
       01  MSGNO                   PIC S9(4) BINARY.
       01  CASE                    PIC S9(4) BINARY.
       01  SEV2                    PIC S9(4) BINARY.
       01  CNTRL                   PIC S9(4) BINARY.
       01  FACID                   PIC X(3).
       01  ISINFO                  PIC S9(9) BINARY.

       PROCEDURE DIVISION.
```

Figure 182. COBOL Example of CEESGL (Part 1 of 2)

```
 PARA-CBLSGL.
**************************************************
** Call CEENCOD with the values assigned above
** to build a condition token "CONDTOK"
** Set CONDTOK to sev = 0, msgno = 1 facid = CEE
**************************************************
     MOVE 0 TO SEV.
     MOVE 1 TO MSGNO.
     MOVE 1 TO CASE.
     MOVE 0 TO SEV2.
     MOVE 1 TO CNTRL.
     MOVE "CEE" TO FACID.
     MOVE 0 TO ISINFO.

     CALL "CEENCOD" USING SEV, MSGNO, CASE,
         SEV2, CNTRL, FACID, ISINFO, CONDTOK, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEENCOD failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

** Call CEESGL to signal the condition with
**************************************************
**     the condition token and qdata described
**     in CONDTOK and QDATA
**************************************************
     MOVE 0 TO QDATA.
     CALL "CEESGL" USING CONDTOK, QDATA, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEESGL  failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.

     GOBACK.
```

Figure 182. COBOL Example of CEESGL (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMSGL                          */
 /****************************************************/
 /**                                                 */
 /** Function: CEESGL  - Signal a Condition          */
 /**                                                 */
 /****************************************************/
 PLISGL: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL 01 CONDTOK,                /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);
    DCL QDATA  REAL FIXED BINARY(31,0);
    DCL 01 FC,                     /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    /* Give CONDTOK value of condition CEE001        */
    ADDR( CONDTOK ) -> CEEIBMCT = CEE001;

    /* Signal condition CEE001 with qualifying data  */
    QDATA = 1;
    CALL CEESGL ( CONDTOK, QDATA, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST( 'Condition CEE001 signalled' );
       END;
    ELSE  DO;
       DISPLAY( 'CEESGL  failed with msg '
          || FC.MsgNo );
       STOP;
       END;

 END PLISGL;
```

Figure 183. PL/I Example of CEESGL

CEESTXF—Transform string characters into collation weights

CEESTXF, analogous to the C language function `strcfrm()`, transforms every character in a character string to its unique collation weight. The collation weights are established from the LC_COLLATE category for the locale. CEESTFX also returns the length of the transformed string.

CEESTXF is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

Syntax

```
►►──CEESTXF──(──omitted_parm──,──mbstring──,──number──,──txfstring──,──────►
►──length──,──fc──)──────────────────────────────────────────────────────►◄
```

omitted_parm
This parameter is reserved for future expansion and must be omitted. For information on how to code an omitted parm, see “Invoking callable services” on page 107.

mbstring (input)
A halfword length-prefixed character string (VSTRING) that is to be transformed.

number (input)
A 4-byte integer that specifies the number of bytes of *mbstring* to be transformed. The value of this parameter must be greater than zero; otherwise, an error is reported, and no transformation is attempted.

txfstring (output)
A halfword length-prefixed character string (VSTRING) where the transformation of *mbstring* is to be placed.

length (output)
A 4-byte integer that specifies the length of the transformed string, if successful.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE3T1	3	4001	General Failure: Service could not be completed.
CEE3TF	3	4015	Input Error: The number of characters to be transformed must be greater than zero.

Usage notes

- PL/I MTF consideration—CEESETL is not supported in PL/I MTF applications.
- This callable service uses the C/C++ run-time library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- For more information about the `setlocale()` ,see “COUNTRY” on page 22, “CEE3CTY—Set default country” on page 122, and “CEE3LNG—Set national language” on page 164.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 444.

Examples

```
 CBL LIB,QUOTE
*Module/File Name: IGZTSTXF
**************************************************
* Example for callable service CEESTXF          *
*  COBSTXF - Query current collate category and *
*             build input string as function of *
*             locale name.                      *
*            Translate string as function of    *
*             locale.                           *
*  Valid only for COBOL for MVS & VM Release 2  *
*  or later.                                    *
**************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  COBSTXF.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  MBS.
     02  MBS-Length  PIC S9(4) BINARY.
     02  MBS-String  PIC X(10).
 01  TXF.
     02  TXF-Length  PIC S9(4) BINARY.
     02  TXF-String  PIC X(256).
 01  Locale-Name.
     02  LN-Length  PIC S9(4) BINARY.
     02  LN-String  PIC X(256).
* Use Locale category constants
 COPY CEEIGZLC.
 01  MBS-Size    PIC S9(9)  BINARY  VALUE 0.
 01  TXF-Size    PIC S9(9)  BINARY  VALUE 0.
 01  FC.
     02  Condition-Token-Value.
     COPY CEEIGZCT.
         03  Case-1-Condition-ID.
             04  Severity    PIC S9(4) BINARY.
             04  Msg-No      PIC S9(4) BINARY.
         03  Case-2-Condition-ID
                   REDEFINES Case-1-Condition-ID.
             04  Class-Code  PIC S9(4) BINARY.
             04  Cause-Code  PIC S9(4) BINARY.
         03  Case-Sev-Ctl    PIC X.
         03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
 PROCEDURE DIVISION.
**************************************************
*  Call CEEQRYL to retrieve locale name
**************************************************
     CALL "CEEQRYL" USING LC-COLLATE,
                          Locale-Name, FC.
**************************************************
*  Check feedback code and set input string
**************************************************
     IF Severity = 0
        IF LN-String (1:LN-Length) =
              "Sv-SE.IBM-1047"
           MOVE 10 TO MBS-Length
           MOVE 10 TO MBS-Size
           MOVE "7,123,456."
                   TO MBS-String (1:MBS-Length)
```

Figure 184. COBOL Example of CEESTXF (Part 1 of 2)

```
            ELSE
               MOVE 7 TO MBS-Length
               MOVE 7 TO MBS-Size
               MOVE "8765432"
                       TO MBS-String (1:MBS-Length)
            END-IF
         ELSE
            DISPLAY "Call to CEEQRYL failed. " Msg-No
            STOP RUN
         END-IF.
              MOVE SPACES TO TXF-String.
         MOVE 0 to TXF-Length.

     ************************************************
     *  Call CEESTXF to translate the string
     ************************************************
         CALL "CEESTXF" USING OMITTED, MBS, MBS-Size,
                              TXF, TXF-Size, FC.
    ************************************************
     *  Check feedback code and return length
     ************************************************
         IF Severity = 0
            IF TXF-Length > 0
               DISPLAY "Translated string is "
                       TXF-String
            ELSE
               DISPLAY "String not translated."
            END-IF
         ELSE
            DISPLAY "Call to CEESTXF failed. " Msg-No
         END-IF.
        STOP RUN.
      END PROGRAM COBSTXF.
```

Figure 184. COBOL Example of CEESTXF (Part 2 of 2)

```
*PROCESS MACRO;
 /*Module/File Name: IBMSTXF                          */
 /*****************************************************/
 /* Example for callable service CEESTXF             */
 /* Function: Query current collate category and     */
 /*   build input string as function of locale name. */
 /*   Translate string as function of locale.        */
 /*****************************************************/
 PLISTXF: PROC OPTIONS(MAIN);
 %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
 %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
 %INCLUDE CEEIBMLC; /* Locale category constants     */
```

Figure 185. PL/I Example of CEESTXF (Part 1 of 2)

```
/* CEESTXF service call arguments */
DCL MBSTRING  CHAR(10) VARYING;   /* input string   */
DCL MBNUMBER  BIN FIXED(31);      /* input length   */
DCL TXFSTRING CHAR(256) VARYING;  /* output string  */
DCL TXFLENGTH BIN FIXED(31);      /* output length  */
/* CEEQRYL service call arguments */
DCL LOCALE_NAME_COLLATE CHAR(256) VARYING;
DCL 01 FC,                        /* Feedback token */
       03 MsgSev    REAL FIXED BINARY(15,0),
       03 MsgNo     REAL FIXED BINARY(15,0),
       03 Flags,
          05 Case      BIT(2),
          05 Severity  BIT(3),
          05 Control   BIT(3),
       03 FacID     CHAR(3),       /* Facility ID */
       03 ISI      /* Instance-Specific Information */
                    REAL FIXED BINARY(31,0);
  /* retrieve active locale for collate category */
  /* Use LC_COLLATE category const from CEEIBMLC */
  CALL CEEQRYL ( LC_COLLATE, LOCALE_NAME_COLLATE, FC);
  /* FBCHECK macro used (defined in CEEIBMCT) */
  IF FBCHECK( FC, CEE000 ) THEN
    DO; /* successful query, set string for CEESTXF */
      IF LOCALE_NAME_COLLATE = 'Sv_SE.IBM-1047' THEN
          MBSTRING = '7,123,456.';
      ELSE
          MBSTRING = '8765432';
      MBNUMBER = LENGTH(MBSTRING);
    END;
  ELSE
    DO;
      DISPLAY ( 'Locale LC_COLLATE  '||FC.MsgNo );
      STOP;
    END;
  TXFSTRING = ';
  CALL CEESTXF ( *, MBSTRING, MBNUMBER,
                    TXFSTRING, TXFLENGTH, FC );
  IF FBCHECK( FC, CEE000 ) THEN
    DO; /* successful call, use transformed length */
      IF TXFLENGTH >0 THEN
        DO;
          PUT SKIP LIST( 'Transformed string is '||
                  SUBSTR(TXFSTRING,1, TXFLENGTH) );
        END;
    END;
  ELSE
    DO;
      IF FBCHECK( FC, CEE3TF ) THEN
        DO;
          DISPLAY ( 'Zero length input string' );
        END;
    END;
END PLISTXF;
```

Figure 185. PL/I Example of CEESTXF (Part 2 of 2)

CEETDLI—Invoke IMS

CEETDLI provides an interface to PL/I facilities that operates in IMS. In assembler, COBOL, PL/I, and C/C++, you can also invoke IMS by using the following interfaces:

- In assembler, the ASMTDLI interface
- In COBOL, the CBLTDLI interface
- In PL/I, the PLITDLI interface

- In C/C++, the CTDLI interface, a `ctdli()` function call

CEETDLI performs essentially the same functions as these interfaces, but it offers some advantages, particularly if you plan to run an ILC application in IMS.

The names CEETDLI, AIBTDLI, ASMTDLI, CBLTDLI, CTDLI, and PLITDLI are all interpreted as IMS interfaces. If you are currently using them in any other way in your application, you must change them.

The CEETDLI interface supports calls to IMS that use an application interface block (AIB) or a program communication block (PCB).

Syntax

```
►►─CEETDLI─(─┬──────────────┬─,─function─,─┬────────┬─)──────────►◄
             └─parmcount─,─┘              └─args───┘
```

parmcount
A fullword integer specifying the total number of arguments for the CEETDLI call. This option usually is not needed and can be omitted; it is supported for compatibility with earlier interface modules.

function
The IMS function that you want to perform. The possible values for this field are defined by IMS, not Language Environment.

args
Arguments that you pass to IMS. You cannot pass run-time options as CEETDLI arguments. You cannot alter the settings of run-time options when invoking IMS facilities. The order and meaning of the arguments is defined by IMS, not Language Environment.

Usage notes

- CEETDLI is not supported with CICS.
- z/OS UNIX considerations—IMS supports only applications that use the POSIX(ON) run-time option from a single thread. Calls to z/OS UNIX threading functions are restricted under IMS. See *z/OS C/C++ Programming Guide*for a list of restrictions on running IMS and z/OS UNIX.

For more information

- For more information about AIB and a complete description of all available IMS functions and argument parameters you can specify in CEETDLI, see *IMS Application Programming Guide* listed in the Bibliography of this document.
- For more information about CEETDLI in the context of other DLI interfaces, and in the context of IMS condition handling, see *z/OS Language Environment Programming Guide*.

