GnuCOBOL Manual

for GnuCOBOL 4.0-early-dev

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2 Getting started

2.1 Hello, world!

This is a sample program that displays “Hello, world!”:

```
---- hello.cob -------------------------
      * Sample COBOL program
       IDENTIFICATION DIVISION.
       PROGRAM-ID. hello.
       PROCEDURE DIVISION.
           DISPLAY "Hello, world!".
           STOP RUN.
----------------------------------------
```

The compiler, `cobc`, is executed as follows:

```
$ cobc -x hello.cob
$ ./hello
Hello, world!
```

The executable file name (`hello` in this case) is determined by removing the extension from the source file name.

You can specify the executable file name by specifying the compiler option `-o` as follows:

```
$ cobc -x -o hello-world hello.cob
$ ./hello-world
Hello, world!
```

The program can be written in a more modern style, with free format code, inline comments, the `GOBACK` verb and an optional `END-DISPLAY` terminator:

```
---- hellonew.cob ----------------
*> Sample GnuCOBOL program
identification division.
program-id. hellonew.
procedure division.
display
   "Hello, new world!"
```

```
end-display
goback.
----------------------------------
```

To compile free-format code, you must use the compiler option `-free`.

```
$ cobc -x -free hellonew.cob
$ ./hellonew
Hello, new world!
```

3 Compile

This chapter describes how to compile COBOL programs using GnuCOBOL.

3.1 Compiler options

The compiler `cobc` accepts the options described in this section. The compiler arguments follow the general syntax `cobc options file [file …]`. A complete list of options can be displayed by using the option `--help`.

3.1.1 Help options

The following switches display information about the compiler:

`--help, -h`
: Display help screen (see Appendix A). No further actions will be taken.

`--version, -V`
: Display compiler version, author package date and executable build date. No further actions will be taken.

`-dumpversion`
: Display internal compiler version (plain string of numbers). No further actions will be taken.

`--info`
: Display build information along with the default and current compiler configurations. No further actions will be taken except for further display options.

`--verbose, -v`
: Verbosely display the programs invoked during compilation and additional diagnostics. Use multiple times to increase the verbosity.

`--list-reserved`
: Display reserved words (see Appendix B). A Yes/No output shows if the word is supported[1], context sensitive and its aliases. The given options for reserved words specified for example by option `-std=dialect` will be taken into account. No further actions will be taken except for further display options.

`--list-intrinsics`
: Display intrinsic functions (see Appendix C). A Y/N field shows if the function is implemented. No further actions will be taken except for further display options.

[1] Support may be partial or complete.

`--list-system`
: Display system routines (see Appendix D). No further actions will be taken except for further display options.

`--list-mnemonics`
: Display mnemonic names (see Appendix E). No further actions will be taken except for further display options.

`--list-exceptions`
: Display exception names (see Appendix F). No further actions will be taken except for further display options.

3.1.2 Build target

The compiler `cobc` treats files like `*.cob`, `*.cbl` as COBOL source code, `*.c` as C source code, `*.o` as object code, `*.i` as preprocessed code and `*.so` as dynamic modules and knows how to handle such files in the generation, compilation, and linking steps.

The special input name `-` takes input from `stdin` which is assumed to be COBOL source, and uses a default output name of `a.out` (or `a.so/c/o/i`, selected as appropriate) for the build type.

You may also use `-` as output name for the listing file or the preprocessor result, for example with `cobc -t - prog.cob` / `cobc -P- prog.cob`.

By default, the compiler builds a dynamically loadable module.

The following options specify the target type produced by the compiler:

`-E`
: Preprocess only: compiler directives are executed, comment lines are removed, and `COPY` and `REPLACE` statements are performed. The output is sent to stdout, allowing you to directly use it as input for another process. You can manually set an output file using `-o`.

`--copy copybook`
: Include `copybook` at the beginning of the source code, as if `COPY copybook` had been parsed.

`--include file.h`
: Add a `#include file.h` at the beginning of the generated C source file. The file name is put into quotes, unless it starts by `<`. Quoted files should be absolute paths, since C files are compiled in temporary directories. The directive `>>IMP INCLUDE "FILE.h"` or `>>IMP INCLUDE <FILE.h>` can be used as an alternative to this compiler option. The option also implies `-fno-gen-c-decl-static-call`. This option can be used to check function prototypes when static calls are used. When this option is used, the source file is compiled in the project directory (instead of the temp directory), and no prototypes are generated, so ALL static call functions must appear in the header file, with GnuCOBOL compatible types.

-C

Translation only. COBOL source files are translated into C files. The output is saved in file `*.c`.

--save-temps

Normal compilation with additional storing the preprocessed files as `*.i` and the translated C files as file `*.c`.

-S

Compile only. Translated C files are compiled by the C compiler to assembler code. The output is saved in file `*.s`.

-c

Compile and assemble. This is equivalent to `cc -c`. The output is saved in file `*.o`.

-m

Compile, assemble, and build a dynamically loadable module (i.e., a shared library). The output is saved in file `*.so`.[2] This is the default behaviour.

-b

Compile, assemble, and combine all input files into a single dynamically loadable module. Unless `-o` is also used, the output is saved using the first filename as `*.so`.

-x

Include the main function in the output, creating an executable image. The main entry point being the first program in the file.

This option takes effect at the translation stage. If you give this option with `-C`, you will see the main function at the end of the generated C file.

-j, -job, -j=args, -job=args

Run job after compilation. Either from executable with `-x`, or with `cobcrun` when compiling a module. Optional arguments <args>, if given, are passed to the program or module command line.

-I directory

Add <directory> to copy/include search path.

-L directory

Add <directory> to library search path.

-l lib

Link the library <lib>.

-D define

Pass <define> to the COBOL compiler.

[2]The extension varies depending on your host.

-o file
Place the output into <file>.

3.1.3 Source format

GnuCOBOL supports fixed, free, Micro Focus' Variable, X/Open Free-form, ICOBOL xCard and Free-form, ACUCOBOL-GT Terminal, and COBOLX source formats. By default, the compiler tries to autodetect the format using the indicator on the first line, using the fixed format for correct indicators and the free format for incorrect ones. This can be overridden either by the `>>SOURCE [FORMAT] [IS] {FIXED|FREE|COBOL85|VARIABLE|XOPEN|XCARD|CRT|TERMINAL|COBOLX|AUTO}` directive, or by one of the following options:

-free, -F, -fformat=free
Free format. The program-text area starts in column 1 and continues till the end of line (effectively 255 characters in GnuCOBOL).

-fixed, -fformat=fixed
Fixed format. Source code is divided into: columns 1-6, the sequence number area; column 7, the indicator area; columns 8-72, the program-text area; and columns 72-80 as the reference area.[3]

-fformat=cobol85
Fixed format with enforcements on the use of Area A.

-fformat=variable
Micro Focus' Variable format. Identical to the fixed format above except for the program-text area which extends up to column 250 instead of 72.

-fformat=xcard
ICOBOL xCard format. Variable format with right margin set at column 255 instead of 250.

-fformat=xopen
X/Open Free-form format. The program-text area may start in column 1 unless an indicator is present, and lines may contain up to 255 characters. Indicator for debugging lines is '`D`' (D followed by a space) instead of '`D`' or '`d`'.

-fformat=crt
ICOBOL Free-form format (CRT). Similar to the X/Open format above, with lines containing up to 320 characters and single-character debugging line indicators ('`D`' or '`d`').

-fformat=terminal
ACUCOBOL-GT Terminal format. Similar to the CRT format above, with indicator for debugging lines being '`\D`' instead of '`D`' or '`d`'. This format is mostly compatible with VAX COBOL terminal source format.

[3] Historically, fixed format was based on 80-character punch cards.

-fformat=cobolx
: COBOLX format. This format is similar to the CRT format above, except that the indicator area is always present in column 1; the program-text area starts in column 2 and extends up to the end of the record. Lines may contain up to 255 characters.

-fformat=auto
: Autodetection of format. The compiler will use the first line of the file to detect whether the file is in fixed format (with a correct indicator at position 7), or in free format.

Note that with source formats `XOPEN`, `CRT`, `TERMINAL`, and `COBOLX`, missing spaces are not inserted within continued alphanumeric literals that are truncated before the right margin.

Area A denotes the source code that spans between margin A and margin B, and Area B spans from the latter to the end of the record. *Area A enforcement* checks the contents of Area A, and reports any item that does not belong to the correct Area: this feature helps in developping COBOL programs that are portable to actual mainframe environments.

In general, division, section, and paragraph names must start in Area A. In the `DATA DIVISION`, level numbers '`01`' and '`77`', must also start in Area A. In the `PROCEDURE DIVISION`s, statements and separator periods must fit within Area B. Every source format listed above may be subject to Area A enforcement, except `FIXED`, `FREE`, and `XOPEN`.

Note that Area A enforcement enables recovery from missing periods between paragraphs and sections.

3.1.4 Warning options

Warnings are diagnostic messages that report constructions that are not inherently erroneous but that are risky or suggest there may have been an error.

The following options do not enable specific warnings but control the kinds of diagnostics produced by `cobc`.

-fsyntax-only
: Check Check the code for syntax errors, but don't do anything beyond that.

-fmax-errors=n
: Limits the maximum number of error messages to <n>, at which point `cobc` bails out rather than attempting to continue processing the source code. If <n> is 0, there is no limit on the number of error messages produced. If `-Wfatal-errors` is also specified, then `-Wfatal-errors` takes precedence over this option.

-w
: Inhibit all warning messages.

-Werror
: Make all warnings into errors.

-Werror=warning

Make the specified <warning> into an error. The specifier for a warning is appended; for example `-Werror=obsolete` turns the warnings controlled by `-Wobsolete` into errors. This switch takes a negative form, to be used to negate `-Werror` for specific warnings; for example `-Wno-error=obsolete` makes `-Wobsolete` warnings not be errors, even when `-Werror` is in effect.

The warning message for each controllable warning includes the option that controls the warning. That option can then be used with `-Werror=` and `-Wno-error=` as described above. (Printing of the option in the warning message can be disabled using the `-fno-diagnostics-show-option` flag.)

Note that specifying `-Werror=foo` automatically implies `-Wfoo`. However, `-Wno-error=foo` does not imply anything.

-Wfatal-errors

This option causes the compiler to abort compilation on the first error occurred rather than trying to keep going and printing further error messages.

You can request many specific warnings with options beginning with '`-W`', for example `-Wimplicit-define` to request warnings on implicit declarations. Each of these specific warning options also has a negative form beginning '`-Wno`' to turn off warnings; for example, `-Wno-implicit-define`. This manual lists only one of the two forms, whichever is not the default.

Some options, such as `-Wall` and `-Wextra`, turn on other options, such as `-Wtruncate`. The combined effect of positive and negative forms is that more specific options have priority over less specific ones, independently of their position in the command-line. For options of the same specificity, the last one takes effect.

-Wall

Enable all the warnings about constructions that some users consider questionable, and that are easy to avoid (or modify to prevent the warning). The list of warning flags turned on by this option is shown in `--help`.

-Wextra, -W

Enable every possible warning that is not dialect specific. This includes more information than `-Wall` would normally provide. (This option used to be called `-W`. The older name is still supported, but the newer name is more descriptive.)

-Wwarning

Enable single warning <warning>.

-Wno-warning

Disable single warning <warning>.

-Warchaic
: Warn if archaic features are used, such as continuation lines or the `NEXT SENTENCE` statement.

-Wcall-params
: Warn if non-01/77-level items are used as arguments in a `CALL` statement. This is *not* set with `-Wall`.

-Wcolumn-overflow
: Warn if text after column 72 in FIXED format. This is *not* set with `-Wall`.

-Wconstant
: Warn inconsistent constant

-Wimplicit-define
: Warn if implicitly defined data items are used.

-Wlinkage
: Warn dangling `LINKAGE` items. This is *not* set with `-Wall`.

-Wobsolete
: Warn if obsolete features are used.

-Wparentheses
: Warn about any lack of parentheses around `AND` within `OR`.

-Wredefinition
: Warn about incompatible redefinitions of data items.

-Wstrict-typing
: Warn about type mismatch strictly.

-Wterminator
: Warn about the lack of scope terminator END-XXX. This is *not* set with `-Wall`.

-Wtruncate
: Warn on possible field truncation. This is *not* set with `-Wall`.

`-Wconstant-expression`

-Wconstant-numlit-expression
: Warn about expressions that always resolve to true/false and therefore lead to unreachable code.

-Wunreachable
: Warn if statements are likely unreachable. This is *not* set with `-Wall`.

-Wadditional
: Enable warnings that don't have an own warning flag.

3.1.5 Diagnostics options

The compiler provides some options to tune the way errors and warnings (diagnostics) are displayed to the user.

`-fdiagnostics-absolute-paths`
: Print absolute paths in diagnostics. This option can be useful if your editor is not able to correctly locate relative paths in your project.

`-fdiagnostics-plain-output`
: Make diagnostic output as plain as possible.

`-fno-diagnostics-show-option`
: Suppress output of option that directly controls the diagnostic, on which warnings should be displayed.

`-fno-diagnostics-show-caret`
: Do not display source context on warning/error diagnostic. By default, diagnostics contain an excerpt with two lines before and after the location.

`-fno-diagnostics-show-line-numbers`
: Suppress display of line numbers in the source context in diagnostics

3.1.6 Configuration options

The compiler uses many dialect specific options. These may be set via a defined dialect by `-std=`, a configuration file by `-conf=` or by using the single dialect flags directly.

See Compiler Configuration, and `config/*.conf`.

Note concerning the defined dialects: The GnuCOBOL compiler tries to limit both the feature-set and reserved words to the specified compiler when the "strict" dialects are used. COBOL sources compiled with these dialects are therefore *likely* to compile with the specified compiler and vice versa: sources that were compiled on the specified compiler should compile without any issues with GnuCOBOL. With the "non-strict" dialects GnuCOBOL will activate the complete feature-set where it doesn't directly conflict with the specified dialect, including reserved words. COBOL sources compiled with these dialects therefore may work only with GnuCOBOL. COBOL sources may need a change because of reserved words in GnuCOBOL, otherwise offending words <word-1> and <word-2> may be removed by `-fno-reserved=word-1,word-1`.

The dialects COBOL-85, X/Open COBOL, COBOL 2002 and COBOL 2014 are always "strict".

`-std=dialect`
: Compiler uses the given <dialect> to determine certain compiler features and warnings.

-std=default
: GnuCOBOL dialect, supporting many of the COBOL 2002 and COBOL 2014 features, many extensions found in other dialects and its own feature-set

-std=cobol85
: COBOL-85 without any extensions other than the amendment Intrinsic Function Module (1989), source compiled with this dialect is likely to compile with most COBOL compilers

-std=xopen
: X/Open COBOL (based on COBOL-85) without any vendor extensions, source compiled with this dialect is likely to compile with most COBOL compilers; will warn items that "should not be used in a conforming X/Open COBOL source program"

-std=cobol2002, -std=cobol2014
: COBOL 2002 / COBOL 2014 without any vendor extensions, use `-Warchaic` and `-Wobsolete` if archaic/obsolete features should be flagged

-std=ibm-strict, -std=ibm
: IBM compatible

-std=mvs-strict, -std=mvs
: MVS compatible

-std=mf-strict, -std=mf
: Micro Focus compatible

-std=bs2000-strict, -std=bs2000
: BS2000 compatible

-std=acu-strict, -std=acu
: ACUCOBOL-GT compatible

-std=rm-strict, -std=rm
: RM/COBOL compatible

-std=realia-strict, -std=realia
: CA Realia II compatible

-std=gcos-strict, -std=gcos
: GCOS compatible

-freserved-words=dialect
: Compiler uses the given <dialect> to determine the reserved words.

-conf=<file>
: User-defined dialect configuration.

-febcdic-table=cconv-table/file

EBCDIC/ASCII translation table to use; either read from <file>, or one of the existing <cconv-table> from the configuration directory (see `cobc --info`) which have a .ttbl extension, for example `-febcdic-table=alternate`. See the `default.ttbl` file for detailed information about the format. You may use the `--gentable` option to build such tables. Note that this option may affect LOW/HIGH-VALUE if using a non-native program collating sequence.

You can override each single configuration entry by using compiler configuration options on the command line.

Examples:

```
-frelax-syntax-checks
-frenames-uncommon-levels=warning
-fnot-reserved=CHAIN,SCREEN
-ftab-width=4
```

See Compiler `cobc` options.

3.1.7 Listing options

-t=file

Generate and place the standard print listing into `file`.

-T=file

Generate and place a wide print listing into `*file`.

--tlines=lines

Specify lines per page in print listing, default = 55. Set to zero for no additional page breaks.

-ftsymbols

Generate symbol table in listing.

-fno-theader

Suppress all headers from listing while keeping page breaks.

-fno-tmessages

Suppress warning and error summary from listing.

-fno-tsource

Suppress actual source from listing (for example to only produce the cross-reference).

-P, -Pdirectory, -P=file

Generate and place a preprocessed listing (old format) into `filename.lst`, `directory/filename.lst`, `file`.

`-Xref`

-X

Generate cross reference in the listing.

Here is an example program listing with the options `-t -ftsymbols`:

```
GnuCOBOL 3.0.0   test.cbl                  Mon May 14 10:23:45 2018  Page 0001

LINE    PG/LN  A...B.........................................................

000001         IDENTIFICATION   DIVISION.
000002         PROGRAM-ID.      prog.
000003         ENVIRONMENT DIVISION.
000004         CONFIGURATION SECTION.
000005         DATA             DIVISION.
000006         WORKING-STORAGE  SECTION.
000007         COPY 'values.cpy'.
000001C        78  I   VALUE 20.
000002C        78  J   VALUE 5000.
000003C        78  M   VALUE 5.
000008         01  SETUP-REC.
000009             05  FL1       PIC X(04).
000010             05  FL2       PIC ZZZZZ.
000011             05  FL3       PIC 9(04).
000012             05  FL4       PIC 9(08) COMP.
000013             05  FL5       PIC 9(04) COMP-4.
000014             05  FL6       PIC Z,ZZZ.99.
000015             05  FL7       PIC S9(05) SIGN LEADING SEPARATE.
000016             05  FL8       PIC X(04).
000017             05  FL9 REDEFINES FL8 PIC 9(04).
000018             05  FLA.
000019                 10  FLB OCCURS I TIMES.
000020                     15  FLC PIC X(02).
000021                 10  FLD   PIC X(20).
000022             05  FLD1      PIC X(100).
000023             05  FLD2 OCCURS M TO J TIMES DEPENDING ON FL5.
000024                 10  FILLER PIC X(01).
000025             05  FLD3      PIC X(3).
000026             05  FLD4      PIC X(4).
000027         PROCEDURE        DIVISION.
000028             STOP RUN.
```

The first part of the listing lists the program text. If the program text is a COPY the line number reflects the COPY line number and is appended with a '`C`'.

When the wide list option `-T` is specified, the `SEQUENCE` columns (for fixed-form reference-format) are included in the listing.

The second part of the listing file is the listing of the Symbol Table:

```
GnuCOBOL 3.0.0   test.cbl                  Mon May 14 10:23:45 2018  Page 0002

SIZE TYPE           LVL  NAME                          PICTURE

5204 GROUP          01   SETUP-REC
0004 ALPHANUMERIC   05     FL1                         X(04)
0005 ALPHANUMERIC   05     FL2                         ZZZZZ
0004 ALPHANUMERIC   05     FL3                         9(04)
0004 NUMERIC        05     FL4                         9(08) COMP
0002 NUMERIC        05     FL5                         9(04) COMP
0008 ALPHANUMERIC   05     FL6                         Z,ZZZ.99
0006 ALPHANUMERIC   05     FL7                         S9(05)
0004 ALPHANUMERIC   05     FL8                         X(04)
0004 ALPHANUMERIC-R 05     FL9                         9(04)
0060 ALPHANUMERIC   05     FLA
0040 ALPHANUMERIC   10       FLB                       OCCURS 20
0002 ALPHANUMERIC   15         FLC                     X(02)
0020 ALPHANUMERIC   10       FLD                       X(20)
0100 ALPHANUMERIC   05     FLD1                        X(100)
5000 ALPHANUMERIC   05     FLD2                        OCCURS 5 TO 5000
0001 ALPHANUMERIC   10       FILLER                    X(01)
0003 ALPHANUMERIC   05     FLD3                        X(3)
0004 ALPHANUMERIC   05     FLD4                        X(4)
```

If the symbol redefines another variable the `TYPE` is marked with 'R'. If the symbol is an array the `OCCURS` phrase is in the `PICTURE` field.

The last part of the listing file is the summary of warnings an error in the compilation group:

```
0 warnings in compilation group
2 errors in compilation group
```

3.1.8 Debug switches

`-g`

Produce C debugging information in the output.

`--debug, -d`

Enable all run-time error checks.

-fmemory-check=scope
Enable checking of internal storage during CALL (implied by `--debug`.

-fec=exception-name, -fno=ec=exception-name
Enable/disable specified exception checks, see Exception Names; `--debug` implies `-fec=ALL`.

-fsource-location
Generate source location code (implied by `--debug`, `-fdump` and `-fec`).

-fstack-check
Enable `PERFORM` stack checking (implied by `--debug` or `-g`).

-ftrace
Generate trace code (log executed procedures, if tracing is enabled).

-ftraceall
Generate trace code (log executed procedures and statements, if tracing is enabled).

-fdebugging-line
Enable debugging lines ('`D`' in indicator column; '`>>D`' directive).

-O
Enable optimization of code size and execution speed. See your C compiler documentation, for example `man gcc` for details.

-O2
Optimize even more.

-Os
Optimize for size. Optimizer will favour code size over execution speed.

-fnotrunc
Do not truncate binary fields according to PICTURE.

3.1.9 Automatic Prerequisites

Dependencies are files containing the content included by `COPY` statements. These options are usually used by build systems to extract dependencies from COBOL files. The dependencies can then be used to decide when a file should be recompiled or not.

-M
Output dependency list in Makefile format on stdout. Stop after preprocessing the file and do not generate any other files.

-MT <target>
Set/add target file used in dependency list

-MQ <target>
Same as -MT but with Makefile-quoting of the target

-MF <file>
Specify a filename <file> where to output dependencies

-MP
Create phony targets for all dependencies

-MG
Output missing dependencies without complaining

-MD
Output dependencies in .d files while compiling

3.1.10 Miscellaneous

-ext <extension>
Add default file extension.

-fintrinsics=[ALL|intrinsic function name(,name,...)]
Allow use of all or specific intrinsic functions without `FUNCTION` keyword.

Note: defining this within your source with `CONFIGURATION SECTION. REPOSITORY.` is preferred.

-ffold-copy=LOWER
Fold `COPY` subject to lower case (default no transformation).

-ffold-copy=UPPER
Fold `COPY` subject to upper case (default no transformation).

-save-temps(=<dir>)
Save intermediate files (by default, in current directory).

-fimplicit-init
Do automatic initialization of the COBOL runtime system.

--gentable=ebcdic-enc,ascii-enc[+]
Build an EBCDIC/ASCII translation table between <ebcdic-enc> and <ascii-enc>, and exit. The translation might not be reversible: characters with no equivalent in the other encoding are mapped to the substitution character, thus leaving unused characters in both encodings. Append + to make the translation reversible, by arbitrarily mapping together these unused characters.