Examples

```
/*Module/File Name: EDCMRCR   */

#pragma runopts(env(IMS),plist(IMS))
#include <ims.h>
#include <leawi.h>
#define io_pcb ((IO_PCB_TYPE *)(__pcblist??(0??)))

/* ------------------------------------------------ */
/*                                                  */
/*   Function: Use CEETDLI - interface to IMS       */
/*                           from C.                */
/*                                                  */
/*   In this example, a call is made to CEETDLI     */
/*   to interface to IMS for an IMS service.        */
/*                                                  */
/* ------------------------------------------------ */
/*                 ENTRY POINT                      */
/* ------------------------------------------------ */

main() {

  static char func_GU??(4??) = "GU  ";
  char msg_seg_io_area??(32??);
  CEETDLI(func_GU,io_pcb,msg_seg_io_area);
}
```

Figure 186. C Example of CEETDLI

```
      *Module/File Name: IGZTTDLI
      ***********************************************/
      **                                           */
      ** Function: Use CEETDLI - interface to IMS   */
      **                         from COBOL.        */
      **                                           */
      ** In this example, a call is made to CEETDLI */
      ** to interface to IMS for an IMS service.    */
      **                                           */
      ***********************************************/
       IDENTIFICATION DIVISION.
       PROGRAM-ID. CBL2IMS.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       77  FUNC-GU             PIC X(4) VALUE "GU  ".
       01  MSG-SEG-IO-AREA      PIC X(32).
       LINKAGE SECTION.
       01  IO-PCB              PIC X(48).
      ** ENTRY POINT:                              */
       PROCEDURE DIVISION USING IO-PCB.
           CALL "CEETDLI" USING FUNC-GU,IO-PCB,
                                MSG-SEG-IO-AREA.
           GOBACK.
```

Figure 187. COBOL Example of CEETDLI

```
*PROCESS MACRO SYSTEM(IMS);
 /*Module/File Name: IBMTDLI                          */
 /* ------------------------------------------- */
 /*                                             */
 /* Function: Use CEETDLI - interface to IMS    */
 /*                         from PL/I.          */
 /*                                             */
 /* In this example, a call is made to CEETDLI  */
 /* to interface to IMS for an IMS service.     */
 /*                                             */
 /* ------------------------------------------- */
 /*               ENTRY POINT                   */
 /* ------------------------------------------- */
 PLI2IMS: PROCEDURE(IO_PTR) OPTIONS(MAIN NOEXECOPS);

 %INCLUDE   CEEIBMAW;

 DCL   FUNC_GU         CHAR(4)   INIT('GU  ');

 DCL   IO_PTR          PTR;
 DCL 1 IO_PCB          CHAR(48) BASED (IO_PTR);

 DCL 1 MSG_SEG_IO_AREA CHAR(32);

 CALL CEETDLI (FUNC_GU, IO_PCB, MSG_SEG_IO_AREA);

 RETURN;

 END PLI2IMS;
```

Figure 188. PL/I Example of CEETDLI

CEETEST—Invoke Debug Tool

CEETEST invokes a debug service such as Debug Tool, which is supplied with z/OS.

Debug Tool supports debugging of Language Environment, except for some restrictions noted in *Debug Tool User's Guide and Reference*. If you want to invoke another interactive debug service, refer to the appropriate user's guide.

Syntax

```
►►──CEETEST──(──┬──────────────────────────┬──,──fc──)──────────────────────►◄
                └─string_of_commands──,────┘
```

string_of_commands (input)
A halfword-prefixed string containing a debug tool command list. *string_of_commands* is optional.

If a debug tool is available, the commands in the list are passed to the debug tool and carried out.

If this parameter is omitted, your debug service defines the action taken. For more information, refer to the appropriate user's guide for your debug service.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following Feedback Code can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE2F2	3	2530	A debug tool was not available.
CEE2F7	3	2535	Profiler loaded; a debug tool was not available.

Usage notes

- z/OS UNIX considerations—CEETEST applies to the enclave. All threads in the enclave can access debugger information.

For more information

- If you are using CEETEST to invoke Debug Tool and need more information about how to create a Debug Tool command list, refer to *Debug Tool User's Guide and Reference*.

Examples

```
/*Module/File Name: EDCTEST   */

#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {

   int x,y,z;
   _VSTRING commands;
   _FEEDBACK fc;

   strcpy(commands.string,
            "AT LINE 30 { LIST(x); LIST(y); GO; }");
   commands.length = strlen(commands.string);

   CEETEST(&commands,&fc);

   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEETEST failed with message number %d\n",
              fc.tok_msgno);
      exit(2999);
   }
   x = y = 12;
  /* .
     .
     . */
   /* debug tool displays the values of x and y */
   /* at statement 30 */
  /* .
     .
     . */
}
```

Figure 189. C/C++ Example of CEETEST

```
CBL LIB,QUOTE
      *Module/File Name: IGZTTEST
       IDENTIFICATION DIVISION.
       PROGRAM-ID. IBCT002.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01  MANVAR1                PIC S9(9) BINARY.
       01  CEETEST-PARMS.
           02  Vstring-length      PIC S9(4) BINARY.
           02  Vstring-text.
               03  Vstring-char    PIC X,
                           OCCURS 0 TO 256 TIMES
                           DEPENDING ON Vstring-length
                              of CEETEST-PARMS.
           01 FC.
           02  Condition-Token-Value.
           COPY  CEEIGZCT.
               03  Case-1-Condition-ID.
                   04  Severity    PIC S9(4) BINARY.
                   04  Msg-No      PIC S9(4) BINARY.
               03  Case-2-Condition-ID
                         REDEFINES Case-1-Condition-ID.
                   04  Class-Code  PIC S9(4) BINARY.
                   04  Cause-Code  PIC S9(4) BINARY.
               03  Case-Sev-Ctl    PIC X.
               03  Facility-ID     PIC XXX.
           02  I-S-Info            PIC S9(9) BINARY.
       PROCEDURE DIVISION.
       PARA-IBCT002.
           MOVE 0 TO MANVAR1
           COMPUTE MANVAR1 = MANVAR1 + 100
           DISPLAY "The value of MANVAR1 is " , MANVAR1
      ****************************************************
      *  CALL CEETEST FOR FIRST  TIME.                   *
      ****************************************************
           MOVE 70 TO Vstring-length of CEETEST-PARMS.
           MOVE "DESC PROGRAM AT ENTRY IBCT002:>SUBRTN"
             TO Vstring-text of CEETEST-PARMS(1:37).
           move " PERFORM Q LOC GO END-PERFORM GO "
             TO Vstring-text of CEETEST-PARMS(38:33).
           CALL "CEETEST" USING CEETEST-PARMS, FC.
           IF NOT CEE000 of FC  THEN
               DISPLAY "CEETEST(1st call) failed with msg "
                   Msg-No of FC UPON CONSOLE
               STOP RUN
           END-IF.
```

Figure 190. COBOL Example of CEETEST (Part 1 of 2)

```
*****************************************************
*  CALL CEETEST A SECOND TIME.                      *
*****************************************************
     MOVE 4 TO Vstring-length of CEETEST-PARMS.
     MOVE "QUIT "
       TO Vstring-text of CEETEST-PARMS.
     CALL "CEETEST" USING CEETEST-PARMS, FC.
     IF NOT CEE000 of FC  THEN
         DISPLAY "CEETEST(2nd call) failed with msg "
             Msg-No of FC UPON CONSOLE
         STOP RUN
     END-IF.
****************************************************
     GOBACK.
****************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. SUBRTN.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  MANVAR1                PIC S9(9) BINARY.
 01  MVAR                   PIC S9(9) BINARY.
PROCEDURE DIVISION.
 PARA-SUBRTN.
     COMPUTE MVAR = MVAR + 100 .
     COMPUTE MANVAR1 = MANVAR1 + 100 .

     GOBACK.
 END PROGRAM SUBRTN.
 END PROGRAM IBCT002.
```

Figure 190. COBOL Example of CEETEST (Part 2 of 2)

```
*PROCESS MACRO;
 /* Module/File Name: IBMTEST                          */
 /****************************************************/
 /**                                                **/
 /** Function: CEETEST - Invoke a Debug Tool        **/
 /**                                                **/
 /****************************************************/
 PLITEST: PROC OPTIONS(MAIN);

    %INCLUDE  CEEIBMAW;
    %INCLUDE  CEEIBMCT;

    DCL DBGCMD  CHAR(255) VARYING;
    DCL 01 FC,                    /* Feedback token */
           03 MsgSev    REAL FIXED BINARY(15,0),
           03 MsgNo     REAL FIXED BINARY(15,0),
           03 Flags,
              05 Case      BIT(2),
              05 Severity  BIT(3),
              05 Control   BIT(3),
           03 FacID     CHAR(3),      /* Facility ID */
           03 ISI   /* Instance-Specific Information */
                        REAL FIXED BINARY(31,0);

    DBGCMD = 'QUERY PROGRAMMING LANGUAGE';

    CALL CEETEST ( DBGCMD, FC );
    IF  FBCHECK( FC, CEE000)  THEN  DO;
       PUT SKIP LIST('Debug tool called with command: '
          || DBGCMD );
       END;
    ELSE  DO;
       DISPLAY('CEETEST failed with msg ' || FC.MsgNo);
       STOP;
       END;

 END PLITEST;
```

Figure 191. PL/I Example of CEETEST

CEEUTC—Get Coordinated Universal Time

CEEUTC is an alias of CEEGMT. See “CEEGMT—Get current Greenwich Mean Time” on page 297.

Chapter 4. Bit manipulation routines

This section contains an alphabetical list of the Language Environment bit manipulation routines.

In this section, bits are numbered from right to left, starting from 0.

CEESICLR—Bit clear

CEESICLR returns a copy of its *parm1* input, but with a single bit selectively set to 0.

Syntax

```
►►──CEESICLR──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the Bit Clear routine. The input can be any 32-bit integer.

parm2 (input)
The second input to the Bit Clear routine. The input is a 32-bit integer in the range 0 ≤ *parm2* ≤ 31.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

result (output)
The result of the Bit Clear routine. The output is a copy of *parm1*, but with the bit numbered *parm2* (counting from the right) set to 0.

CEESISET—Bit set

CEESISET returns a copy of its *parm1* input, but with a single bit selectively set to 1.

Syntax

```
►►──CEESISET──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the Bit Set routine. The input can be any 32-bit integer.

parm2 (input)
The second input to the Bit Set routine. The input is a 32-bit integer in the range 0 ≤ *parm2* ≤ 31.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

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The following symbolic conditions can result from this service:

result (output)
The result of the Bit Set routine. The output is a copy of *parm1*, but with the bit numbered *parm2* (counting from the right) set to 1.

CEESISHF—Bit shift

CEESISHF returns a copy of its *parm1* input right- or left-shifted by the number of bits indicated by *parm2*.

Syntax

```
►►──CEESISHF──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the Bit Shift routine. The input can be any 32-bit integer.

parm2 (input)
The second input to the Bit Shift routine. The input is a 32-bit integer in the range -32 ≤ *parm2* ≤ 32.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

result (output)
The result of the Bit Shift routine. The output is a 32-bit integer whose value depends upon the value of *parm2*:
If *parm2* ≥ 0, *result* is a copy of *parm1* shifted left by *parm2* bits.
If *parm2* < 0, *result* is a copy of *parm1* shifted right by |*parm2*| bits.

In either case, vacated bits are set to 0.

CEESITST—Bit test

CEESITST selectively tests a bit in its *parm1* input to determine if the bit is on.

Syntax

```
►►──CEESITST──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the Bit Test routine. The input can be any 32-bit integer.

parm2 (input)
The second input to the Bit Test routine. The input is a 32-bit integer in the range 0 ≤ *parm2* ≤ 31.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

result (output)
The result of the Bit Test routine. The output is a 32-bit integer with value:
1, if bit number *parm2* in *parm1* is 1
0, if bit number *parm2* in *parm1* is 0

Bits are counted from the right.

Chapter 5. Language Environment math services

Language Environment math services provide standard math computations. You can call them from Language Environment-conforming languages or from assembler routines by using the call interface (defined below and shown throughout this chapter), or the syntax specific to the HLL of your application.

Math services do not depend on enclave-level resources. You can invoke them from any thread.