3.2 Multiple sources

This section describes how to compile a program from multiple source files.

This section also describes how to build a shared library that can be used by any COBOL program and how to use external libraries in COBOL programs.

3.2.1 Static linking

The easiest way of combining multiple files is to compile them into a single executable.

One way is to compile all the files in one command:

```
$ cobc -x -o prog main.cob subr1.cob subr2.cob
```

Another way is to compile each file with the option `-c`, and link them at the end. The top-level program must be compiled with the option `-x`.

```
$ cobc -c subr1.cob
$ cobc -c subr2.cob
$ cobc -c -x main.cob
$ cobc -x -o prog main.o subr1.o subr2.o
```

You can link C routines as well using either method:

```
$ cobc -o prog main.cob subrs.c
```

or

```
$ cobc -c subrs.c
$ cobc -c -x main.cob
$ cobc -x -o prog main.o subrs.o
```

Any number of functions can be contained in a single C file.

The linked programs will be called dynamically; that is, the symbol will be resolved at run time. For example, the following COBOL statement

```
CALL "subr" USING X.
```

will be converted into equivalent C code like this:

```
int (*func)() = cob_resolve("subr");
if (func != NULL)
  func (X);
```

With the compiler option `-fstatic-call`, more efficient code will be generated:

```
subr(X);
```

Please notice that this option only takes effect when the called program name is in a literal (like `CALL "subr"`). With a data name (like `CALL SUBR`), the program is still called dynamically.

3.2.2 Dynamic linking

There are two methods to achieve this: a driver program, or compiling the main program and subprograms separately.

3.2.2.1 Driver program

Compile all programs with the option `-m`:

```
$ cobc -m main.cob subr.cob
```

This creates the shared object files `main.so` and `subr.so`.[4]

Before running the main program, install the module files in your library directory:

```
$ cp subr.so /your/cobol/lib
```

Set the runtime variable `COB_LIBRARY_PATH` to your library directory, and run the main program:

```
$ export COB_LIBRARY_PATH=/your/cobol/lib
```

(*Please notice:* You may set the variable via a runtime configuration file, see Runtime Configuration. You may also set the variable to directly point to the directory where you compiled the sources.)

Now execute your program:

```
$ cobcrun main
```

3.2.2.2 Compiling programs separately

The main program is compiled as usual:

```
$ cobc -x -o main main.cob
```

Subprograms are compiled with the option `-m`:

```
$ cobc -m subr.cob
```

This creates a module file `subr.so`[5].

Before running the main program, install the module files in your library directory:

```
$ cp subr.so /your/cobol/lib
```

[4] The extension used depends on your operating system.
[5] The extension used depends on your operating system.

Now, set the environment variable `COB_LIBRARY_PATH` to your library directory, and run the main program:

```
$ export COB_LIBRARY_PATH=/your/cobol/lib
$ ./main
```

3.2.3 Building library

You can build a shared library by combining multiple COBOL programs and even C routines:

```
$ cobc -c subr1.cob
$ cobc -c subr2.cob
$ cc -c subr3.c
$ cc -shared -o libsubrs.so subr1.o subr2.o subr3.o
```

3.2.4 Using library

You can use a shared library by linking it with your main program.

Before linking the library, install it in your system library directory:

```
$ cp libsubrs.so /usr/lib
```

or install it somewhere else and set `LD_LIBRARY_PATH`:

```
$ cp libsubrs.so /your/cobol/lib
$ export LD_LIBRARY_PATH=/your/cobol/lib
```

Then, compile the main program, linking the library as follows:

```
$ cobc -x main.cob -L/your/cobol/lib -lsubrs
```

3.3 C interface

This chapter describes how to combine C programs with COBOL programs.

3.3.1 Writing Main Program in C

Include `libcob.h` in your C program and call `cob_init` before using any COBOL module. Do a cleanup afterwards, either by calling `cob_stop_run` (if your program should terminate) or by calling `cob_tidy` (if your program should execute further on without any more COBOL calls). Calling `cob_init`, one or several GnuCOBOL modules and then `cob_tidy` in this sequence can be done multiple times).

```
#include <libcob.h>

int
main (int argc, char **argv)
{
  /* initialize your program */
  ...

  /* initialize the COBOL run-time library */
  cob_init (argc, argv);

  /* rest of your program */
  ...

  /* Clean up and terminate - This does not return */
  cob_stop_run (return_status);
}
```

You can write `cobc_init(0, NULL);` if you do not want to pass command line arguments to COBOL.

You can compile your C program as follows:

```
cc -c `cob-config --cflags` main.c
```

The compiled object must be linked with libcob as follows:

```
cc -o main main.o `cob-config --libs`
```

3.3.2 Static linking with COBOL programs

Let's call the following COBOL module from a C program:

```
---- say.cob ---------------------------
       IDENTIFICATION DIVISION.
       PROGRAM-ID. say.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       LINKAGE SECTION.
       01 hello PIC X(7).
       01 world PIC X(6).
       PROCEDURE DIVISION USING hello world.
           DISPLAY hello world.
```

```
           GOBACK.
---------------------------------------
```

This program accepts two arguments, displays them, and exits.

From the viewpoint of C, this is equivalent to a function having the following prototype:

```
extern int say(char *hello, char *world);
```

So, your main program will look like as follows:

```
---- hello.c ---------------------------
#include <libcob.h>

extern int say(char *hello, char *world);

int
main()
{
  int ret;
  char hello[8] = "Hello, ";
  char world[7] = "world!";

  /* initialize the COBOL run-time library */
  cob_init(0, NULL);

  /* call the static module and store its return code */
  ret = say(hello, world);

  /* shutdown the COBOL run-time library, keep program running */
  (void)cob_tidy();

  return ret;
}
---------------------------------------
```

Compile and run these programs as follows:

```
$ cobc -x hello.c say.cob
$ ./hello
Hello, world!
```

or, more split and directly using the C compiler:

```
$ cc -c `cob-config --cflags` hello.c
$ cobc -c -static say.cob
$ cobc -x -o hello hello.o say.o
$ ./hello
Hello, world!
```

Note: The biggest benefits of static linking are that all programs are verified to be available in the resulting binary. Furthermore there is a slightly performance benefit in this type of CALL (not visible for "normal" programs).

3.3.3 Dynamic linking with COBOL programs

You can find a COBOL module having a specific name by using the C function `cob_resolve`, which takes the module name as a string and returns a pointer to the module function.

`cob_resolve` returns `NULL` if there is no module. In this case, the function `cob_resolve_error` returns the error message.

Let's see an example:

```
---- hello-dynamic.c --------------------
#include <libcob.h>

static int (*say)(char *hello, char *world);

int main()
{
  int ret;
  char hello[8] = "Hello, ";
  char world[7] = "world!";

  /* initialize the COBOL run-time library */
  cob_init(0, NULL);

  /* Find the module with PROGRAM-ID "say". */
  say = cob_resolve("say");

  /* If there is no such module, show error and exit. */
  if(say == NULL) {
    fprintf(stderr, "%s\n", cob_resolve_error());
    exit(1);
  }
```

```
  /* Call the module found ... */
  ret = say(hello, world);

  /* ...and exit with the return code. */
  cob_stop_run(ret);
}
----------------------------------------
```

Compile and run these programs as follows:

```
$ cobc -x -o hello hello-dynamic.c
$ cobc -m say.cob
$ export COB_LIBRARY_PATH=.
$ ./hello
Hello, world!
```

The check of the module load as written above can be directly done in libcob as follows:

```
---- hello-dynamic2.c ------------------
#include <libcob.h>

int main()
{
  int ret;
  char hello[8] = "Hello, ";
  char world[7] = "world!";

  void *cob_argv[2];
  cob_argv[0] = hello;
  cob_argv[1] = world;

  /* initialize the COBOL run-time library */
  cob_init(0, NULL);

  /* do a CALL, expecting the module to exist,
     otherwise exiting with an error. */
  ret = cob_call ("say", 2, cob_argv);

  /* ...and exit with the return code. */
  cob_stop_run(ret);
}
----------------------------------------
```

In any case be aware that all errors that happen within COBOL will exit your program, as same as a `STOP RUN` will do.

Depending on the application you possibly want to register C signal handlers; error and/or exit handlers in C and/or COBOL to do cleanups, logging or anything else.

There is one way to handle all these scenarios with a call, too, using `cob_call_with_exception_check` instead of `cob_call` as follows:

```
---- hello-dynamic3.c ------------------
#include <libcob.h>

int main()
{
  int ret;
  char hello[8] = "Hello, ";
  char world[7] = "world!";

  void *cob_argv[2];
  cob_argv[0] = hello;
  cob_argv[1] = world;

  /* initialize the COBOL run-time library */
  cob_init(0, NULL);

  /* do a CALL, catching all possible results, */
  ret = cob_call_with_exception_check ("say", 2, cob_argv);

  switch (ret) {
  case 0:  /* program coming back */

    /* Clean up and terminate runtime */
    cob_runtime_hint("program exited with return code %d",
       cob_last_exit_code ());
    cob_tidy ();
    break;

  case 1:  /* normal exit */
    cob_runtime_hint("STOP RUN with return code %d",
       cob_last_exit_code ());
    break;

  case -1:  /* error exit */
```

```
    cob_runtime_hint("error exit with return code %d and error \"%s\"",
       cob_last_exit_code (), cob_last_runtime_error ());
    break;

  case -2:  /* hard error exit */
    cob_runtime_hint("hard error exit with return code %d and error \"%s\"",
       cob_last_exit_code (), cob_last_runtime_error ());
    break;

  case -3:  /* signal handler  exit */
    cob_runtime_hint("signal handler exit with signal %d and error \"%s\"",
       cob_last_exit_code (), cob_last_runtime_error ());
    break;

  default:
    cob_runtime_hint("unexpected return from cob_call_with_exception_check,"
       " last exit code %d, last error \"%s\"",
       cob_last_exit_code (), cob_last_runtime_error ());
    break;
  }

  /* ...and exit with zero if no error happened */
  exit(ret != 0 && ret != 1);
}
----------------------------------------
```

3.3.4 Static linking with C programs

Let's call the following C function from COBOL:

```
---- say.c -----------------------------
int say(char *hello, char *world)
{
  int i;
  for(i = 0; i < 7; i++)
    putchar(hello[i]);
  for(i = 0; i < 6; i++)
    putchar(world[i]);
  putchar('\n');
  return 0;
}
----------------------------------------
```

This program is equivalent to the program in `say.cob` above.

Note that, unlike C, the arguments passed from COBOL programs are not terminated by the null character (i.e., '`\0`').

You can call this function in the same way you call COBOL programs:

```
---- hello.cob -------------------------
       IDENTIFICATION DIVISION.
       PROGRAM-ID. hello.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01 hello PIC X(7) VALUE "Hello, ".
       01 world PIC X(6) VALUE "world!".
       PROCEDURE DIVISION.
       CALL "say" USING hello world.
       STOP RUN.
---------------------------------------
```

Compile these programs as follows:

```
$ cobc -x -o hello -static hello.cob say.c
$ ./hello
Hello, world!
```

or separate:

```
$ cc -c say.c
$ cobc -c -static -x hello.cob
$ cobc -x -o hello hello.o say.o
$ ./hello
Hello, world!
```

3.3.5 Dynamic linking with C programs

You can create a dynamically-linked module from a C program by compiling it with cobc ...

```
$ cobc -m say.c
$ cobc -x hello.cob
$ export COB_LIBRARY_PATH=.
$ ./hello
Hello, world!
```

or with most C compilers by passing option `-shared` to the C compiler:

```
$ cc -shared -o say.so say.c
$ cobc -x hello.cob
$ export COB_LIBRARY_PATH=.
$ ./hello
Hello, world!
```

Mind that for COBOL to be able to load the module via CALL the name of the binary must either be identical to the CALL name or the binary containing the entry-point must have been loaded before (by a previous call or COB_PRE_LOAD).