If your application uses extended-precision arithmetic and runs on a 370-mode machine under VM, you must specify the TRAP(ON) run-time option (the default) and add the CMSLIB TXTLIB with the GLOBAL TXTLIB command.

This chapter contains the following sections:

- "Call interface to math services"
- "Sample calls to math services" on page 474
- "Examples of math services" on page 510
- "Math services" on page 475

Call interface to math services

The syntax for math services has two forms, depending on how many input parameters the routine requires. The first four letters of the math services are always CEES. The fifth character is *x*, which you replace according to the parameter types listed in "Parameter types: parm1 Type and parm2 type". The last three letters name the math function performed. In the following examples, the first function performed is the absolute value (ABS), and the second function is the positive difference (DIM).

One Parameter

```
►►──CEESxABS──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

Two Parameters

```
►►──CEESxDIM──(──parm1──,──parm2──,──fc──,──result──)──────────────────►◄
```

Parameter types: parm1 Type and parm2 type

The first parameter (*parm1*) is mandatory. The second parameter (*parm2*) is used only when you use a math service with two parameters. The *x* in the fifth space of CEESx must be replaced by a parameter type for input and output. Substitute I, S, D, Q, T, E, or R for *x*:

I 32-bit binary integer
S 32-bit single floating-point number
D 64-bit double floating-point number
Q 128-bit extended floating-point number

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T 32-bit single floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 32-bit single floating-point number.

E 64-bit double floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 64-bit double floating-point number.

R 128-bit extended floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 128-bit extended floating-point number.

Language Environment math services expect normalized input.

In the routines described in this chapter, the output range for complex-valued functions can be determined from the input range. For functions of complex variables, the image of the input is generally a non-rectangular shape. For this reason, the output range is not provided .

Feedback code parameter (fc)

The *fc* value is a feedback code that indicates the result of the math service. If you specify *fc* as an argument, feedback information in the form of a condition token is returned to the calling routine. The condition token indicates whether the routine completed successfully or whether a condition was encountered while the routine was running. If you do not specify *fc* as an argument and the requested service does not successfully complete, the condition is signaled. Math services call other services that might generate feedback codes.

Language-specific built-in math services

C/C++, COBOL, Fortran, and PL/I offer built-in math services that you can also use under Language Environment. For a description of these functions, see one of the language references listed in the bibliography.

Sample calls to math services

This section contains sample calls to Language Environment math services from C/C++, COBOL, and PL/I.

C/C++ call to CEESLOG—logarithm base e

```
#include <leawi.h>
#include <string.h>
#include <stdio.h>

int main (void) {

  float int1, intr;

  _FEEDBACK fc;
  #define SUCCESS "\0\0\0\0"

  int1 = 39;
  CEESSLOG(&int1,&fc,&intr);

  if (memcmp(&fc,SUCCESS,4) != 0) {
     printf("CEESSLOG failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  printf("Log base e of %f is %f\n",int1,intr);
}
```

COBOL call to CEESSLOG—logarithm base e

```
⋮
    77   ARG1RS  COMP-1.
    77   FBCODE  PIC X(12).
    77   RESLTRS COMP-1.

         CALL "CEESSLOG" USING ARG1RS , FBCODE , RESLTRS.
⋮
```

PL/I call to CEESSLOG—logarithm base e

```
⋮
DCL ARG1 RESULT REAL FLOAT DEC (6);
DCL FC   CHARACTER (12);

CALL CEESSLOG (ARG1, FC, RESULT)
⋮
```

Math services

This section contains an alphabetical list of the Language Environment math services.

CEESxABS—Absolute value

CEESxABS returns the absolute value of the parameter by using the equation *result* = |*parm1*|.

The following routines are provided for the various data types supported:

CEESIABS 32-bit binary integer
CEESSABS 32-bit single floating-point number
CEESDABS 64-bit double floating-point number
CEESQABS 128-bit extended floating-point number
CEESTABS 32-bit single floating-point complex number

CEESEABS 64-bit double floating-point complex number
CEESRABS 128-bit extended floating-point complex number

Syntax

```
►►──CEESxABS──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the absolute value routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*.

result (output)
The result of the absolute value routine. The output range is the non-negative numbers

$\leq \Omega$

Omega varies depending on the precision of *parm1*

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxACS—Arccosine

CEESxACS returns the arccosine of the parameter by using the equation *result* = arccos (*parm1*).

The following routines are provided for the various data types supported:
CEESSACS 32-bit single floating-point number
CEESDACS 64-bit double floating-point number
CEESQACS 128-bit extended floating-point number

Syntax

```
►►──CEESxACS──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the arccosine routine. The input range is

$|parm1| \leq 1$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V0	2	2016	The absolute value of the parameter was greater than *limit* in math routine *routine-name*.

result (output)
The result, in radians, of the arccosine routine.

$0 \leq result \leq \pi$

CEESxASN—Arcsine

CEESxASN returns the arcsine of the parameter by using the equation *result* = arcsin(*parm1*).

The following routines are provided for the various data types supported:
CEESSASN 32-bit single floating-point number
CEESDASN 64-bit double floating-point number
CEESQASN 128-bit extended floating-point number

Syntax

```
►►──CEESxASN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the arcsine routine. The input range is

$|parm1| \leq 1$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V0	2	2016	The absolute value of the parameter was greater than *limit* in math routine *routine-name*.

result (output)
The result, in radians, of the arcsine routine. The output range is

$|result| < \Pi/2$

CEESxATH—Hyperbolic arctangent

CEESxATH returns the hyperbolic arctangent of the parameter by using the equation

$result = \tanh^{-1}(parm1)$

The following routines are provided for the various data types supported:

CEESSATH 32-bit single floating-point number
CEESDATH 64-bit double floating-point number
CEESQATH 128-bit extended floating-point number
CEESTATH 32-bit single floating-point complex number
CEESEATH 64-bit double floating-point complex number
CEESRATH 128-bit extended floating-point complex number

Syntax

```
►►──CEESxATH──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the hyperbolic arctangent routine.

The input range for real variables is:

$|parm1| \leq 1$

For complex variables, *parm1* cannot be equal to 1 or −1.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code (fc)	Severity	Message number	Message text
CEE000	0	—	The service completed successfully.
CEE1V1	2	2017	The absolute value of the argument was greater than or equal to *limit* in math routine *routine-name*.
CEE1V6	2	2022	The value of the argument was plus or minus *limit* in math routine *routine-name*.

result (output)
The result of the hyperbolic arctangent routine. The output range for functions of real variables is

$|result| \leq \Omega$

Omega varies depending on the precision of *parm1*:

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxATN—Arctangent

CEESxATN returns the arctangent of the parameter by using the equation *result* = arctan(*parm1*).

The following routines are provided for the various data types supported:

CEESSATN 32-bit single floating-point number
CEESDATN 64-bit double floating-point number
CEESQATN 128-bit extended floating-point number
CEESTATN 32-bit single floating-point complex number
CEESEATN 64-bit double floating-pointcomplex number
CEESRATN 128-bit extended floating-point complex number

Syntax

```
►►──CEESxATN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the arctangent routine. The input range for real variables is not restricted. The input range of complex variables in *parm1* is not equal to i or -i, where

$i = \sqrt{-1}$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V6	2	2022	The value of the parameter was plus or minus *limit* in math routine *routine-name*.
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*.

result (output)
The result, in radians, of the arctangent routine. The output range for functions of real variables is

$|result| < \Pi/2$

CEESxAT2—Arctangent2

CEESxAT2 calculates a result by using the equation *result* = the angle (in radians) between the positive X axis and a vector defined by (*parm2*, *parm1*) with a range from

$-\Pi$ to Π, with Π,

For example, if *parm1* and *parm2* are positive, then *result* = arctan (*parm1*/*parm2*).

The following routines are provided for the various data types supported:

CEESSAT2 32-bit single floating-point number
CEESDAT2 64-bit double floating-point number
CEESQAT2 128-bit extended floating-point number

Syntax

```
►►──CEESxAT2──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the arctangent2 routine. The input range is *parm1* cannot equal 0 if *parm2* equals 0.

parm2 (input)
The second parameter to the arctangent2 routine. The input range is *parm2* cannot equal 0 if *parm1* equals 0.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UU	2	2014	Both parameters were equal to *limit* in math routine *routine-name*.
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*.

result (output)
The result, in radians, of the arctangent2 routine. The output range is

$|result| \leq \Pi$

CEESxCJG—Conjugate of complex

CEESxCJG returns the conjugate of the complex number by using the equation *result* = *u* - *vi*, where *parm1* = *u* + *vi*.

The following routines are provided for the various data types supported:

CEESTCJG 32-bit single floating-point complex number
CEESECJG 64-bit double floating-point complex number
CEESRCJG 128-bit extended floating-point complex number

Syntax

```
►►──CEESxCJG──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the math service. Any representable complex number can be used as input.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the conjugate of complex routine.

CEESxCOS—Cosine

CEESxCOS returns the cosine of the parameter by using the equation *result* = cos(*parm1*).

The following routines are provided for the various data types supported:
CEESSCOS 32-bit single floating-point number
CEESDCOS 64-bit double floating-point number
CEESQCOS 128-bit extended floating-point number
CEESTCOS 32-bit single floating-point complex number
CEESECOS 64-bit double floating-point complex number
CEESRCOS 128-bit extended floating-point complex number

Syntax

```
►►──CEESxCOS──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The type is determined by the fifth character of the service name. The input range for real variables is:

for single floating-point numbers,

$$|parm1| < (2^{18} \bullet \Pi)$$

for double floating-point numbers, and

$|parm1| < (2^{50} \bullet \Pi)$

for extended floating-point numbers.

$|parm1| < 2^{100}$

For complex functions, the input range differs for the imaginary and real parts of the input. For the imaginary part, the input range is:

$|\mathrm{Im}\ (parm1)| < 174.673$

For the real part, it is

$|\mathrm{Re}\ (parm1)| < (2^{18} \bullet \Pi)$

for single floating-point complex numbers,

$|\mathrm{Re}\ (parm1)| < (2^{50} \bullet \Pi)$

for double floating-point complex numbers, and

$|\mathrm{Re}\ (parm1)| < 2^{100}$

for extended floating-point complex numbers.

For complex functions, the input range differs for the imaginary and real parts of the input. For the imaginary part, the input range is

$|\mathrm{Im}\ (parm1)| < 174.673$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UT	2	2013	The absolute value of the imaginary part of the parameter was greater than *limit* in math routine *routine-name*.

Code	Severity	Message Number	Message Text
CEE1V1	2	2017	The absolute value of the parameter was greater than or equal to *limit* in math routine *routine-name*.
CEE1V3	2	2019	The absolute value of the real part of the parameter was greater than or equal to *limit* in math routine *routine-name*.

result (output)
The result of the cosine routine. The output range for functions of real variables is

$|result| \leq 1$

CEESxCSH—Hyperbolic cosine

CEESxCSH returns the hyperbolic cosine of the parameter by using the equation *result* = cosh(*parm1*).

The following routines are provided for the various data types supported:

CEESSCSH 32-bit single floating-point number
CEESDCSH 64-bit double floating-point number
CEESQCSH 128-bit extended floating-point number
CEESTCSH 32-bit single floating-point complex number
CEESECSH 64-bit double floating-point complex number
CEESRCSH 128-bit extended floating-point complex number

Syntax

```
►►──CEESxCSH──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the hyperbolic cosine routine.

The input range for the functions of real variables is:

$|parm1| < 175.366$

For complex functions, the input range differs for the imaginary and real parts. For the real part of complex numbers, it is

$|\mathrm{Re}\ (parm1)| < 174.673$

For the imaginary part of complex numbers, the input range is

$| \text{Im}(parm1)| < (2^{18} \bullet \Pi)$

for single floating-point complex numbers,

$| \text{Im}(parm1)| < (2^{50} \bullet \Pi)$

for double floating-point complex numbers, and

$| \text{Im}(\text{parm1}) | < 2^{100}$

for extended floating-point complex numbers.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V0	2	2016	The absolute value of the parameter was greater than *limit* in math routine *routine-name*.

result (output)
The result of the hyperbolic cosine routine. The output range for functions of real variables is

$1 \leq result \leq \Omega$

for single-precision routines,

$\Omega = 16^{63}(1 - 16^{6})$

$16^{63}(1 - 16^{-14})$

for double-precision routines, and for extended-precision routines.

$16^{63}(1 - 16^{-28})$

CEESxCTN—Cotangent

CEESxCTN returns the cotangent of the parameter by using the equation *result* = cot(*parm1*).

The following routines are provided for the various data types supported:

CEESSCTN 32-bit single floating-point number
CEESDCTN 64-bit double floating-point number
CEESQCTN 128-bit extended floating-point number

Syntax

```
►►──CEESxCTN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input, in radians, into the cotangent routine.

If *parm1* is a 32-bit single floating-point number, input range is

$|parm1| < (2^{18} \bullet \Pi)$

If *parm1* is a 64-bit double floating-point number, input range is

$|parm1| < (2^{50} \bullet \Pi)$

If *parm1* is a 128-bit extended floating-point number, the input range is

$|parm1| < 2^{100}$

If this is an extended floating-point number, this argument cannot approach a multiple of π. Single floating-point numbers and double floating-point numbers cannot approach zero.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UI	2	2002	The parameter value was too close to one of the singularities (plus or minus pi/2, plus or minus 3pi/2, for the tangent; or plus or minus pi, plus or minus 2pi, for the cotangent) in math routine *routine-name*.
CEE1V1	2	2017	The absolute value of the parameter was greater than or equal to *limit* in math routine *routine-name*.

result (output)
The result of the cotangent routine. The output range is

$|result| \leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

The output range is

result $\leq \Omega$

CEESxDIM—Positive difference

CEESxDIM returns the positive difference between two numbers by using one of the following equations:

if
then *result* = *parm1* - *parm2*

parm1 > *parm2*

if
then *result* = 0

parm1 [*parm2*

The following routines are provided for the various data types supported:

CEESIDIM	32-bit binary integer
CEESSDIM	32-bit single floating-point number
CEESDDIM	64-bit double floating-point number
CEESQDIM	128-bit extended floating-point number

Syntax

```
►►──CEESxDIM──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the positive difference routine. The input range is not restricted.

parm2 (input)
The second parameter to the positive difference routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the positive difference routine. The output range is the non-negative numbers

$\leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxDVD—Floating-point complex divide

CEESxDVD performs the mathematical function of floating-point complex divide by using the equation:

$$result = \frac{parm1}{parm2}$$

The following routines are provided for the various data types supported:

CEESTDVD 32-bit single floating-point complex number
CEESEDVD 64-bit double floating-point complex number
CEESRDVD 128-bit extended floating-point complex number

Syntax

```
►►──CEESxDVD──(──parm1──,──parm2──,──fc──,──result──)──────────────────►◄
```

parm1 (input)
The first input to the math service. Any representable complex number can be used as input.

parm2 (input)
The second parameter to the math service. Do not set *parm2* to 0.

fc (output)
A 12-byte feedback code passed by reference indicating the result of the service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the floating-point complex divide routine.

CEESxERC—Error function complement

CEESxERC calculates the error function complement by using the equation:

$$result = \left(1-\left(\frac{2}{\sqrt{\Pi}} \int_{o}^{parm1} e^{-u^2} du \right) \right)$$

complement.

The following routines are provided for the various data types supported:

CEESSERC 32-bit single floating-point number
CEESDERC 64-bit double floating-point number
CEESQERC 128-bit extended floating-point number

Syntax

```
►►──CEESxERC──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the error function complement routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the error function complement routine. The output range is

$0 < result < 2$

CEESxERF—Error function

CEESxERF calculates the error function by using the equation:

$$result = \frac{2}{\sqrt{\Pi}} \int_{o}^{parm1} e^{-u^2} du$$

The following routines are provided for the various data types supported:

CEESSERF 32-bit single floating-point number
CEESDERF 64-bit double floating-point number
CEESQERF 128-bit extended floating-point number

Syntax

```
►►──CEESxERF──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the error function. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the error function. The output range is

$|result| \leq 1$

CEESxEXP—Exponential base e

CEESxEXP calculates the mathematical function of e raised to a power by using the equation:

$result = e^{parm1}$

The following routines are provided for the various data types supported:

CEESSEXP 32-bit single floating-point number
CEESDEXP 64-bit double floating-point number
CEESQEXP 128-bit extended floating-point number
CEESTEXP 32-bit single floating-point complex number
CEESEEXP 64-bit double floating-point complex number
CEESREXP 128-bit extended floating-point complex number

Syntax

```
►►──CEESxEXP──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the exponential base e routine. The input range for functions of real variables is:

$|parm1| \leq 174.673$

For complex functions, the input range differs for the imaginary and real parts of the function. The input ranges are

for the real part of complex numbers.

$|\mathrm{Re}\ (parm1)| < 174.673$

For the imaginary part, the ranges are

$|\text{Im}\ (parm1)| < 2^{18}\Pi$

for single floating-point complex numbers,

$|\text{Im}\ (parm1)| < 2^{50}\ \Pi$

for double floating-point complex numbers, and

$|\text{Im}\ (parm1)| < 2^{100}$

for extended floating-point complex numbers.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UP	2	2009	The value of the real part of the parameter was greater than *limit* in math routine *routine-name*.
CEE1UR	2	2011	The parameter was greater than *limit* in math routine *routine-name*.
CEE1UT	2	2013	The absolute value of the imaginary part of the parameter was greater than *limit* in math routine *routine-name*.
CEE1UV	2	2015	The absolute value of the imaginary part of the parameter was greater than or equal to *limit* in math routine *routine-name*.
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*.

result (output)
The result of the exponential base e routine. The output range for functions of real variables is

$0 < \text{result} \leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxGMA—Gamma function

CEESxGMA performs the mathematical gamma function by using the equation:

$$result = \int_0^{\infty} u_{parm1} \text{-}1e_{-U}\, du$$

The following routines are provided for the various data types supported:
CEESSGMA 32-bit single floating-point number
CEESDGMA 64-bit double floating-point number

Syntax

```
►►──CEESxGMA──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the gamma function. The input range is

$2^{-252} < parm1 < 57.5744$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UL	2	2005	The value of the parameter was outside the valid range *range* in math routine *routine-name*.

result (output)
The result of the gamma function. The output range is

$0.88560 \leq result \leq \Omega$

$\Omega = 16^{63}(1\text{-}16^{6})$

for single-precision routines and

$\Omega = 16^{63}(1\text{-}16^{-14})$

for double-precision routines.

CEESxIMG—Imaginary part of complex

CEESxIMG returns the imaginary part of a complex number using the equation *result* = *v*, where *parm1* = *u* + *vi*.

The following routines are provided for the various data types supported:

CEESTIMG 32-bit single floating-point complex number
CEESEIMG 64-bit double floating-point complex number
CEESRIMG 128-bit extended floating-point complex number

Syntax

```
►►──CEESxIMG──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the math service. Any complex number can be used as input.

fc (output)
A 12-byte feedback code passed by reference indicating the result of the service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the math service is

$|result| \leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxINT—Truncation

CEESxINT returns the truncated value of the parameter by using the equation:

result = (sign of *parm*1) • n, where n = |parm1|

$|parm1| = |m|$

where *M* is the greatest integer satisfying the relationship and the result is expressed as a floating-point number.

$|m| \leq |parm1|$

The following routines are provided for the various data types supported:
CEESSINT 32-bit single floating-point number
CEESDINT 64-bit double floating-point number
CEESQINT 128-bit extended floating-point number

Syntax

```
►►──CEESxINT──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the truncation routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the truncation routine. The output range is

$$|result| \leq \Omega$$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxLGM—Log gamma

CEESxLGM performs the mathematical function of log gamma by using the equation:

$$result = \log_e \Gamma(parm1)$$

or

$$result = \log_e \int_0^{\infty} u^{parm1} - 1e^{-U}\, du$$

The following routines are provided for the various data types supported:
CEESSLGM 32-bit single floating-point number
CEESDLGM 64-bit double floating-point number

Syntax

```
►►──CEESxLGM──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the log gamma routine. The input range is

$parm1 < 4.2913 \bullet 10^{73}$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UL	2	2005	The value of the parameter was outside the valid range *range* in math routine *routine-name*.

result (output)
The result of the log gamma routine. The output range is

$-0.12149 \leq result \leq \Omega$

for single-precision routines and

$\Omega = 16^{63}(1-16^{6})$

$\Omega = 16^{63}(1-16^{-14})$

for double-precision routines.

CEESxLG1—Logarithm base 10

CEESxLG1 returns the logarithm base 10 of the input parameter by using the equation

$result = \log_{10} parm1$

The following routines are provided for the various data types supported:

CEESSLG1 32-bit single floating-point number
CEESDLG1 64-bit double floating-point number
CEESQLG1 128-bit extended floating-point number

Syntax

```
►►──CEESxLG1──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the log base 10 routine. The input range is *parm1* > 0.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1US	2	2012	The parameter was less than or equal to *limit* in math routine *routine-name*.

result (output)
The result of the log base 10 routine. The output range is

$-78.268 \leq result \leq 75.859$

CEESxLG2—Logarithm base 2

CEESxLG2 performs the mathematical function logarithm base 2 by using the equation

$result = \log_2 parm1$

The following routines are provided for the various data types supported:
CEESSLG2 32-bit single floating-point number
CEESDLG2 64-bit double floating-point number
CEESQLG2 128-bit extended floating-point number

Syntax

```
►►──CEESxLG2──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the log base 2 routine. The input range is *parm1* > 0.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1US	2	2012	The parameter was less than or equal to *limit* in math routine *routine-name*.

result (output)
The result of the log base 2 routine. The output range is

$-260 \leq result \leq 252$

CEESxLOG—Logarithm base e

CEESxLOG performs the mathematical function logarithm base e by using the equation

result = $\log_e$ *parm*1 *(result* = ln *parm*1*)*

The following routines are provided for the various data types supported:

CEESSLOG 32-bit single floating-point number
CEESDLOG 64-bit double floating-point number
CEESQLOG 128-bit extended floating-point number
CEESTLOG 32-bit single floating-point complex number
CEESELOG 64-bit double floating-point complex number
CEESRLOG 128-bit extended floating-point complex number

Syntax

```
►►──CEESxLOG──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the log base e routine. The input range for reals is

*parm*1 > 0

The input range for complex numbers is

*parm*1 ≠ 0

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1US	2	2012	The parameter was less than or equal to *limit* in math routine *routine-name*.
CEE1V2	2	2018	The real and imaginary parts of the parameter were equal to *limit* in math routine *routine-name*.

result (output)
The result of the log base e routine. The output range for functions of real variables is

-180.218 ≤ *result* ≤ 174.673

CEESxMLT—Floating-point complex multiply

CEESxMLT performs the mathematical function floating-point complex multiply by using the equation

result = *parm*1 • *parm*2

The following routines are provided for the various data types supported:

CEESTMLT 32-bit single floating-point complex number
CEESEMLT 64-bit double floating-point complex number
CEESRMLT 128-bit extended floating-point complex number

Syntax

```
►►──CEESxMLT──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The first input to the math service. Any representable complex number can be used as input.

parm2 (input)
The second parameter to the math service. Any representable complex number can be used as input.

fc (output)
A 12-byte feedback code passed by reference indicating the result of the service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the floating-point complex multiply routine.

CEESxMOD—Modular arithmetic

CEESxMOD performs the mathematical function modular arithmetic by using the equation

result = *parm*1(modulo *parm*2)

The expression

*parm*1(modulo *parm*2)

is defined as

*parm*1 - [(*parm*1/*parm*2)• *parm*2]

with the brackets indicating an integer part, that is, the largest integer whose magnitude does not exceed the magnitude of

*parm*1/*parm*2

is used. The sign of the integer is the same as the sign of

*parm*1• *parm*2

The following routines are provided for the various data types supported:

CEESIMOD 32-bit binary integer
CEESSMOD 32-bit single floating-point number
CEESDMOD 64-bit double floating-point number
CEESQMOD 128-bit extended floating-point number

Syntax

```
►►──CEESxMOD──(──parm1──,──parm2──,──fc──,──result──)──────────────────►◄
```

parm1 (input)
The first parameter to the modular arithmetic routine. The input range is not restricted.

parm2 (input)
The second parameter to the modular arithmetic routine. The input range is

*parm*2 $\neq$ 0

If *parm2* = 0, the modulus routine is undefined. In addition, a divide exception is recognized and an interrupt occurs.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the mod routine. The output range is

|*result*| $\leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxNIN—Nearest integer

CEESxNIN performs the mathematical function nearest integer by using the equation:

result = (sign of *parm*1) • n

If *parm*1 m 0, then *n* = [|*parm*1 + .5|]
If *parm*1 < 0, then *n* = [|*parm*1 - .5|]

n = |*m*|, where *m* is the greatest integer satisfying the relationship |*m*| [|*parm*1 + .5|, or |*m*| [|*parm*1 - .5|, respectively.

The following routines are provided for the various data types supported:
CEESSNIN 32-bit single floating-point number
CEESDNIN 64-bit double floating-point number

Syntax

```
►►──CEESxNIN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the nearest integer routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the nearest integer routine. The output parameter is an unrestricted type I, a 32-bit binary integer.