3.3.6 Redirecting output to a (FILE *)

From a module written in C you can call `cob_set_runtime_option` to set the exact `(FILE *)` which is used to write trace data to. In `common.h` is the following:

```
enum cob_runtime_option_switch {
   COB_SET_RUNTIME_TRACE_FILE              /* 'p' is  FILE *  */
   COB_SET_RUNTIME_DISPLAY_PRINTER_FILE    /* 'p' is  FILE *  */
   COB_SET_RUNTIME_RESCAN_ENV              /* rescan environment variables */
   COB_SET_RUNTIME_DISPLAY_PUNCH_FILE      /* 'p' is  FILE *  */
   COB_SET_RUNTIME_STDIN_FILE              /* 'p' is  FILE *  */
   COB_SET_RUNTIME_STDOUT_FILE             /* 'p' is  FILE *  */
   COB_SET_RUNTIME_STDERR_FILE             /* 'p' is  FILE *  */
};
COB_EXT_IMPORT  void  cob_set_runtime_option   (enum cob_runtime_option_switch opt,
void *p);
```

So from you C code you can tell the GnuCOBOL runtime to redirect TRACE output by:

```
cob_set_runtime_option (COB_SET_RUNTIME_TRACE_FILE,
                        (void*)((FILE*)myfd));
```

You could also redirect all `DISPLAY UPON PRINTER` output to a file by:

```
cob_set_runtime_option (COB_SET_RUNTIME_DISPLAY_PRINTER_FILE,
                        (void*)((FILE*)myfd));
```

You could also redirect all `DISPLAY UPON SYSPUNCH` output to a file by:

```
cob_set_runtime_option (COB_SET_RUNTIME_DISPLAY_PUNCH_FILE,
                         (void*)((FILE*)myfd));
```

You are also able to redirect `ACCEPT` so that instead of stdin, it reads from a file, by using:

```
cob_set_runtime_option (COB_SET_RUNTIME_STDIN_FILE,
                        (void*)((FILE*)myfd));
```

Likewise, you could also redirect all `DISPLAY` output that would be normally printed to stdout/stderr, including outputs directly coming from the runtime, to a file by:

```
cob_set_runtime_option (COB_SET_RUNTIME_STDOUT_FILE,
                        (void*)((FILE*)myfd));
cob_set_runtime_option (COB_SET_RUNTIME_STDERR_FILE,
                        (void*)((FILE*)myfd));
```

Another routine can be used to return the current value of the option.

```
COB_EXT_IMPORT  void *
cob_get_runtime_option (enum cob_runtime_option_switch opt);
```

3.3.7 Loading EBCDIC/ASCII translation tables (collating sequences)

When an EBCDIC/ASCII translation table is needed (for instance when calling sort functions), you can can call the `cob_load_collation` function to retrieve such tables:

```
COB_EXT_IMPORT int
cob_load_collation (const char *col_name,
                    cob_u8_t *ebcdic_to_ascii,
                    cob_u8_t *ascii_to_ebcdic)
```

4 Customize

4.1 Customizing compiler

These settings are effective at compile-time.

Environment variables (default value in brackets):

COB_CC
: C compiler ("gcc")

COB_CFLAGS
: Flags passed to the C compiler ("-I$(PREFIX)/include")

COB_LDFLAGS
: Flags passed to the C compiler ("")

COB_LIBS
: Standard libraries linked with the program ("-L$(PREFIX)/lib -lcob")

COB_LDADD
: Additional libraries linked with the program ("")

4.2 Customizing library

These settings are effective at run-time. You can set them either via the environment or by a runtime configuration file.

To set the global runtime configuration file export `COB_RUNTIME_CONFIG` to point to your configuration file. To set an explicit runtime configuration file for a single run via `cobcrun` you can use its option `-c file`, `--config=file`.

For displaying the current runtime settings you can use the option `-r`, `--runtime-env` of `cobcrun`.

For a complete list of runtime variables, aliases, their default values and options to set them see Runtime Configuration.

5 Optimize

5.1 Optimize options

There are five compiler options for optimization: `-O0`, `-O`, `-Os`, `-O2`, `-O3`. These options enable optimization at both translation (from COBOL to C) and compilation (C to assembly) levels.

Currently, there is no difference between these optimization options at the translation level other than `-O0` disabling constant folding of expressions and disabling removement of unreachable code.

The option `-O`, `-Os` or `-O2` is passed to the C compiler as is and used for C level optimization.

Additional the options `-fremove-unreachable` and `-fconstant-folding` may be used to adjust handling of these parts; note that constant-folding is a dialect specific option and that both options have an effect on the detail of checks done to unreachable code.

5.2 Optimize call

When a `CALL` statement is executed, the called program is linked at run time. By specifying the compiler option `-fstatic-call`, you can statically link the program at compile time and call it efficiently. (see Static linking)

5.3 Optimize binary

By default, data items of usage binary or comp are stored in big-endian form. On those machines whose native byte order is little-endian, this is not quite efficient.

If you prefer, you can store binary items in the native form of your machine. Set the config option `binary-byteorder` to `native` in your config file (see Customize).

In addition, setting the option `binary-size` to `2-4-8` or `1-2-4-8` is more efficient than others.

6 Debug

6.1 Debug options

The compiler option `--debug` can be used, especially during the development of your programs. It enables all run-time error checking, such as subscript boundary checks and numeric data checks, and leads to display of run-time errors with source locations. Exceptions may also be enabled/disabled separately. See Debug switches.

6.2 Source Level Debugger

Compiling with `-g` enables several kinds of debug information, allowing you to run your programs with the system debugger. This allows you to step through the COBOL code and inspect the call stack, but direct access to the COBOL variables is not available. Different GDB frontends exist that provide access the COBOL variables directly.

Compiling with debug information also enables several tools to profile the code or test it, for example against memory violations.

6.3 Memory Dumps

Memory Dumps can be enabled/disabled at runtime and will by default be executed in case of runtime errors or handling of different signals.

They can also be requested via C interface.

Only modules that are explicit enabled for dump code will output their data.

6.4 Core Dumps

By default GnuCOBOL catches signals that normally may create core-dumps. To disable this or to even explicit raise SIGABRT on runtime errors or to directly generate core-dumps through libcob, see the runtime varialbes `COB_CORE_ON_ERROR` and `COB_CORE_FILENAME`. To inspecting the reason for the abort check the content of the variable `runtime_err_str` in the generated dump file.[6]

6.5 Tracing execution

Tracing program execution, either in general or in specific parts can be enabled.

[6] The usability of coredumps depends on your operating system.

7 Profiling COBOL

7.1 Profiling options

Profiling is enabled with the `-fprof` flag while compiling a COBOL module. Only modules that have been compiled with profiling enabled can be later profiled.

Then executing your program with `COB_PROF_ENABLE=1` will automatically profile the module(s) and generate a CSV result file. Note that physical `CANCEL` is disabled when profiling is enabled, because some profiling information in the module needs to remain available until the end of the program.

By default, this file is called `cob-prof-<program-id>-<pid>.csv`, but this name can be configured using `COB_PROF_FILE`.

Some environment variables (and the corresponding options in the runtime configuration) can be used to tune the behavior of profiling during execution: `COB_PROF_FILE`, `COB_PROF_ENABLE` and `COB_PROF_MAX_DEPTH`, `COB_PROF_FORMAT` see Runtime Configuration for more information.

7.2 Profiling results

By default, the generated CSV file has 8 columns for each line (it can be customized with the `COB_PROF_FORMAT` environment/runtime configuration):

`program-id`
: The program identifier of the module.

`section`
: The name of the section. The time of a section is not computed directly, but as the sum of the time spent in its paragraphs.

`paragraph`
: The name of the paragraph. If a section has no paragraph, or does not start with a paragraph, a default paragraph called `MAIN PARAGRAPH` is created.

`entry`
: The name of the entry for `ENTRY` statements, or the name of the target for `CALL` statements. No time is associated with `ENTRY` statements, as the time is directly included in the including paragraph. However, the number of calls is still recorded.

`location`
: The file and line number of the corresponding entry point (section or paragraph)

kind
: The kind is either `PROGRAM`, `SECTION`, `PARAGRAPH`, `CALL` or `ENTRY`.

time-ns
: The time spent in the module/section/paragraph/call in nanoseconds

time
: The time spent in the module/section/paragraph/call in a human readable form (currently, the time in seconds and milliseconds)

ncalls
: The number of calls to this section/paragraph

8 Non-standard extensions

8.1 SELECT ASSIGN TO

A file may be assigned to a literal file, a file in a variable, or a file in an environment variable.

8.1.1 Literal file.

Assign to a literal file.

```
Select file assign to "/tmp/myfile.txt".
```

8.1.2 <variable>

Assign to a file which name is read from a variable.

```
Select file assign to my-file.

01  my-file            pic x(512).

Move "/tmp/myfile.txt" to my-file.
Open output <file>.
```

8.1.3 <environment variable>

Assign to a file in an environment variable.

```
export myfile=/tmp/myfile.txt

Select file assign to external myfile.
```

8.2 Indexed file packages

<This section is in progress.>

8.3 Extended ACCEPT statement

Extended `ACCEPT` statements allow for full control of items accepted from the screen. Items accept by line and column positioning.

All commands following `WITH` are optional.

```
ACCEPT variable-1
   LINE variable-2 | literal-1 COLUMN variable-3 | literal-2
```

```
   WITH
      AUTO-SKIP | AUTO
      BACKGROUND-COLOR variable-4 | literal-3
      BELL | BEEP
      BLINK
      FOREGROUND-COLOR variable-5 | literal-4
      LOWLIGHT | HIGHLIGHT
      PROMPT
      PROTECTED
      SIZE [IS] variable-6 | literal-5
      UPDATE
   ON EXCEPTION
      exception processing
   NOT ON EXCEPTION
      normal processing
END-ACCEPT.
```

8.3.1 LINE

The line number of <variable-2> or <literal-1> to accept the field.

8.3.2 COLUMN

The column number of <variable-3> or <literal-2> to accept the field.

8.3.3 AUTO-SKIP

The word `AUTO` may be used for `AUTO-SKIP`.

With this option the `ACCEPT` statement returns after the last character is typed at the end of the field. This is the same as if the Enter key were pressed.

Without this option the cursor remains at the end of the field and waits for the user to press Enter.

The Right-Arrow key returns from the end of the field. The Left-Arrow key returns from the beginning. See Arrow keys.

The Alt-Right-Arrow and Alt-Left-Arrow keys never `AUTO-SKIP`.

8.3.4 BACKGROUND-COLOR

The background color is the color used behind the characters.

<Variable-4> or <literal-3> must be numeric. See file `screenio.cpy` for the color assignments to <variable-4> or <literal-3>.

8.3.5 BELL

The word `BEEP` may be used for `BELL`.

The system beeps when the cursor moves to accept from this field. On some systems, there is no sound. Some other method may indicate a beep, such a flashing screen or pop up window.

8.3.6 BLINK

The field blinks while the user enters the data. This can help small menu selection fields to stand out.

8.3.7 FOREGROUND-COLOR

The foreground color is the color used for the characters.

<Variable-5> or <literal-4> must be numeric. See file `screenio.cpy` for the color assignments to <variable-5> or <literal-4>.

8.3.8 LOWLIGHT

The `LOWLIGHT` and `HIGHLIGHT` phrases vary the intensity of the field.

`LOWLIGHT` displays with lower intensity and `HIGHLIGHT` displays with higher intensity. Having neither `LOWLIGHT` nor `HIGHLIGHT` displays at normal intensity.

These may have different levels of intensity, if at all, depending on the make and model of the screens.