CEESxNWN—Nearest whole number

CEESxNWN performs the mathematical function nearest whole number by using the equation

result = (sign of parm1)•v

If *parm*1 $\geq$ 0, then *v* = [|*parm*1 +.5|]. If *parm*1 <0, then *v* = [|*parm*1 - .5|].

v = |*m*|, where *m* is the greatest integer satisfying the relationship |*m*|$\leq$|*parm*1 + .5|, or |*m*|$\leq$|*parm*1 - .5|, respectively.

and the resulting *v* is expressed as a floating-point number.

The following routines are provided for the various data types supported:
CEESSNWN 32-bit single floating-point number
CEESDNWN 64-bit double floating-point number

Syntax

```
►►──CEESxNWN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the nearest whole number routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the nearest whole number routine. The output range is

$|result| \leq \Omega$

$\Omega = 16^{63}(1-16^{6})$

for single-precision routines, and

$\Omega = 16^{63}(1-16^{-14})$

for double-precision routines.

CEESxSGN—Transfer of sign

CEESxSGN performs the mathematical function transfer of sign by using either of the two equations:

result = |*parm*1| if *parm*2 $\geq$ 0 or *result* = -|*parm*1| if *parm*2 < 0.

The following routines are provided for the various data types supported:

CEESISGN 32-bit binary integer
CEESSSGN 32-bit single floating-point number
CEESDSGN 64-bit double floating-point number
CEESQSGN 128-bit extended floating-point number

Syntax

```
►►─CEESxSGN─(─parm1─,─parm2─,─fc─,─result─)──────────────────────►◄
```

parm1 (input)
The first input to the transfer of sign routine. The input range is not restricted.

parm2 (input)
The second parameter to the transfer of sign routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the transfer of sign routine. The output range is

$|result| \leq \Omega$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxSIN—Sine

CEESxSIN returns the sine of the parameter by using the equation *result* = sin (*parm1*).

The following routines are provided for the various data types supported:

CEESSSIN 32-bit single floating-point number
CEESDSIN 64-bit double floating-point number
CEESQSIN 128-bit extended floating-point number
CEESTSIN 32-bit single floating-point complex number
CEESESIN 64-bit double floating-point complex number
CEESRSIN 128-bit extended floating-point complex number

Syntax

```
►►──CEESxSIN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input, in radians, to the sine routine.

For real functions, if *parm1* is a 32-bit single floating-point number, the input range is

$|parm1| < (2^{18} \bullet \Pi)$

If *parm1* is a 64-bit double floating-point number, the input range is

$|parm1| < (2^{50} \bullet \Pi)$

If *parm1* is an extended floating-point number, the input range is

$|parm1| < 2^{100}$

For complex functions, the input range differs for the imaginary and real parts of the input. For the imaginary part, the input range is

$|\mathrm{Im}\ (parm1)| < 174.673$

For the real part, it is

$|\mathrm{Re}\ (parm1)| < (2^{18} \bullet \Pi)$

for single floating-point complex numbers,

$|\mathrm{Re}\ (parm1)| < (2^{50} \bullet \Pi)$

for double floating-point complex numbers, and

$|\mathrm{Re}\ (parm1)| < 2^{100}$

for extended floating-point complex numbers.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UT	2	2013	The absolute value of the imaginary part of the parameter was greater than *limit* in math routine *routine-name*.
CEE1V1	2	2017	The absolute value of the parameter was greater than or equal to *limit* in math routine *routine-name*.
CEE1V3	2	2019	The absolute value of the real part of the parameter was greater than or equal to *limit* in math routine *routine-name*.

result (output)
The result of the sine routine. The output range for functions of real variables is

$-1 \leq result \leq 1$

CEESxSNH—Hyperbolic sine

CEESxSNH performs the mathematical function hyperbolic sine by using the equation *result* = sinh (*parm1*).

The following routines are provided for the various data types supported:

CEESSSNH 32-bit single floating-point number
CEESDSNH 64-bit double floating-point number
CEESQSNH 128-bit extended floating-point number
CEESTSNH 32-bit single floating-point complex number
CEESESNH 64-bit double floating-point complex number
CEESRSNH 128-bit extended floating-point complex number

Syntax

```
►►──CEESxSNH──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the hyperbolic sine routine. Input range for reals is:

$|parm1| < 175.366$

For complex functions, the input range differs for the imaginary and real parts of the input. For the real part, the input range is:

$|\mathrm{Re}(parm1)| < 174.673$

The input range of the imaginary part differs depending on the precision of *parm1*:

$|\mathrm{Im}(parm1)| < 2^{18} \bullet \Pi$

for single floating-point complex numbers,

$|\mathrm{Im}(parm1)| < 2^{50} \bullet \Pi$

for double floating-point complex numbers, and

$|\mathrm{Im}(parm1)| < 2^{100}$

for extended floating-point complex numbers.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1V0	2	2016	The absolute value of the parameter was greater than *limit* in math routine *routine-name*.

result (output)
The result of the hyperbolic sine routine. The output range for functions of real variables is

$|result| \leq \Omega$

CEESxSQT—Square root

CEESxSQT returns the square root of *parm1* by using the equation

$result = \sqrt{\mathrm{parm1}}$

The following routines are provided for the various data types supported:

CEESSSQT 32-bit single floating-point number
CEESDSQT 64-bit double floating-point number
CEESQSQT 128-bit extended floating-point number
CEESTSQT 32-bit single floating-point complex number
CEESESQT 64-bit double floating-point complex number
CEESRSQT 128-bit extended floating-point complex number

Syntax

```
►►──CEESxSQT──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the square root routine. The input range for real number functions is

$parm1 \geq 0$

For complex numbers, the input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UQ	2	2010	The parameter was less than *limit* in math routine *routine-name*.

result (output)
The result of the square root routine. The output range for functions of real variables is

$0 \leq result \leq \Omega^{1/2}$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxTAN—Tangent

CEESxTAN returns the tangent of the parameter by using the equation *result* = tan (*parm1*).

The following routines are provided for the various data types supported:

CEESSTAN 32-bit single floating-point number
CEESDTAN 64-bit double floating-point number
CEESQTAN 128-bit extended floating-point number
CEESTTAN 32-bit single floating-point complex number
CEESETAN 64-bit double floating-point complex number
CEESRTAN 128-bit extended floating-point complex number

Syntax

```
►►──CEESxTAN──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input, in radians, to the tangent routine.

If *parm1* is a single floating-point number, the input range is:

$|parm1| < 2^{18} \bullet \Pi$

If *parm1* is a double floating-point number, the input range is

$|parm1| < 2^{50} \bullet \Pi$

If *parm1* is an extended floating-point number, the input range is <

$|parm1| < 2^{100}$

Also, for extended as well as complex functions, this argument cannot approach odd multiples of

$\Pi/2$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UI	2	2002	The parameter value was too close to one of the singularities (plus or minus pi/2, plus or minus 3pi/2, for the tangent; or plus or minus pi, plus or minus 2pi, for the cotangent) in math routine *routine-name*.
CEE1V1	2	2017	The absolute value of the parameter was greater than or equal to *limit* in math routine *routine-name*.
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*.

result (output)
The result of the tangent routine. The output range for functions of real variables is

$|result| \leq \Omega$

CEESxTNH—Hyperbolic tangent

CEESxTNH performs the mathematical function hyperbolic tangent by using the equation: *result* = tanh (*parm1*).

The following routines are provided for the various data types supported:

CEESSTNH 32-bit single floating-point number
CEESDTNH 64-bit double floating-point number
CEESQTNH 128-bit extended floating-point number
CEESTTNH 32-bit single floating-point complex number
CEESETNH 64-bit double floating-point complex number
CEESRTNH 128-bit extended floating-point complex number

Syntax

```
►►──CEESxTNH──(──parm1──,──fc──,──result──)──────────────────────────►◄
```

parm1 (input)
The input to the hyperbolic tangent routine. The input range is not restricted for real functions. For complex functions, *parm1* must not approach odd multiples of

$\Pi/2 \bullet i$, where $i = \sqrt{-1}$

where

$i = \sqrt{-1}$

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.

result (output)
The result of the hyperbolic tangent routine. The output range for functions of real variables is:

$|result| < 1$

CEESxXPx—Exponentiation

CEESxXPx performs the mathematical function exponentiation by using the equation

$result = parm1^{parm2}$

The following routines are provided for the various data types supported:

CEESIXPI	32-bit binary integer raised to a 32-bit binary integer
CEESSXPI	32-bit single floating-point number raised to a 32-bit binary integer
CEESDXPI	64-bit double floating-point number raised to a 32-bit binary integer
CEESQXPI	128-bit extended floating-point number raised to a 32-bit binary integer
CEESTXPI	32-bit single floating-point complex number raised to a 32-bit binary integer
CEESEXPI	64-bit double floating-point complex number raised to a 32-bit binary integer
CEESRXPI	128-bit extended floating-point complex number raised to a 32-bit binary integer
CEESSXPS	32-bit single floating-pointing point raised to a 32-bit single floating-point
CEESDXPD	64-bit double floating-point raised to a 64-bit double floating-point
CEESQXPQ	128-bit extended floating-point raised to a 128-bit extended floating-point
CEESTXPT	32-bit single floating-point complex raised to a 32-bit single floating-point complex
CEESEXPE	64-bit double floating-point complex raised to a 64-bit double floating-point complex
CEESRXPR	128-bit extended floating-point complex raised to a 128-bit extended floating-point complex

Syntax

```
►►──CEESxXPx──(──parm1──,──parm2──,──fc──,──result──)──────────────────────►◄
```

parm1 (input)
The input for the base of the exponentiation routine. The input range for functions of real variables is as follows:

if → *parm1* = 0, then *parm2* > 0.

If *parm1* is a 32-bit number and *parm1* < 0, then and *parm2 = 'awholenumber'*.

$|parm1| \leq (16^6 - 1)$

If *parm1* is a 64-bit number and *parm1 < 0*, then and *parm2 = 'awholenumber'*.

$|parm1| \leq (16^{14} - 1)$

If *parm1* is a 128-bit number and *parm1 < 0*, then and *parm2 = 'awholenumber'*.

$|Parm1| \leq (16^{28} - 1)$

The input range for functions of complex variables: If Re(*parm1*) = 0 and Im(*parm1*) = 0, then Re(*parm2*) must be positive.

parm2 (input)
The input for the power of the exponentiation routine. The type is determined by the eighth character of the service name.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service.

The following symbolic conditions can result from this service:

Code	Severity	Message Number	Message Text
CEE000	0	—	The service completed successfully.
CEE1UJ	2	2003	For an exponentiation operation (I**J) where I and J are integers, I was equal to zero and J was less than or equal to zero in math routine *routine-name*.
CEE1UK	2	2004	For an exponentiation operation (R**I) where R is real and I is an integer, R was equal to zero and I was less than or equal to zero in math routine *routine-name*.
CEE1UL	2	2005	The value of the parameter was outside the valid range *range* in math routine *routine-name*.
CEE1UM	2	2006	For an exponentiation operation (R**S) where R and S are real values, R was equal to zero and S was less than or equal to zero in math routine *routine-name*.
CEE1UN	2	2007	The exponent exceeded *limit* in math routine *routine-name*.
CEE1UO	2	2008	For an exponentiation operation (Z**P) where the complex base Z equals zero, the real part of the complex exponent P, or the integer exponent P was less than or equal to zero in math routine *routine-name*.
CEE1V4	2	2020	For an exponentiation operation (R**S) where R and S are real values, either R is equal to zero and S is negative, or R is negative and S is not an integer whose absolute value is less than or equal to *limit* in math routine *routine-name*.
CEE1V5	2	2021	For an exponentiation operation (X**Y), the parameter combination of Y*log2(X) generated a number greater than or equal to *limit* in math routine *routine-name*.
CEE1V8	2	2024	An overflow has occurred in math operation (X**Y).
CEE1V9	1	2025	An underflow has occurred in math routine *routine-name*. The output value from the math routine is undefined.
CEE1VF	2	2031	The value of the argument was a non-positive whole number in math routine (X**Y).

result (output)
The result of the exponentiation routine. The output range for functions of real variables is

$|result| \leq \Omega$

Examples of math services

This section contains representative calls to math services from each supported language.

C/C++ math service example

The following are C/C++ examples.

Log base 10 and modular arithmetic (CEESDGL1 and CEESIMOD)

```
#include <leawi.h>
#include <string.h>
#include <stdio.h>

int main (void) {

  _FLOAT8 f1,result;
  _INT4 int1, int2, intr;

  _FEEDBACK fc;
  #define SUCCESS "\0\0\0\0"

  f1 = 1000.0;

  CEESDLG1(&f1,&fc,&result);

  if (memcmp(&fc,SUCCESS,4) != 0) {
     printf("CEESDLG1 failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  printf("%f log base 10 is %f\n",f1,result);

  int1 = 39;
  int2 = 7;
  CEESIMOD(&int1,&int2,&fc,&intr);

  if (memcmp(&fc,SUCCESS,4) != 0) {
     printf("CEESIMOD failed with message number %d\n",
            fc.tok_msgno);
     exit(2999);
  }

  printf("%d modulo %d is %d\n",int1,int2,intr);
}
```

COBOL math service examples

The following are COBOL examples.

Log base e (CEESSLOG)

```
77   ARG1RS  COMP-1.
77   FBCODE  PIC X(12).
77   RESLTRS COMP-1.

     CALL "CEESSLOG" USING ARG1RS , FBCODE ,
     RESLTRS.
```

Log base 10 (CEESDLG1)

```
77   ARG1RL  COMP-2.
77   FBCODE  PIC X(12).
77   RESLTRL COMP-2.


     CALL "CEESDLG1" USING ARG1RL , FBCODE ,
     RESLTRL.
```

Exponentiation (CEESIXPI)

```
77   ARG1IS  PIC S9(9) COMP.
77   ARG2IS  PIC S9(9) COMP.
77   FBCODE  PIC X(12).
77   RESLTIS PIC S9(9) COMP.


     CALL "CEESIXPI" USING ARG1IS , ARG2IS ,
     FBCODE , RESLTIS.
```

Exponentiation (CEESSXPI)

```
77   ARG1RS  COMP-1.
77   ARG2IS  PIC S9(9) COMP.
77   FBCODE  PIC X(12).
77   RESLTRS COMP-1.


     CALL "CEESSXPI" USING ARG1RS , ARG2IS ,
     FBCODE , RESLTRS.
```

Arctangent2 (CEESSAT2)

```
77   ARG1RS  COMP-1.
77   ARG2RS  COMP-1.
77   FBCODE  PIC X(12).
77   RESLTRS COMP-1.

     CALL "CEESSAT2" USING ARG1RS , ARG2RS ,
     FBCODE , RESLTRS.
```

PL/I math service examples

The following are PL/I examples.

EXAMPLES

Modular arithmetic and log base e (CEESIMOD and CEESSLOG)

```
PLIMATH: PROC OPTIONS(MAIN);

   DCL CEESSLOG ENTRY OPTIONS(ASM) EXTERNAL;
   DCL CEESIMOD ENTRY OPTIONS(ASM) EXTERNAL;

   DCL ARG1  RESULT REAL FLOAT DEC (6);
   DCL ARGM1 ARGM2  RES2 FLOAT BINARY(21)
   DCL FC    CHARACTER (12);

  /* Call log base e routine, which has    */
  /* only one input parameter              */
   CALL CEESSLOG (ARG1, FC, RESULT)

   IF ( FC = '000000000000000000000000'X )
     THEN DO;
       PUT SKIP LIST
          ( 'Error occurred in call to CEESSLOG.' );
     ELSE;

  /* Call modular arithmetic routine,      */
  /* which has two input parameters        */
   CALL CEESIMOD (ARGM1, ARGM2, FC, RES2);

   IF ( FC = '000000000000000000000000'X )
     THEN DO;
       PUT SKIP LIST
          ( 'Error occurred in call to CEESIMOD.' );
     ELSE;
   END;
```

Double-precision complex tangent (CEESETAN)

```
 TRYETAN:  PROCEDURE OPTIONS( MAIN );

    DECLARE FC           CHARACTER(12);
    DECLARE PARM1        COMPLEX FLOAT BINARY(53);
    DECLARE RESULT       COMPLEX FLOAT BINARY(53);

    DECLARE CEESETAN     ENTRY(COMPLEX FLOAT BINARY(53),
                            *, COMPLEX FLOAT BINARY(53))
                            OPTIONS(ASSEMBLER) EXTERNAL;