8.3.9 PROMPT

Display the field with prompt characters as the cursor moves to accept from this field.

8.3.10 PROTECTED

`PROTECTED` is ignored.

8.3.11 SIZE

The size of <variable-1> to accept from the screen.

<Variable-6> or <literal-5> must be numeric.

`SIZE <greater than zero>`

If <variable-6> or <literal-5> is less than the length of <variable-1> then only the `SIZE` number of characters accept into the field. <Variable-1> pads with spaces after `SIZE` to the end of the field.

If <variable-6> or <literal-5> is greater than <variable-1>, then the screen pads with spaces after <variable-1> to the `SIZE` length.

`SIZE ZERO`; `<SIZE option not specified>`

The <variable-1> accepts to its field length.

8.3.12 UPDATE

The contents of variable-1 displays on the screen as the `ACCEPT` begins. This allows the user to update the field without having to type it all again.

Without this option, the `ACCEPT` field is always blank.

8.3.13 ON EXCEPTION

Check the special register cob-crt-status for the special key that was pressed. This includes Escape, Tab, Back-Tab, F-keys, arrows, etc... See screenio.cpy for the values.

8.3.14 NOT ON EXCEPTION

Reset any F-key indicator because no special key was pressed.

8.4 ACCEPT special keys

Special keys are available for extended `ACCEPT` statements.

The `COB-CRT-STATUS` values are in the screenio.cpy copy file.

8.4.1 Arrow keys

The Left-Arrow key moves the cursor to the left. Without `AUTO-SKIP` the cursor stops at the beginning of the field. With `AUTO-SKIP` it returns with the `COB-SCR-KEY-LEFT` value of 2009. See AUTO-SKIP.

The Alt-Left-Arrow key is the same as Left-Arrow except that it never returns, even for `AUTO-SKIP`.

The Right-Arrow key moves the cursor to the right. Without `AUTO-SKIP` the cursor stops at the end of the field. With `AUTO-SKIP` it returns with the `COB-SCR-KEY-RIGHT` value of 2010. See AUTO-SKIP.

The Alt-Right-Arrow key is the same as Right-Arrow except that it never returns, even for `AUTO-SKIP`.

8.4.2 Backspace key

The Backspace key moves the cursor, and the remainder of the text, to the left.

8.4.3 Delete keys

The Delete key deletes the cursor's character and moves the remainder of the text to the left. The cursor does not move.

The Alt-Delete key deletes all text from the cursor to the end of the field.

8.4.4 End key

The End key moves the cursor after the last non-space character. Pressing the End key again moves the cursor to the end of the field. Repeated pressing moves the cursor back and forth.

8.4.5 Home key

The Home key moves the cursor to the first non-space character. Pressing the Home key again moves the cursor to the beginning of the field. Repeated pressing moves the cursor back and forth.

8.4.6 Insert key

The Insert key changes the insert mode.

The value of the insert mode is used in all following `ACCEPT` statements while the program is running.

When the insert mode is on, typed characters move the existing characters to the right until field is full. When it is off, typed characters type over existing characters.

Note: The insert mode is ignored for fields with a size of 1.

The insert mode can also be changed by the `COB_INSERT_MODE` setting at any time, see Runtime Configuration.

8.4.7 Tab keys

The Tab key returns from the `ACCEPT` with the `COB-SCR-TAB` value of 2007.

The Shift-Tab key returns with the `COB-SCR-BACK-TAB` value of 2008.

8.5 Extended DISPLAY statement

Extended `DISPLAY` statements allow for full control of items that display on the screen. Items display by line and column positioning.

```
DISPLAY variable-1 | literal-1 | figurative constant
   LINE line COLUMN column
   WITH BELL
        BLANK LINE | SCREEN
        ERASE EOL | EOS
        SIZE [IS] variable-2 | literal-2
END-DISPLAY.
```

8.5.1 BELL

Ring the bell. It is optional.

8.5.2 BLANK

Clear the whole line or screen. It is optional.

`BLANK LINE`

Clear the line from the beginning of the line to the end of the line.

BLANK SCREEN
: Clear the whole screen.

8.5.3 ERASE

Clear the line or screen from LINE and COLUMN. It is optional.

ERASE EOL
: Clear the line from LINE and COLUMN to the end of the line.

ERASE EOS
: Clear the screen from LINE and COLUMN to the end of the screen.

8.5.4 SIZE

The size of <variable-1>, <literal-1>, or <figurative-constant> to display onto the screen. It is optional.

SIZE positive-integer
: If `SIZE` is less than the length of <variable-1> or <literal-1> then only the `SIZE` number of characters display.

  If `SIZE` is greater than the length of <variable-1> or <literal-1>, then the screen pads with spaces after the field to the `SIZE` length.

  Figurative constants display repeatedly the number of times in `SIZE`. Except that `LOW-VALUES` always positions the cursor (see `SIZE` ZERO below).

SIZE ZERO; <SIZE option not specified>
: <Variable-1> or <literal-1> displays with the field length.

8.5.5 Figurative Constants

Certain figurative constants and values have special functions. All other figurative constants display as a single character.

SPACE
: Display spaces from LINE and COLUMN to the end of the screen. This is the same as WITH ERASE EOS.

LOW-VALUE
: Position the cursor to LINE and COLUMN. The next `DISPLAY` statement does not need a LINE or COLUMN to display at that position.

ALL X"01"
: Display spaces from LINE and COLUMN to the end of the line. This is the same as `WITH ERASE EOL`.

ALL X"02"
: Clear the whole screen. This is the same as `WITH BLANK SCREEN`.

`ALL X"07"`

Ring the bell. This is the same as `WITH BELL`.

8.6 CONTENT-LENGTH

`FUNCTION CONTENT-LENGTH` returns the length of NUL byte terminated data given a pointer:

```
       identification division.
       program-id. zlen.
       data division.
       working-storage section.
       01 ptr   usage pointer.
       01 str   pic x(4) value z"abc".

      *> Testing CONTENT-LENGTH
       procedure division.

       set ptr to address of str
       display content-length(ptr)

       goback.
       end program hosted.
```

8.7 CONTENT-OF

`FUNCTION CONTENT-OF` returns an alphanumeric field given a pointer and optional length:

Data from pointer is returned as a COBOL field either by scanning for a NUL byte or using the optional length. Reference modification of result allowed.

```
       identification division.
       program-id. contents.
       data division.
       working-storage section.
       01 ptr   usage pointer.
       01 str   pic x(4) value z"abc".

      *> Testing CONTENT-OF
       procedure division.

       set ptr to address of str
       display content-of(ptr)
       display content-of(ptr, 2)
```

```
       display content-of(ptr)(2:2)

       goback.
       end program hosted.
```

9 System Routines

For a complete list of supported system routines, see System routines.

9.1 CBL_GC_GETOPT

`CBL_GC_GETOPT` provides the quite well-known option parser, getopt, for GnuCOBOL. The usage of this system routine is described by the following example.

```
        identification division.
        program-id. prog.

        data division.
        working-storage section.
            78 shortoptions value "jkl".

            01 longoptions.
                05 optionrecord occurs 2 times.
                    10 optionname   pic x(25).
                    10 has-value    pic 9.
                    10 valpoint     pointer value NULL.
                    10 return-value pic x(4).

            01 longind     pic 99.
            01 long-only   pic 9 value 1.

            01 return-char pic x(4).
            01 opt-val     pic x(10).

            01 counter     pic 9 value 0.
```

We first need to define the necessary fields for getopt's shortoptions (so), longoptions (lo), longoption index (longind), long-only-option (long-only) and also the fields for return values return-char and opt-val (arbitrary size with trimming, see return codes).

The shortoptions are written down as an alphanumeric field (i.e., a string with arbitrary size) as follows:

```
"ab:c::d"
```

This means we want getopt to look for shortoptions named a, b, c or d and we demand an option value for b and we are accepting an optional one for c.

The longoptions are defined as a table of records with oname, has-value, valpoint and val.

- oname defines the name of a longoption.
- has-value defines if an option value is demanded (has-val = 1), optional (has-val = 2) or not required (has-val = 0).
- valpoint is a pointer used to specify an address to save getopt's return value to. The pointer is optional. If it is `NULL`, getopt returns a value as usual. If you use the pointer it has to point to a `PIC X(4)` field.
- The field val is a `PIC X(4)` character which is returned if the longoption was recognized.

The longoption structure is immutable! You can only vary the number of records.

Now we have the tools to run `CBL_GC_GETOPT` within the procedure division.

```
        procedure division.
            move "version" to optionname   (1).
            move 0         to has-value    (1).
            move "v"       to return-value (1).

            move "verbose" to optionname   (2).
            move 0         to has-value    (2).
            move "V"       to return-value (2).

            perform with test after until return-code = -1
                call 'CBL_GC_GETOPT' using
                   by reference shortoptions longoptions longind
                   by value long-only
                   by reference return-char opt-val
                end-call

                display return-char end-display
                display opt-val     end-display
            end-perform
            stop run.
```

The example shows how we initialize all parameters and call the routine until `CBL_GC_GETOPT` runs out of options and returns −1.

If the option is recognized, `return-char` contains the option character. Otherwise, `return-char` will contain one of the following:

`?`
: undefined or ambiguous option

`1`
: non-option (only if first byte of so is '`-`')

`0`
: `valpoint != NULL` and we are writing the return value to the specified address

`-1`
: no more options (or reached the first non-option if first byte of so is '`+`')

The return-code of `CBL_GC_GETOPT` is one of:

`1`
: a non-option (only if first byte of so is '`-`')

`0`
: `valpoint != NULL` and we are writing the return value to the specified address

`-1`
: no more options (or reach the first non-option if first byte of so is '`+`')

`2`
: truncated option value in opt-val (because opt-val was too small)

`3`
: regular answer from `getopt`

9.2 CBL_GC_HOSTED

`CBL_GC_HOSTED` provides access to the following C hosted variables:

- `argc` to binary-long by value
- `argv` to pointer to char **
- `stdin`, `stdout`, `stderr` to pointer
- `errno` giving address of errno in pointer to binary-long, use based for more direct access

and conditional access to the following variables:

- `tzname` pointer to pointer to array of two char pointers
- `timezone` C long, will be seconds west of UTC
- `daylight` C int, will be 1 during daylight savings

System will need to `HAVE_TIMEZONE` defined for these to return anything meaningful. Attempts made when they are not available return 1 from `CBL_GC_HOSTED`.

It returns 0 when match, 1 on failure, case matters as does length, `arg` won't match.

The usage of this system routine is described by the following example.

```
HOSTED identification division.
       program-id. hosted.
       data division.
       working-storage section.
       01 argc  usage binary-long.
       01 argv  usage pointer.

       01 stdin usage pointer.
       01 stdout usage pointer.
       01 stderr usage pointer.

       01 errno usage pointer.
       01 err   usage binary-long based.

       01 domain usage float-long value 3.0.

       01 tzname usage pointer.
       01 tznames usage pointer based.
          05 tzs usage pointer occurs 2 times.

       01 timezone   usage binary-long.
       01 daylight   usage binary-short.


      *> Testing CBL_GC_HOSTED
       procedure division.
       call "CBL_GC_HOSTED" using stdin "stdin"
       display "stdin                : " stdin
       call "feof" using by value stdin
       display "feof stdin           : " return-code

       call "CBL_GC_HOSTED" using stdout "stdout"
       display "stdout               : " stdout
       call "fprintf" using by value stdout by content "Hello" & x"0a"

       call "CBL_GC_HOSTED" using stderr "stderr"
       display "stderr               : " stderr
       call "fprintf" using by value stderr by content "on err" & x"0a"

       call "CBL_GC_HOSTED" using argc "argc"
```

```
       display "argc                : " argc

       call "CBL_GC_HOSTED" using argv "argv"
       display "argv                : " argv

       call "args" using by value argc argv

       call "CBL_GC_HOSTED" using errno "errno"
       display "&errno              : " errno
       set address of err to errno
       display "errno               : " err
       call "acos" using by value domain
       display "errno after acos(3.0): " err ", EDOM is 33"

       call "CBL_GC_HOSTED" using argc "arg"
       display "'arg' lookup        : " return-code
       call "CBL_GC_HOSTED" using null "argc"
       display "null with argc      : " return-code
       display "argc is still       : " argc


       *> the following only returns zero if the system has HAVE_TIMEZONE set

       call "CBL_GC_HOSTED" using daylight "daylight "
       display "'timezone' lookup   : " return-code

       if return-code not = 0
          display "system doesn't has timezone"
       else

          display "timezone is         : " timezone

          call "CBL_GC_HOSTED" using daylight "daylight "
          display "'daylight' lookup   : " return-code
          display "daylight is         : " daylight

          set environment "TZ" to "PST8PDT"
          call static "tzset" returning omitted on exception continue end-call

          call "CBL_GC_HOSTED" using tzname "tzname"
          display "'tzname' lookup     : " return-code
```

```
         *> tzs(1) will point to z"PST" and tzs(2) to z"PDT"
         if return-code equal 0 and tzname not equal null then
             set address of tznames to tzname
             if tzs(1) not equal null then
                display "tzs #1               : " tzs(1)
             end-if
             if tzs(2) not equal null then
                display "tzs #2               : " tzs(2)
             end-if
         end-if

       end-if

       goback.
       end program hosted.
```

9.3 CBL_GC_NANOSLEEP

`CBL_GC_NANOSLEEP` allows you to pause the program for nanoseconds. The actual precision depends on the system.

```
      *> Waiting a half second
       call "CBL_GC_NANOSLEEP" using "500000000" end-call

      *> Waiting five seconds using compiler string catenation for readability
       call "CBL_GC_NANOSLEEP" using "500" & "0000000"  end-call
```

9.4 CBL_GC_FORK

`CBL_GC_FORK` allows you to fork the current COBOL process to a new one. The current content of the process' storage (including `LOCAL-STORAGE`) will be identical, any file handles get invalid in the new process, positions and file / record locks are only available to the original process.

This system routine is not available on Windows (exception: GCC on Cygwin).

Parameters

none

Returns

PID (the child process gets '`0`' returned, the calling process gets the PID of the created children). Negative values are returned for system dependent error codes and −1 if the function is not available on the current system.

```
       IDENTIFICATION DIVISION.
       PROGRAM-ID. prog.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       01 CHILD-PID   PIC S9(9) BINARY.
       01 WAIT-STS    PIC S9(9) BINARY.
       PROCEDURE DIVISION.

           CALL "CBL_GC_FORK" RETURNING CHILD-PID END-CALL
           EVALUATE TRUE
              WHEN CHILD-PID = ZERO
                 PERFORM CHILD-CODE
              WHEN CHILD-PID > ZERO
                 PERFORM PARENT-CODE
              WHEN CHILD-PID = -1
                 DISPLAY 'CBL_GC_FORK is not available '
                         'on the current system!'
                 END-DISPLAY
                 PERFORM CHILD-CODE
                 MOVE 0 TO CHILD-PID
                 PERFORM PARENT-CODE
              WHEN OTHER
                 MULTIPLY CHILD-PID BY -1 END-MULTIPLY
                 DISPLAY 'CBL_GC_FORK returned system error: '
                         CHILD-PID
                 END-DISPLAY
           END-EVALUATE

           STOP RUN.

       CHILD-CODE.
           CALL "C$SLEEP" USING 1 END-CALL
           DISPLAY "Hello, I am the child"
           END-DISPLAY
           MOVE 2 TO RETURN-CODE

           CONTINUE.

       PARENT-CODE.
           DISPLAY "Hello, I am the parent"
           END-DISPLAY
```

```
           CALL "CBL_GC_WAITPID" USING CHILD-PID RETURNING WAIT-STS
           END-CALL
           MOVE 0 TO RETURN-CODE
           EVALUATE TRUE
              WHEN WAIT-STS >= 0
                 DISPLAY 'Child ended with status: '
                         WAIT-STS
                 END-DISPLAY
              WHEN WAIT-STS = -1
                 DISPLAY 'CBL_GC_WAITPID is not available '
                         'on the current system!'
                 END-DISPLAY
              WHEN WAIT-STS < -1
                 MULTIPLY -1 BY WAIT-STS END-MULTIPLY
                 DISPLAY 'CBL_GC_WAITPID returned system error: ' WAIT-STS
                 END-DISPLAY
           END-EVALUATE

           CONTINUE.
```

9.5 CBL_GC_WAITPID

`CBL_GC_WAITPID` allows you to wait until another system process ended. Additional you can check the process' return code.

Parameters: none Returns: function-status / child-status Negative values are returned for system dependent error codes and −1 if the function is not available on the current system.

```
        CALL "CBL_GC_WAITPID" USING CHILD-PID RETURNING WAIT-STS
        END-CALL
        MOVE 0 TO RETURN-CODE
        DISPLAY 'CBL_GC_WAITPID ended with status: ' WAIT-STS
        END-DISPLAY
```

9.6 CBL_GC_WINDOW

`CBL_GC_WINDOW` allows you to create, move, hide, show, top, bottom or list multiple windows if your installation supports CURSES & PANELS. Note windows have depth like a stack of cards on a flat table. Each window has its contents independent of any other window. All of the writes to the console are directed to the window on top of the deck of windows.

Parameters: the gcwindow.cpy copy member defines all parameters for this function. All commands but the the LIST command uses the same secondary parameter `WP-WINDOW-PARMS`, the LIST command uses `WL-WINDOW-LIST` instead.

TODO explain the parameters

Returns: COBOL RETURN-CODE contains general error code (like not available PANEL function in the curses runtime library) and specific problems depending on the parameters, zero means "no error". You can use `RETURNING WP-WINDOW-RETURN-CODE` to use the condition-names for more detailed error handling, otherwise use those as reference.

```
           TODO
```

10 Compiler `cobc` options

The following list of options was extracted from `cobc --help` and shows all available compiler options with a short description.

10.1 Common Options

`-h, --help`
display this help and exit

`-V, --version`
display compiler version information and exit

`-dumpversion`
display compiler version and exit

`-i, --info`
display compiler information (build/environment) and exit

`-v, --verbose`
verbose mode, display additional information; multiple `-v` options increase the verbosity, the maximum is 3 as follows: (1) display compiler version and the commands invoked by the compiler, (2) pass verbose option to assembler/compiler (3) pass verbose option to linker

`-q, --brief`
reduced displays, commands invoked not shown

`-###`
like -v but commands not executed

`-x`
build an executable program

`-m`
build a dynamically loadable module (default)

`-j [args], --job[=args]`
run program after build, passing <args>

`-std=dialect`
warnings/features for a specific dialect <dialect> can be one of: default, cobol2014, cobol2002, cobol85, xopen, ibm-strict, ibm, mvs-strict, mvs, mf-strict, mf, bs2000-strict, bs2000, acu-strict, acu, rm-strict, rm, gcos-strict, gcos; see configuration files in directory config

-F, --free
use free source format (alias for -fformat=free)

--fixed
use fixed source format (default; alias for

-fformat=fixed)

-O, -O2, -O3, -Os
enable optimization

-O0
disable optimization

-g
enable C compiler debug and stack check

-d, --debug
enable all run-time error checking, equal to `-fstack-check -fec=``EC-ALL`

-fec=exception-name
enable code generation for <exception-name>, see –list-exceptions for the possible values, sets `-fsource-location`

-fno-ec=exception-name
disable code generation for <exception-name>

-o file
place the output into <file>

-b
combine all input files into a single dynamically loadable module

-E
preprocess only; do not compile or link

-C
translation only; convert COBOL to C

-S
compile only; output assembly file

-c
compile and assemble, but do not link

-T file
generate and place a wide program listing into <file>

-t file
generate and place a program listing into <file>

--tlines=lines
specify lines per page in listing, default = 55

-P[=dir or file]
generate preprocessed program listing (.lst)

-X, --Xref
specify cross reference in listing

-I directory
add <directory> to copy/include search path

--copy copybook
include <copybook> at beginning of file, as would `COPY` copybook.

-L directory
add <directory> to library search path

--include file.h
add a #include "file.h" at the beginning of the C generated file (implies `-fno-gen-c-decl-static-call`)

-l lib
link the library <lib>

-K entry
generate `CALL` to <entry> as static

-D define
define <define> for COBOL compilation

-A options
add <options> to the C compile phase

-Q options
add <options> to the C link phase

--coverage
instrument generated binaries for coverage

--conf=file
user-defined dialect configuration; see -std

--list-reserved
display reserved words

--list-intrinsics
display intrinsic functions

--list-mnemonics
display mnemonic names

--list-exceptions
: display exception names

--list-system
: display system routines

--save-temps[=dir]
: save intermediate files; default: current directory

-M
: output dependency list in Makefile format

-MT target
: set/add target file used in dependency list

-MQ target
: same as -MT but with Makefile-quoting of the target

-MF file
: place dependency list into <file>

-MP
: create phony targets for all dependencies

-MG
: output missing dependencies without complaining

-MD
: output dependencies in .d files while compiling

-ext extension
: add file extension for resolving COPY

--gentable=ebcdic-enc,ascii-enc[+]
: output a translation table between the given encodings to stdout and exit

10.2 Warning options

-Wall
: enable most warnings (all except as noted below)

-Wextra
: like -Wall but enable some extra warning flags

-w
: disable all warnings

-Wno-warning
: disable warning enabled by default, -Wall or -Wextra

-Wadditional
: additional warnings only raised with -Wall

-Wno-unfinished
: do not warn if unfinished features are used; *always* active

-Wno-pending
: do not warn if pending features are used; *always* active

-Wno-repository-checks
: do not warn/check for program/function/external signature mismatch; *always* active

-Wno-ignored-error
: do not warn about errors in code parts which are unreachable and so normally ignored; *always* active

-Wobsolete
: warn if obsolete features are used

-Warchaic
: warn if archaic features are used

-Wredefinition
: warn about non-referenced ambiguous data items

-Wtruncate
: warn about field truncation from constant assignments

-Wpossible-truncate
: warn about possible field truncation; *not* set with `-Wall`

-Woverlap
: warn about overlapping `MOVE` of items

-Wpossible-overlap
: warn about `MOVE` of items that may overlap depending on variables; *not* set with `-Wall`

-Wparentheses
: warn if parentheses are omitted around `AND` within `OR`

-Wstrict-typing
: warn strictly about type mismatch, even when same size; *not* set with `-Wall`

-Wtyping
: warn about type mismatch

-Wimplicit-define
: warn about implicitly defined data items; *not* set with `-Wall`

-Wno-corresponding
: do not warn about `CORRESPONDING` with no matching items; *always* active

-Winitial-value
: warn if initial `VALUE` clause is ignored

-Wprototypes
: warn about missing `FUNCTION` prototypes/definitions

-Warithmetic-osvs
: warn if arithmetic expression precision has changed

-Wcall-params
: warn about non 01/77 items for `CALL` parameters; *not* set with `-Wall`

-Wconstant-expression
: warn about expressions that always resolve to true/false

-Wconstant-numlit-expression
: warn about numeric expressions that always resolve to true/false

-Wlarger-01-redefines
: warn about larger redefines allowed by COBOL standards

-Wcolumn-overflow
: warn about text after program-text area, `FIXED` format; *not* set with `-Wall`

-Wterminator
: warn about lack of scope terminator `END-XXX`; *not* set with `-Wall`