    PARM1 = COMPLEX(7,1.1);
    CALL CEESETAN ( PARM1, FC, RESULT);
    IF ( FC ¬= '000000000000000000000000'X) THEN
          PUT SKIP LIST( 'Error in call to CEESETAN.');
    ELSE
          PUT SKIP LIST( 'Result is ' || RESULT);
 END TRYETAN;
```

Appendix A. IBM-supplied country code defaults

Table 27 contains the currency symbols and default picture strings for the *country_code* parameters of the COUNTRY run-time option and the national language support callable services. See “COUNTRY” on page 22 and the services listed in Table 12 on page 8 for more information.

Note: In the table, some currency symbols are shown as X'9F404040'. An @euro codeset modifier can be used to get (euro-sign) instead of currency. How this is displayed differs; in the United States, it is shown as a '$' followed by three blanks.

Table 27. Defaults Currency and Picture Strings Based on COUNTRY Setting

Country/ Region	Country Code	Decimal Separator	Thousand Separator	Currency Symbol	Time Picture String	Date Picture String	Date and Time Picture String
Afghanistan	AF	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Albania	AL	,	.	Lek	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Algeria	DZ	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Andorra	AD	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Angola	AO	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Antigua and Barbuda	AG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Argentina	AR	,	.	A	HH.MI.SS	DD/MM/YY	DD/MM/YY HH.MI.SS
Australia	AU	.	,	$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Austria	AT	,	.	S	HH:MI:SS,999	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS,999
Bahamas	BS	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Bahrain	BH	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Bangladesh	BD	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Barbados	BB	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Belgium	BE	,	.	BF	HH:MI:SS,999	DD/MM/YY	DD/MM/YY HH:MI:SS,999
Benin	BJ	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Bermuda	BM	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Bolivia	BO	,	.	BS	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Bosnia/ Herzegovina	BA	,	.	Din	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Botswana	BW	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Brazil	BR	,	.	NCz$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Brunei Darussalam	BN	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Bulgaria	BG	,	.	Lv	HH:MI:SS	YYYY-RRRZ-DD	YYYY-RRRZ-DD HH:MI:SS
Burkina Faso (Upper Volta)	BF	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Burma	BU	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Canada	CA	.	,	$	HH:MI:SS.99	YY-MM-DD	YY-MM-DD HH:MI:SS.99
Cayman Islands	KY	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Chad	TD	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Chile	CL	,	.	$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Colombia	CO	,	.	$	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Costa Rica	CR	,	.	c/	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Croatia	HR	,	.	Din	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Cuba	CU	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Cyprus	CY	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS

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Table 27. Defaults Currency and Picture Strings Based on COUNTRY Setting (continued)

Country/ Region	Country Code	Decimal Separator	Thousand Separator	Currency Symbol	Time Picture String	Date Picture String	Date and Time Picture String
Czech Republic	CZ	,	.	X'D247A240'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Denmark	DK	,	.	kr	HH.MI.SS,99	DD-MM-YY	DD-MM-YY HH.MI.SS,99
Dominican Republic	DO	.	,	$	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Ecuador	EC	,	.	$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Egypt	EG	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
El Salvador	SV	.	,	c/.	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Estonia	EE	,		Kr	HH:MI:SS	DD-MM-YYYY	DD-MM-YYYY HH:MI:SS
Ethiopia	ET	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Finland	FI	,		Mk	HH.MI.SS,999	DD.MM.YYYY	DD.MM.YYYY HH.MI.SS,99
France	FR	,		F	HH:MI:SS,9	DD.MM.YYYY	DD.MM.YYYY HH:MI:SS,9
Gabon	GA	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Gambia	GM	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Germany	DE	,	.	DM	HH:MI:SS	DD.MM.YYYY	DD.MM.YYYY HH:MI:SS
Ghana	GH	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Greece	GR	,	.	Drs	HH:MI:SS.999	DD/MM/YY	DD/MM/YY HH:MI:SS.999
Guatemala	GT	.	,	Q	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Guinea- Bissau	GW	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Guyana	GY	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Haiti	HT	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Honduras	HN	.	,	L.	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
China (Hong Kong S.A.R.)	HK	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Hungary	HU	,		FT	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Iceland	IS	,	.	kr	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
India	IN	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Indonesia	ID	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Iran	IR	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Iraq	IQ	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Ireland	IE	,	,	X'5B404040'	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Israel	IL	.	,	NIS	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Italy	IT	,	.	L.	HH.MI.SS,999	DD/MM/YY	DD/MM/YY HH.MI.SS,999
Jamaica	JM	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Japan	JP	.	,	X'5B404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Jordan	JO	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Kenya	KE	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Korea, Republic of	KR	.	,	X'E0404040'	HH:MI:SS	YYYY.MM.DD	YYYY.MM.DD HH:MI:SS
Kuwait	KW	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Latvia	LV	,		Ls	HH:MI:SS	YYYY.DD.RRRZ	YYYY.DD.RRRZ HH:MI:SS
Lebanon	LB	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Lesotho	LS	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Liberia	LR	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Libya	LY	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Liecht- enstein							
Lithuania	LT	,	.	Lt	HH:MI:SS	YYYY.MM.DD	YYYY.MM.DD HH:MI:SS
Luxembourg	LU	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
China (Macau S.A.R.)	MO	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS

Table 27. Defaults Currency and Picture Strings Based on COUNTRY Setting (continued)

Country/ Region	Country Code	Decimal Separator	Thousand Separator	Currency Symbol	Time Picture String	Date Picture String	Date and Time Picture String
Macedonia, Former Yugoslav Republic of	MK	,	.	Den	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Madagascar	MG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Malawi	MW	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Malaysia	MY	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Mali	ML	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Mauritania	MR	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Mauritius	MU	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Mexico	MX	.	,	$	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Monaco	MC	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Morocco	MA	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Mozam- bique	MZ	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD HH:MI:SS	
Namibia	NA	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Netherlands	NL	,	.	F	HH:MI:SS	DD-MM-YY	DD-MM-YY HH:MI:SS
Netherlands Antilles	AN	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
New Caledonia	NC	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
New Zealand	NZ	.	,	$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Nicaragua	NI	.	,	X'9F404040'	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Niger	NE	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Nigeria	NG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Norway	NO	,	.	kr	HH:MI:SS,999	DD.MM.YY	DD.MM.YY HH:MI:SS,999
Oman	OM	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Pakistan	PK	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Panama	PA	.	,	B/	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Papua New Guinea	PG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Paraguay	PY	,	.	Gs.	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
People's Republic of China	CN	.	,	X'5B404040'	HH:MI:SS	YYYY.MM.DD	YYYY.MM.DD HH:MI:SS
Peru	PE	.	,	I/.	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Philippines	PH	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Poland	PL	,	.	X'E99A4040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Portugal	PT	,	.	Esc.	HH:MI:SS	DD-MM-YYYY	DD-MM-YYYY HH:MI:SS
Puerto Rico	PR	.	,	$	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Qatar	QA	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Taiwan	TW	.	,	$	HH:MI:SS.999	YY/MM/DD	YY/MM/DD HH:MI:SS.999
Romania	RO	,	.	Lei	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Russia	RU	,	.	Rub	HH:MI:SS	DD mmm. YYYY g.	DD mmm. YYYY g. HH:MI:SS
Saint Lucia	LC	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Saudi Arabia	SA	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Senegal	SN	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Seychelles	SC	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Sierra Leone	SL	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Singapore	SG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Slovakia	SK	,	.	X'D247A240'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Slovenia	SI	,	.	tol	HH:MI:SS	DD.MM.YYYY	DD.MM.YYYY HH:MI:SS
Somalia	SO	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS

Table 27. Defaults Currency and Picture Strings Based on COUNTRY Setting (continued)

Country/ Region	Country Code	Decimal Separator	Thousand Separator	Currency Symbol	Time Picture String	Date Picture String	Date and Time Picture String
South Africa	ZA	.		R	HHhMI:SS.999	YYYY-MM-DD	YYYY-MM-DD HHhMI:SS.999
Spain	ES	,	.	Pts	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Sri Lanka	LK	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Sudan	SD	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Surinam	SR	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Swaziland	SZ	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Sweden	SE	,	.	kr	kl HH.MI.SS	YYYY-MM-DD	YYYY-MM-DD kl HH.MI.SS
Switzer- land							
Syria	SY	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Tanzania	TZ	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Thailand	TH	.	,	X'70404040'	HH:MI:SS	DD/MM/YYYY	DD/MM/YYYY HH:MI:SS
Togo	TG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Tunisia	TN	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Turkey	TR	,	.	TL	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Uganda	UG	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Union of Soviet Socialist Republics (See note below)	SU	,	.	Rub	HH:MI:SS	DD mmm. YYYY g.	DD mmm. YYYY g. HH:MI:SS
United Arab Emirates	AE	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
United Kingdom	GB	.	,	X'5B404040'	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
United States	US	.	,	$	ZH:MI:SS AP	MM/DD/YY	MM/DD/YY ZH:MI:SS AP
Uruguay	UY	,	.	N$	HH:MI:SS	DD/MM/YY	DD/MM/YY HH:MI:SS
Vanuatu	VU	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Venezuela	VE	,	.	Bs.	ZH:MI:SS AP	DD/MM/YY	DD/MM/YY ZH:MI:SS AP
Western Samoa	WS	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Yemen	YE	,	.		HH:MI:SS	YYYY/MM/DD	YYYY/MM/DD HH:MI:SS
Yugoslavia	YU	,	.	Din	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Zaire	ZR	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Zambia	ZM	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS
Zimbabwe	ZW	,	.	X'9F404040'	HH:MI:SS	YYYY-MM-DD	YYYY-MM-DD HH:MI:SS

Note:

The Czechoslovakia country code CS is obsolete: Use either the Czech Republic country code CZ, or the Slovakia country code SK.

Country code DE was used for the former Federal Republic of Germany.

The SU country code is obsolete. Use the following country codes for the appropriate country: Estonia, EE; Latvia, LV; Lithuania, LT; Russian Federation, RU.

Appendix B. Date and time services tables

This appendix contains information to help you use Language Environment date and time callable services. Included are tables for picture term and national language era usage.

Table 28. Picture Character Terms Used in Picture Strings for Date and Time Services

Picture Terms	Explanations	Valid Values	Notes
Y YY YYY ZYY YYYY	1-digit year 2-digit year 3-digit year 3-digit year within era 4-digit year	0-9 00-99 000-999 1-999 1582-9999	Y valid for output only. YY ssumes range set by CEESCEN. YYY and ZYY valid only if used with <JJJJ>, <CCCC>, or <CCCCCCCC>.
<JJJJ>	Japanese era name in DBCS characters	*Heisei* (X'0E458D45BA0F') *Showa* (X'0E45B3457A0F') *Taisho* (X'0E455B45770F') *Meiji* (X'0E45A645840F')	Affects YY field: if <JJJJ> specified, YY means the year within Japanese era, for example, 1988 equals Showa 63. See example in Table 29 on page 518.
<CCCC> <CCCCCCCC>	Era name in DBCS characters	(X'0E4D8256CE0F') (X'0E4C845ADD4D8256CE0F')	Affects YY field: if <CCCC> specified, YY means the year within the era. See example in Table 29 on page 518.
MM ZM	2-digit month 1- or 2-digit month	01-12 1-12	For output, leading zero suppressed. For input, ZM treated as MM.
RRRR RRRZ	Roman numeral month	Ibbb-XIIb (Left justified)	For input, source string is folded to uppercase. For output, uppercase only. I=Jan, II=Feb, ..., XII=Dec.
MMM Mmm Mmmm...m MMMM...M MMMMMMMMMZ Mmmmmmmmmz	3-char month, uppercase 3-char month, mixed case 3-20 char mo., mixed case 3-20 char mo., uppercase trailing blanks suppressed trailing blanks suppressed	JAN-DEC Jan-Dec January-December JANUARY-DECEMBER JANUARYbb-DECEMBERb Januarybb-Decemberb	For input, source string always folded to uppercase. For output, M generates uppercase and m generates lowercase. Output is padded with blanks (b) (unless Z specified) or truncated to match the number of M's, up to 20.
DD ZD DDD	2-digit day of month 1- or 2-digit day of mo. day of year (Julian day)	01-31 1-31 001-366	For output, leading zero is always suppressed. For input, ZD treated as DD.
HH ZH	2-digit hour 1- or 2-digit hour	00-23 0-23	For output, leading zero suppressed. For input, ZH treated as HH. If AP specified, valid values are 01-12.
MI	minute	00-59	
SS	second	00-59	
9 99 999	tenths of a second hundredths of a second thousandths of a second	0-9 00-99 000-999	No rounding.
AP ap A.P. a.p.	AM/PM indicator	AM or PM am or pm A.M. or P.M. a.m. or p.m.	AP affects HH/ZH field. For input, source string always folded to uppercase. For output, AP generates uppercase and ap generates lowercase.
W WWW Www WWW...W Www...w WWWWWWWWWZ Wwwwwwwwwz	1-char day-of-week 3-char day, uppercase 3-char day, mixed case 3-20 char day, uppercase 3-20 char day, mixed case trailing blanks suppressed trailing blanks suppressed	S, M, T, W, T, F, S SUN-SAT Sun-Sat SUNDAY-SATURDAY Sunday-Saturday SUNDAYbbb-SATURDAYb Sundaybbb-Saturdayb	For input, Ws are ignored. For output, W generates uppercase and w generates lowercase. Output padded with blanks (unless Z specified) or truncated to match the number of Ws, up to 20.
All others	Delimiters Constants	X'01'-X'FF' (X'00' reserved for Language Environment use)	For input, treated as delimiters between the month, day, year, hour, minute, second, and fraction of a second. For output, copied exactly as is to the target string. Constant designating year in Russia, Estonia, Latvia, Lithuania, and the Russian Federation. Constant designating time in Sweden.

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Table 28. Picture Character Terms Used in Picture Strings for Date and Time Services (continued)

Picture Terms	Explanations	Valid Values	Notes

Note: If a `Z/z` could be interpreted as belonging to the preceding character string *and* to the following string, then it is always considered part of the following string, even if it would be legal with the preceding string but illegal with the following string. For clarity, you should always use a delimiter to define which string the `Z/z` belongs with. See Table 29 for an example.

Table 29. Examples of Picture Strings Recognized by Date and Time Services

Picture Strings	Examples	Notes
YYMMDD YYYYMMDD YYYY-MM-DD <JJJJ> YY.MM.DD <CCCC> YY.MM.DD	880516 19880516 1988-05-16 *Showa* 63.05.16 *MinKow* 77.05.16	1988-5-16 would also be valid input. *Showa* is a Japanese Era name. *Showa* 63 equals 1988.
MMDDYY MM/DD/YY ZM/ZD/YY MM/DD/YYYY MM/DD/Y	050688 05 688 05/06/88 5/6/88 05/06/1988 05/06/8	Accepts imbedded blanks 1-digit year format (`Y`) valid for output only
DD.MM.YY DD-RRRR-YY DD MMM YY DD Mmmmmmmmmm YY ZD Mmmmmmmmmz YY Mmmmmmmmmz ZD, YYYY	09.06.88 09-VI -88 09 JUN 88 09 June 88 9 June 88 June 9, 1988	Z suppresses zeros/blanks
YY.DDD YYDDD YYYY/DDD	88.137 88137 1988/137	Julian date
YYMMDDHHMISS YYYYMMDDHHMISS YYYY-MM-DD HH:MI:SS.999 WWW, ZM/ZD/YY HH:MI AP Wwwwwwwwwz DD Mmm YYYY ZH:MI AP	880516204229 19880516204229 1988-05-16 20:42:29.046 MON, 5/16/88 08:42 PM Monday, 16 May 1988, 8:42 PM	Timestamp valid only for CEESECS and CEEDATM. If used with CEEDATE, time positions are left blank. If used with CEEDAYS, `HH`, `MI`, `SS`, and `999` fields are ignored.

Note: Lowercase characters must be used only for alphabetic picture terms.

Table 30. Japanese Eras Used by Date/Time Services When <JJJJ> Specified

First Date of Japanese Era	Era Name	Era Name in IBM Japanese DBCS Code	Valid Year Values
1868-09-08	Meiji	X'0E45A645840F'	01-45
1912-07-30	Taisho	X'0E455B45770F'	01-15
1926-12-25	Showa	X'0E45B3457A0F'	01-64
1989-01-08	Heisei	X'0E458D45BA0F'	01-999 (01 = 1989)

Appendix C. Controlling storage allocation

The following run-time options control storage allocation:
- STACK
- THREADSTACK
- LIBSTACK
- THREADHEAP
- HEAP
- ANYHEAP
- BELOWHEAP
- STORAGE
- HEAPPOOLS

Ensure that these options are tuned appropriately to avoid performance problems. Tuning tips are provided in the *z/OS Language Environment Programming Guide*.

To generate a report of the storage a routine (or more specifically, an enclave) used during its run, specify the RPTSTG(ON) run-time option. The storage report, generated during enclave termination, provides statistics that can help you understand how space is being consumed as the enclave runs. If storage management tuning is desired, the statistics can help you set the corresponding storage-related run-time options for future runs. The output is written to the Language Environment message file.

Neither the storage report nor the corresponding run-time options include the storage that Language Environment acquires during early initialization, before run-time options processing, and before the start of space management monitoring.

Figure 192 on page 520 shows a sample storage report for a multithreading application, and the sections that follow describe the contents of the report.

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```
Storage Report for Enclave main 01/18/01 12:59:59 PM
Language Environment V1 R1.0
    STACK statistics:
      Initial size:                                        131072
      Increment size:                                      131072
      Maximum used by all concurrent threads:               12600
      Largest used by any thread:                           12600
      Number of segments allocated:                             1
      Number of segments freed:                                 0
    NONIPTSTACK statistics:
      Initial size:                                         32768
      Increment size:                                       32768
      Maximum used by all concurrent threads:                6552
      Largest used by any thread:                            2232
      Number of segments allocated:                             4
      Number of segments freed:                                 0
    LIBSTACK statistics:
      Initial size:                                          8192
      Increment size:                                        4080
      Maximum used by all concurrent threads:                 784
      Largest used by any thread:                             784
      Number of segments allocated:                             1
      Number of segments freed:                                 0
    THREADHEAP statistics:
      Initial size:                                          4096
      Increment size:                                        4096
      Maximum used by all concurrent threads:                   0
      Largest used by any thread:                               0
      Successful Get Heap requests:                             0
      Successful Free Heap requests:                            0
      Number of segments allocated:                             0
      Number of segments freed:                                 0
    HEAP statistics:
      Initial size:                                         32768
      Increment size:                                       32768
      Total heap storage used (sugg. initial size):         20312
      Successful Get Heap requests:                            25
      Successful Free Heap requests:                            3
      Number of segments allocated:                             1
      Number of segments freed:                                 0
    HEAP 24 statistics
      Initial size:                                          8192
      Increment size:                                        4096
      Total heap storage used (sugg. initial size)              0
      Successful Get Heap requests:                             0
      Successful Free Heap requests:                            0
      Number of segments allocated:                             0
      Number of segments freed:                                 0
    ANYHEAP statistics:
      Initial size:                                         16384
      Increment size:                                        8192
      Total heap storage used (sugg. initial size):        105256
      Successful Get Heap requests:                           412
      Successful Free Heap requests:                          391
```

Figure 192. Storage Report Produced by RPTSTG(ON) and HEAPPOOLS(ON) (Part 1 of 3)

```
  Number of segments allocated:                          2
  Number of segments freed:                              0
BELOWHEAP statistics:
  Initial size:                                       8192
  Increment size:                                     4096
  Total heap storage used (sugg. initial size):     240304
  Successful Get Heap requests:                         41
  Successful Free Heap requests:                        32
  Number of segments allocated:                          5
  Number of segments freed:                              4
Additional Heap statistics:
  Successful Create Heap requests:                       0
  Successful Discard Heap requests:                      0
  Total heap storage used:                               0
  Successful Get Heap requests:                          0
  Successful Free Heap requests:                         0
  Number of segments allocated:                          0
  Number of segments freed:                              0
Largest number of threads concurrently active:           2
 HEAPPOOLS Statistics:
   Pool 1 size:    8
     Successful Get Heap requests:    1-   8              5
   Pool 2 size:   32
     Successful Get Heap requests:    9-  16             55
     Successful Get Heap requests:   25-  32             14
   Pool 3 size:  128
     Successful Get Heap requests:   33-  40              2
     Successful Get Heap requests:   41-  48             17
     Successful Get Heap requests:   49-  56              3
     Successful Get Heap requests:   57-  64              2
     Successful Get Heap requests:  121- 128              2
   Pool 4 size:  256
     Successful Get Heap requests:  169- 176             30
     Successful Get Heap requests:  193- 200              3
     Successful Get Heap requests:  209- 216              4
     Successful Get Heap requests:  217- 224              1
     Successful Get Heap requests:  233- 240              1
     Successful Get Heap requests:  249- 256              1
   Pool 5 size: 1024
     Successful Get Heap requests:  257- 264              1
     Successful Get Heap requests:  289- 296              1
     Successful Get Heap requests:  313- 320              1
     Successful Get Heap requests:  377- 384              1
     Successful Get Heap requests:  393- 400              8
     Successful Get Heap requests:  505- 512              3
     Successful Get Heap requests:  513- 520              1
     Successful Get Heap requests:  697- 704              1
     Successful Get Heap requests:  761- 768              3
     Successful Get Heap requests:  793- 800              1
     Successful Get Heap requests:  865- 872              1
     Successful Get Heap requests:  873- 880              1
     Successful Get Heap requests:  993-1000              1
     Successful Get Heap requests: 1009-1016              1
     Successful Get Heap requests: 1017-1024              2
```

Figure 192. Storage Report Produced by RPTSTG(ON) and HEAPPOOLS(ON) (Part 2 of 3)

```
      Pool 6 size: 2048
        Successful Get Heap requests: 1265-1272                1
        Successful Get Heap requests: 1433-1440                1
        Successful Get Heap requests: 1785-1792                2
        Successful Get Heap requests: 2041-2048                2
      Requests greater than the largest cell size:            59
    HeapPools Summary:
      Cell  Extent   Cells Per  Extents    Maximum     Cells In
      Size  Percent  Extent     Allocated  Cells Used  Use
      ----------------------------------------------------------
         8     10       13107           1           5          1
        32     10        5242           1          50          5
       128     10        1542           1          24          2
       256     10         794           1          35         15
      1024     10         203           1          13          2
      2048     10         102           1           4          0
      ----------------------------------------------------------
      Suggested Percentages for current Cell Sizes:
        HEAPP(ON,8,1,32,1,128,1,256,1,1024,1,2048,1)
      Suggested Cell Sizes:
         HEAPP(ON,56,,176,,264,,520,,1024,,2048,)
    Largest number of threads concurrently active:             1

End of Storage Report
```

Figure 192. Storage Report Produced by RPTSTG(ON) and HEAPPOOLS(ON) (Part 3 of 3)

The statistics for initial and incremental allocations of storage types that have a corresponding run-time option differ from the run-time option settings when their values have been rounded up by the implementation, or when allocations larger than the amounts specified were required during execution. All of the following are rounded up to an integral number of double-words:

- Initial STACK allocations
- Initial allocations of all types of heap
- Incremental allocations of all types of stack and heap

Stack storage statistics

Language Environment stack storage is managed at the thread level—each thread has its own stack-type resources.

STACK, THREADSTACK, and LIBSTACK statistics

- Initial size—the actual size of the initial segment assigned to each thread. (If a pthread-attributes-table is provided on the invocation of pthread-create, then the stack size specified in the pthread-attributes-table will take precedence over the STACK run-time option.)
- Increment size—the size of each incremental segment acquired, as determined by the increment portion of the corresponding run-time option.
- Maximum used by all concurrent threads—the maximum amount allocated in total at any one time by all concurrently executing threads.
- Largest used by any thread—the largest amount allocated ever by any single thread.
- Number of segments allocated—the number of incremental segments allocated by all threads.
- Number of segments freed—the number of incremental segments freed by all threads.

The number of incremental segments freed could be less than the number allocated if any of the segments were not freed individually during the life of the thread, but rather were freed implicitly in the course of thread termination.

Determining the applicable threads

If the application is not a multithreading or PL/I multitasking application, then the STACK statistics are for the one and only thread that executed, and the THREADSTACK statistics are all zero.

If the application is a multithreading or PL/I multitasking application, and THREADSTACK was not suppressed, then the STACK statistics are for the initial thread (the IPT), and the THREADSTACK statistics are for the other threads. However, if THREADSTACK was suppressed, then the STACK statistics are for all of the threads, initial and other.

Allocating stack storage

Another type of stack, called the reserve stack, is allocated for each thread and used to handle out-of-storage conditions. Its size is controlled by the 4th subparameter of the STORAGE run-time option, but its usage is neither tracked nor reported in the storage report.

In a multithreaded environment, including PL/I multitasking applications, the initial allocations for all types of stack are made from library heap storage. Library stack and reserve stack are always allocated from BELOWHEAP. User stack is allocated from BELOWHEAP if STACK(,,BELOW) is specified or if ALL31(OFF) is specified; otherwise, it is allocated from ANYHEAP.

Language Environment acquires some initial storage, which is neither stack nor heap, at thread creation time; this storage is allocated from BELOWHEAP if ALL31(OFF) is in effect, or from ANYHEAP if ALL31(ON) is in effect.

Heap storage statistics

Language Environment heap storage, other than what is explicitly defined using THREADHEAP, is managed at the enclave level—each enclave has its own heap-type resources, which are shared by the threads that execute within the enclave. Heap storage defined using THREADHEAP is controlled at the thread level.

HEAP, HEAP24, THREADHEAP, ANYHEAP, and BELOWHEAP statistics

- Initial size—the default initial allocation, as specified by the corresponding run-time option. For HEAP24, the initial size indicates the value specified for the initsz24 suboption of the HEAP option.
- Increment size—the minimum incremental allocation, as specified by the corresponding run-time option. For HEAP24, the increment size is the value of the incrsz24 suboption of the HEAP option.

THREADHEAP statistics

- Maximum used by all concurrent threads—the maximum total amount used by all concurrent threads at any one time.
- Largest used by any thread—the largest amount used by any single thread.

HEAP, HEAP24, ANYHEAP, BELOWHEAP, and additional heap statistics

- Total heap storage used—the largest total amount used by the enclave at any one time.

HEAP, HEAP24, THREADHEAP, ANYHEAP, BELOWHEAP, and additional heap statistics

- Successful Get Heap requests—the number of Get Heap requests.
- Successful Free Heap requests—the number of Free Heap requests.
- Number of segments allocated—the number of incremental segments allocated.
- Number of segments freed—the number of incremental segments individually freed.

The number of Free Heap requests could be less than the number of Get Heap requests if the pieces of heap storage acquired by individual Get Heap requests were not freed individually, but rather were freed implicitly in the course of enclave termination.

The number of incremental segments individually freed could be less than the number allocated if the segments were not freed individually, but rather were freed implicitly in the course of enclave termination.

These statistics, in all cases, specify totals for the whole enclave. For THREADHEAP, they indicate the total across all threads in the enclave.

Additional heap statistics

Besides the fixed types of heap, additional types of heap can be created, each with its own heap ID. You can create and discard these additional types of heap by using the CEECRHP

- Successful Create Heap requests—the number of successful Create Heap requests.
- Successful Discard Heap requests—the number of successful Discard Heap requests.

The number of Discard Heap requests could be less than the number of Create Heap requests if the special heaps allocated by individual Create Heap requests were not freed individually, but rather were freed implicitly in the course of enclave termination.

Heap pools storage statistics

The HEAPPOOLS run-time option controls usage of the heap pools storage algorithm at the enclave level. The heap pools algorithm allows for the definition of one to six heap pools, each consisting of a number of storage cells of a specified length.

Heap pools statistics

- Pool *p* size: *ssss*
  - *p* — the number of the pool
  - *ssss*— the cell size specified for the pool.
- Successful Get Heap requests: *xxxx-yyyy n*
  - *xxxx* — the low side of the 8 byte range
  - *yyyy* — the high side of the 8 byte range
  - *n* — the number of requests in the 8 byte range.

- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the heap pools statistics report are not serialized when collected, therefore the values are not necessarily exact.

Heap pools summary

The Heap pools summary displays a report of the heap pool statistics and provides suggested percentages for current cell sizes as well as suggested cell sizes.

- Cell Size — the size of the cell specified in the HEAPPOOLS run-time option
- Extent Percent — the cell pool percent specified by the HEAPPOOLS run-time option
- Cells Per Extent — the number of cells per extent. This number is calculated using the following formula:

  ```
  Initial Heap Size * (Extent Percent/100))/(8 + Cell Size)
  ```

  with a minimum of one cell.

  Note: Having only one cell per extent is not recommended since the pool could allocate many extents, which would cause the heap pool algorithm to perform inefficiently.
- Extents Allocated — the number of times that each pool allocated an extent.

  In order to optimize storage usage, the extents allocated should be either one or two. If the number of extents allocated is too high, then increase the percentage for the pool.
- Maximum Cells Used — the maximum number of cells used for each pool.
- Cells In Use — the number of cells that were never freed.

  Note: A large number in this field could indicate a storage leak.
- Suggested Percentages for current Cell Sizes — percentages calculated to find the optimal size of the cell pool extent. The calculation is based on the following formula:

  ```
  (Maximum Cells Used * (Cell Size + 8) * 100) / Initial Heap Size
  With a minimum of 1% and a maximum of 90%
  ```

  Make sure that your cell pool extents are neither too large nor too small. If your percentages are too large then additional, unreferenced virtual storage will be allocated, thereby causing the program to exhaust the region size. If the percentages are too small (only one cell per extent — the worst case scenario) then the heap pools algorithm will run inefficiently.
- Suggested Cell Sizes: — sizes that are calculated to optimally use storage (assuming that the application will malloc/free with the same frequency).

  Note: The suggested cell sizes are given with no percentages because the usage of each new cell pool size is not known. If there are less than 6 pool sizes calculated then the last pool will be set at 2048.

For more information about stack and heap storage, see *z/OS Language Environment Programming Guide*.

Appendix D. Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully. The major accessibility features in z/OS enable users to:

- Use assistive technologies such as screen-readers and screen magnifier software
- Operate specific or equivalent features using only the keyboard
- Customize display attributes such as color, contrast, and font size

Using assistive technologies

Assistive technology products, such as screen-readers, function with the user interfaces found in z/OS. Consult the assistive technology documentation for specific information when using it to access z/OS interfaces.

Keyboard navigation of the user interface

Users can access z/OS user interfaces using TSO/E or ISPF. Refer to *z/OS TSO/E Primer*, *z/OS TSO/E User's Guide*, and *z/OS ISPF User's Guide Volume I* for information about accessing TSO/E and ISPF interfaces. These guides describe how to use TSO/E and ISPF, including the use of keyboard shortcuts or function keys (PF keys). Each guide includes the default settings for the PF keys and explains how to modify their functions.

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