-Wlinkage
: warn about dangling `LINKAGE` items; *not* set with `-Wall`

-Wunreachable
: warn about likely unreachable statements; *not* set with `-Wall`

-Wno-dialect
: do not warn about dialect specific issues; *always* active

-Wno-goto-section
: do not warn about `GO TO` section-name; *always* active

-Wgoto-different-section
: warn about `GO TO` a praragraph defined in a different section

-Wsuspicious-perform-thru
: warn if `PERFORM THRU` references procedures not in ascending order or multiple sections; *always* active

-Wdangling-text
: warn about source text after program-area; *not* set with `-Wall`

-Wno-missing-newline
: do not warn about missing newlines; *always* active

-Wno-others
: do not warn about different issues; *always* active

-Wno-unsupported
: do not warn if runtime does not support a feature used

-fdiagnostics-plain-output
: make diagnostic output as plain as possible

-Werror
: treat all warnings as errors

-Wno-error
: don't treat warnings as errors

-Werror=warning
: treat specified <warning> as error

-Wno-error=warning
: don't treat specified <warning> as error

10.3 Compiler options

-fsign=[ASCII|EBCDIC]
: define display sign representation; default: machine native

-ffold-copy=[UPPER|LOWER]
: fold `COPY` subject to value; default: no transformation

-ffold-call=[UPPER|LOWER]
: fold `PROGRAM-ID`, `CALL`, `CANCEL` subject to value; default: no transformation

-fmax-errors=number
: maximum number of errors to report before compilation is aborted; default: 20; if <number> is 0, there's no limit

-fintrinsics=[ALL|intrinsic function name(,name,...)]
: intrinsics to be used without `FUNCTION` keyword

-fdump=scope
: dump data fields on abort, <scope> may be a combination of: `ALL`, `WS`, `LS`, `RD`, `FD`, `SC`, `LO`
default if no scope specified: `ALL`

-fcallfh=name
: specifies <name> to be used for I/O as external provided EXTFH interface module

-fsqlschema=name
: define database schema name

-febcdic-table=cconv-table/file
: EBCDIC/ASCII translation table; e.g. default, ebcdic500_latin1...

-fdefault-colseq=[ASCII|EBCDIC|NATIVE]
: define default collating sequence; default: NATIVE

-fdefault-file-colseq=[ASCII|EBCDIC|NATIVE]
: define default file collating sequence; default: NATIVE

-fsql
: process the XFD directives

-fuse-constructor
: generate internal one-time code via constructor

-fstack-extended
: store origin of entrypoints and PERFORM; turned on by --debug/-fdump

-fno-remove-unreachable
: disable remove of unreachable code; turned off by -g

-finline-intrinsic
: when possible resolve intrinsic FUNCTIONs at compile time

-ftrace
: generate trace code; scope: executed SECTION/PARAGRAPH

-ftraceall
: generate trace code; scope: executed SECTION/PARAGRAPH/STATEMENTS

-fsymtab
: build symbol table for dump/trace/debug

-fsyntax-only
: syntax error checking only; don't emit any output

-fdebugging-line
: enable debugging lines; 'D' in indicator column or floating >>D

-fsource-location
: generate source location code; turned on by --debug/-ftraceall/-fec/-fdump

-fimplicit-init
: automatic initialization of the COBOL runtime system

-fno-recursive-check
: disable check of recursive program call; effectively compiling as RECURSIVE program

-fstack-check
: PERFORM stack checking; turned on by --debug/-g

-fmemory-check=scope
checks for invalid writes to internal storage, <scope> may be one of: all, pointer, using, none; default: none, set to all by -`--debug`

-fsection-exit-check
check that code execution does not leave the scope of `SECTION`s

-fimplicit-goback-check
check that code execution does not end implicit at end of `PROCEDURE DIVISION`

-fwrite-after
use `AFTER 1` for `WRITE` of `LINE SEQUENTIAL`; default: `BEFORE 1`

-fmfcomment
'`*`' in column 1 treated as comment with listing suppression; FIXED/COBOL85/VARIABLE format only

-facucomment
'`$`' in indicator area treated as '`*`', '`|`' treated as floating comment

-fno-trunc
allow numeric field overflow; non-ANSI behaviour

-fsingle-quote
use a single quote (apostrophe) for `QUOTE`; default: double quote

-foptional-file
treat all files as `OPTIONAL`; unless `NOT OPTIONAL` specified

-fstatic-call
output static function calls for the `CALL` statement

-fno-gen-c-decl-static-call
disable generation of C function declarations for subroutines with static `CALL`

-fgen-c-line-directives
generate source location directives in C code;; turned on by `-g`/–coverage

-fgen-c-labels
generate extra labels in C sources;; turned on by `-g`

-fmf-files
Sequential & Relative files will match Micro Focus format

-ffile-format=[MF|GC]
define default format for `Sequential/R`elative files; default: `GC`

-fno-theaders
suppress all headers from listing while keeping page breaks

-fno-tsource
: suppress source from listing

-fno-tmessages
: suppress warning and error summary from listing

-ftsymbols
: specify symbols in listing

-ftcmd
: specify command line in listing

-fdatamap
: specify symbols `DATA MAP` in listing

-fno-ttimestamp
: suppress timestamp in listing headers

-fttitle=title
: set listing title with '_' replaced by spaces; defaults to package name and version

-fno-diagnostics-show-option
: suppress output of option that directly controls the diagnostic

-fno-diagnostics-show-caret
: do not display source context on warning/error diagnostic

-fno-diagnostics-show-line-numbers
: suppress display of line numbers in diagnostics

-fdiagnostics-absolute-paths
: print absolute paths in diagnostics

-fprof
: enable profiling of the COBOL program

-fibmcomp
: sets -fbinary-size=2-4-8 -fsynchronized-clause=ok

-fno-ibmcomp
: sets -fbinary-size=1–8 -fsynchronized-clause=ignore

10.4 Compiler dialect configuration options

-freserved-words=value
: use of complete/fixed reserved words

-ftab-width=value
: number of spaces that are assumed for tabs (comma separated)

-ftext-column=72..255
: right margin column number for fixed-form reference-format

-fpic-length=number
: maximum number of characters allowed in the `PICTURE` character-string

-fword-length=1..63
: maximum word-length for COBOL (= programmer defined) words

-fliteral-length=number
: maximum literal size in general

-fnumeric-literal-length=1..38
: maximum numeric literal size

-falign-record=0..256
: align `WORKING-STORAGE`/`LOCAL-STORAGE` record on boundary

-fkeycompress=0..16
: do `ISAM` indexes with duplicates get compressed

-falign-opt
: align like `MF OPT`, Default: false (Like `MF ALIGN=FIXED`)

-fdefaultbyte=value
: default initialization for fields without `VALUE`, may be one of; character in quotes; decimal 0..255 representing a character; "init" to initialize to `PICTURE`/`USAGE`; "none" to do no explicit initialization; default: "init"

-fformat=value
: default reference-format, may be one of: `FIXED`, `FREE`, COBOL85, `VARIABLE`, `XOPEN`, `XCARD`, `CRT`, `TERMINAL`, COBOLX

-fbinary-size=value
: binary byte size - defines the allocated bytes according to `PIC`, may be one of: 2-4-8, 1-2-4-8, 1–8

-fbinary-byteorder=value
: binary byte order, may be one of: native, big-endian

-fassign-clause=value
: how to interpret `ASSIGN word`: as `ASSIGN EXTERNAL word` or `ASSIGN DYNAMIC word`, may be one of: `dynamic`, `external`, `ibm` (= external), `mf` (= dynamic)

-fscreen-section-rules=value
: which compiler's rules to apply to `SCREEN SECTION` item clauses, may be one of: acu, gc, mf, rm, std, xopen

-fdpc-in-data=value
: whether `DECIMAL-POINT IS COMMA` has effect in `XML`/`JSON GENERATE`, may be one of: none, xml, json, all

-fsubscript-check=value
: checking for subscript (only done with `EC-BOUND-SUBSCRIPT` active), may be one of: full, max, record

-ffilename-mapping
: resolve file names at run time using environment variables

-fpretty-display
: alternate formatting of numeric fields

-fbinary-truncate
: numeric truncation according to ANSI

-fcomplex-odo
: allow non-standard `OCCURS DEPENDING ON` syntax

-fodoslide
: adjust items following `OCCURS DEPENDING` (implies complex-odo)

-finit-justify
: applies `JUSTIFY` with `VALUE` clause

-findirect-redefines
: allow `REDEFINES` to other than last equal level number

-frelax-syntax-checks
: allow certain syntax variations (e.g. `REDEFINES` position)

-fref-mod-zero-length
: allow zero length reference-modification (only changed with `EC-BOUND-REF-MOD` active)

-frelax-level-hierarchy
: allow non-matching level numbers

-flocal-implies-recursive
: `LOCAL-STORAGE SECTION` implies `RECURSIVE` attribute

-fsticky-linkage
: `LINKAGE SECTION` items remain allocated between invocations

-fmove-ibm
: `MOVE` operates as on IBM (left to right, byte by byte), otherwise no propagating move

-fperform-osvs
: exit point of any currently executing perform is recognized if reached

-farithmetic-osvs
: limit precision in intermediate results to precision of final result (less accurate)

-fconstant-folding
: evaluate constant expressions at compile time

-fhostsign
: allow hexadecimal value ‘F’ for `NUMERIC` test of signed `PACKED DECIMAL` field

-fprogram-name-redefinition
: program names don’t lead to a reserved identifier

-faccept-update
: set `WITH UPDATE` clause as default for `ACCEPT` dest-item, instead of `WITH NO UPDATE`

-faccept-auto
: set `WITH AUTO` clause as default for `ACCEPT` dest-item, instead of `WITH TAB`

-fconsole-is-crt
: assume `CONSOLE IS CRT` if not set otherwise

-fno-echo-means-secure
: `NO-ECHO` hides input with asterisks like `SECURE`

-fline-col-zero-default
: assume a field `DISPLAY` starts at `LINE 0 COL 0` (i.e. at the cursor), not `LINE 1 COL 1`

-freport-column-plus
: in a `REPORT COLUMN` may have `PLUS` num, + num, or +num

-fdisplay-special-fig-consts
: special behaviour of `DISPLAY SPACE`/`ALL X'01'`/`ALL X'02'`/`ALL X'07'`

-fbinary-comp-1
: `COMP`−1 is a 16-bit signed integer

-fnumeric-pointer
: `POINTER` is a 64-bit unsigned integer

-fmove-non-numeric-lit-to-numeric-is-zero
: imply zero in move of non-numeric literal to numeric items

-fimplicit-assign-dynamic-var
: implicitly define a variable if an `ASSIGN DYNAMIC` does not match any data item

-fdevice-mnemonics
: specifying device by mnemonic

-fxml-parse-xmlss
: `XML PARSE XMLSS`

-fareacheck
: check contents of Area A (when reference format supports Area A enforcement), enabled checks include:; division, section, paragraph names, level indicators (`FD`, `SD`, `RD`, and `CD`), and toplevel numbers (01 and 77) must start in Area A;; statements must not start in Area A; and; separator periods must not be within Area A

-fcomment-paragraphs=support
: comment paragraphs in `IDENTIFICATION DIVISION` (`AUTHOR`, `DATE-WRITTEN`, ...)

-fcontrol-division=support
: `CONTROL DIVISION`

-fpartial-replace-when-literal-src=support
: apply partial replacing with literal source operand even when it replaces with spaces only;; "skip" prevents such replacements

-fmemory-size-clause=support
: `MEMORY-SIZE` clause

-fmultiple-file-tape-clause=support
: `MULTIPLE-FILE-TAPE` clause

-flabel-records-clause=support
: `LABEL-RECORDS` clause

-fvalue-of-clause=support
: `VALUE-OF` clause

-fdata-records-clause=support
: `DATA-RECORDS` clause

-ftop-level-occurs-clause=support
: `OCCURS` clause on top-level

-fsame-as-clause=support
: `SAME AS` clause

-ftype-to-clause=support
: `TYPE TO` clause

-fusage-type=support
: `USAGE` type-name

-fsynchronized-clause=support
: `SYNCHRONIZED` clause

-fsync-left-right=support
: `LEFT`/`RIGHT` phrases in `SYNCHRONIZED` clause

-fspecial-names-clause=support
SPECIAL-NAMES clause

-fgoto-statement-without-name=support
GO TO statement without name

-fstop-literal-statement=support
STOP-literal statement

-fstop-identifier-statement=support
STOP-identifier statement

-fstop-error-statement=support
STOP ERROR statement

-fdebugging-mode=support
DEBUGGING MODE and debugging indicator

-fuse-for-debugging=support
USE FOR DEBUGGING

-fpadding-character-clause=support
PADDING CHARACTER clause

-fnext-sentence-phrase=support
NEXT SENTENCE phrase

-flisting-statements=support
listing-directive statements EJECT, SKIP1, SKIP2, SKIP3

-ftitle-statement=support
listing-directive statement TITLE

-fentry-statement=support
ENTRY statement

-fmove-noninteger-to-alphanumeric=support
move noninteger to alphanumeric

-foccurs-max-length-without-subscript
occurs max length without subscript

-flength-in-data-division
length in data division

-fmove-figurative-constant-to-numeric=support
move figurative constants to numeric

-fmove-figurative-space-to-numeric=support
move figurative constant SPACE to numeric

-fmove-figurative-quote-to-numeric=support
: move figurative constant `QUOTE` to numeric

-fodo-without-to=support
: `OCCURS DEPENDING ON` without to

-fodo-last-varlen=support
: `OCCURS DEPENDING ON` last of record then variable lenght

-fsection-segments=support
: section segments

-falter-statement=support
: `ALTER` statement

-fcall-overflow=support
: `OVERFLOW` clause for `CALL`

-fnumeric-boolean=support
: boolean literals (`B'1010'`)

-fhexadecimal-boolean=support
: hexadecimal-boolean literals (`BX'A'`)

-fnational-literals=support
: national literals (`N'UTF`−16 string')

-fhexadecimal-national-literals=support
: hexadecimal-national literals (`NX'265E'`)

-fnational-character-literals=support
: non-standard national literals (`NC'UTF`−16 string')

-fhp-octal-literals=support
: `HP` COBOL octal literals (%377)

-facu-literals=support
: ACUCOBOL-GT literals (`#B #O #H #X`)

-febcdic-symbolic-characters
: `EBCDIC` symbolic characters in literals (" "135,151,151"bar"195, 194"Z" for " foobar`BAZ`")

-fword-continuation=support
: continuation of COBOL words

-fnot-exception-before-exception=support
: `NOT ON EXCEPTION` before `ON EXCEPTION`

-faccept-display-extensions=support
: extensions to `ACCEPT` and `DISPLAY`

-frenames-uncommon-levels=support
RENAMES of 01-, 66- and 77-level items

-flarger-redefines=support
allow larger REDEFINES items

-fsymbolic-constant=support
constants defined in SPECIAL-NAMES

-fconstant-78=support
constant with level 78 item (note: has left to right precedence in expressions)

-fconstant-01=support
constant with level 01 CONSTANT AS/FROM item

-fperform-varying-without-by=support
PERFORM VARYING without BY phrase (implies BY 1)

-freference-out-of-declaratives=support
references to sections not in DECLARATIVES from within DECLARATIVES

-freference-bounds-check=support
reference modification strict bounds check

-fprogram-prototypes=support
CALL/CANCEL with program-prototype-name

-fcall-convention-mnemonic=support
specifying call-convention by mnemonic

-fcall-convention-linkage=support
specifying call-convention by WITH ... LINKAGE

-fnumeric-value-for-edited-item=support
numeric literals in VALUE clause of numeric-edited items

-fincorrect-conf-sec-order=support
incorrect order of CONFIGURATION SECTION and its paragraphs

-fdefine-constant-directive=support
allow >> DEFINE CONSTANT var AS literal

-ffree-redefines-position=support
REDEFINES clause not following entry-name in definition

-frecords-mismatch-record-clause=support
record sizes does not match RECORD clause

-frecord-delimiter=support
RECORD DELIMITER clause

-fsequential-delimiters=support
BINARY-SEQUENTIAL and LINE-SEQUENTIAL phrases in RECORD DELIMITER

-frecord-delim-with-fixed-recs=support
RECORD DELIMITER clause on file with fixed-length records

-frecord-sequential-advancing=support
SEQUENTIAL with WRITE ADVANCING phrases

-fmissing-statement=support
missing statement (e.g. empty IF / PERFORM)

-fmissing-period=support
missing period in PROCEDURE DIVISION (when reference format supports Area A enforcement)

-fzero-length-literals=support
zero-length literals, e.g. ” and ""

-fxml-generate-extra-phrases=support
XML GENERATE's phrases other than COUNT IN

-fcontinue-after=support
AFTER phrase in CONTINUE statement

-fgoto-entry=support
ENTRY FOR GO TO and GO TO ENTRY statements

-fdepending-on-not-fixed=support
depending-on-not-fixed

-fbinary-sync-clause=support
BINARY-SHORT/LONG/DOUBLE SYNCHRONIZED clause

-fnonnumeric-with-numeric-group-usage=support
Non-numeric item with numeric group USAGE clause

-fassign-variable=support
ASSIGN [TO] variable in SELECT

-fassign-using-variable=support
ASSIGN USING/VARYING variable in SELECT

-fassign-ext-dyn=support
ASSIGN EXTERNAL/DYNAMIC in SELECT

-fassign-disk-from=support
ASSIGN DISK FROM variable in SELECT

-fvsam-status=support
VSAM status in FILE STATUS

-fself-call-recursive=support

`CALL` to own `PROGRAM-ID` implies `RECURSIVE` attribute

-frecord-contains-depending-clause=support

`DEPENDING` clause in `RECORD CONTAINS`

-fpicture-l=support

`PICTURE` string with 'L' character where <support> is one of: `ok`, `warning`, `archaic`, `obsolete`, `skip`, `ignore`, `error`, `unconformable`

-fnot-reserved=word

<word> to be taken out of the reserved words list

-freserved=word

<word> to be added to reserved words list

-freserved=word:alias

<word> to be added to reserved words list as <alias>

-fnot-register=word

special register to disable

-fregister=word or word:definition, where definition uses backslash esca

special register to enable

11 Reserved Words

The following list of reserved words was extracted from `cobc --list-reserved` and shows the reserved words, an implementation

Please notice: This list is highly specific to the option `-std=dialect` and reserved word options (`-freserved=word`, `-fno-reserved=word`) in effect. You can get the list for a given <dialect> by calling `cobc -std=dialect --list-reserved`.

11.1 Common reserved words

Reserved word	Implemented	Aliases
3-D	Yes (C/S)	
ABSENT	Yes	
ABSTRACT	Yes	
ACCEPT	Yes	
ACCESS	Yes	
ACTION	Yes (C/S)	
ACTIVATING	No (C/S)	
ACTIVE-CLASS	Yes	
ACTIVE-X	Yes (C/S)	
ACTUAL	Yes (C/S)	
ADD	Yes	
ADDRESS	Yes	
ADJUSTABLE-COLUMNS	Yes (C/S)	
ADVANCING	Yes	
AFTER	Yes	
ALIGNED	Yes	
ALIGNMENT	Yes (C/S)	
ALL	Yes	
ALLOCATE	Yes	
ALLOWING	Yes (C/S)	
ALPHABET	Yes	

Reserved word	Implemented	Aliases
ALPHABETIC	Yes	
ALPHABETIC-LOWER	Yes	
ALPHABETIC-UPPER	Yes	
ALPHANUMERIC	Yes	
ALPHANUMERIC-EDITED	Yes	
ALSO	Yes	
ALTER	Yes	
ALTERNATE	Yes	
AND	Yes	
ANUM	No (C/S)	
ANY	Yes	
ANYCASE	No	
APPLY	Yes (C/S)	
ARE	Yes	
AREA	Yes	AREAS
AREAS	Yes	AREA
ARGUMENT-NUMBER	Yes	
ARGUMENT-VALUE	Yes	
ARITHMETIC	Yes (C/S)	
AS	Yes	
ASCENDING	Yes	
ASCII	Yes (C/S)	
ASSIGN	Yes	
AT	Yes	
ATTRIBUTE	Yes (C/S)	
ATTRIBUTES	Yes (C/S)	
AUTHOR	Yes (C/S)	
AUTO	Yes (C/S)	AUTO-SKIP, AUTOTERMINATE
AUTO-DECIMAL	Yes (C/S)	
AUTO-SKIP	Yes	AUTO, AUTOTERMINATE

Reserved word	Implemented	Aliases
AUTO-SPIN	Yes (C/S)	
AUTOMATIC	Yes	
AUTOTERMINATE	Yes	AUTO, AUTO-SKIP
AWAY-FROM-ZERO	Yes (C/S)	
B-AND	Yes	
B-NOT	Yes	
B-OR	Yes	
B-SHIFT-L	Yes	
B-SHIFT-LC	Yes	
B-SHIFT-R	Yes	
B-SHIFT-RC	Yes	
B-XOR	Yes	
BACKGROUND-COLOR	Yes (C/S)	BACKGROUND-COLOUR
BACKGROUND-COLOUR	Yes	BACKGROUND-COLOR
BACKGROUND-HIGH	Yes	
BACKGROUND-LOW	Yes	
BACKGROUND-STANDARD	Yes	
BACKWARD	Yes (C/S)	
BAR	Yes (C/S)	
BASED	Yes	
BEEP	Yes	BELL
BEFORE	Yes	
BELL	Yes (C/S)	BEEP
BINARY	Yes	
BINARY-C-LONG	Yes	
BINARY-CHAR	Yes	
BINARY-DOUBLE	Yes	BINARY-LONG-LONG
BINARY-INT	Yes	BINARY-LONG
BINARY-LONG	Yes	BINARY-INT
BINARY-LONG-LONG	Yes	BINARY-DOUBLE

Reserved word	Implemented	Aliases
BINARY-SEQUENTIAL	Yes (C/S)	
BINARY-SHORT	Yes	
BIT	Yes	
BITMAP	Yes (C/S)	
BITMAP-END	Yes (C/S)	
BITMAP-HANDLE	Yes (C/S)	
BITMAP-NUMBER	Yes (C/S)	
BITMAP-START	Yes (C/S)	
BITMAP-TIMER	Yes (C/S)	
BITMAP-TRAILING	Yes (C/S)	
BITMAP-TRANSPARENT-COLOR	Yes (C/S)	
BITMAP-WIDTH	Yes (C/S)	
BLANK	Yes	
BLINK	Yes (C/S)	
BLOCK	Yes	
BOOLEAN	Yes	
BOTTOM	Yes	
BOX	Yes (C/S)	
BOXED	Yes (C/S)	
BULK-ADDITION	Yes (C/S)	
BUSY	Yes (C/S)	
BUTTONS	Yes (C/S)	
BY	Yes	
BYTE	No (C/S)	
BYTE-LENGTH	Yes (C/S)	
BYTES	No	
C	Yes (C/S)	
CALENDAR-FONT	Yes (C/S)	
CALL	Yes	
CANCEL	Yes	

Reserved word	Implemented	Aliases
CANCEL-BUTTON	Yes (C/S)	
CAPACITY	Yes (C/S)	
CARD-PUNCH	Yes (C/S)	
CARD-READER	Yes (C/S)	
CASSETTE	Yes (C/S)	
CCOL	Yes (C/S)	
CD	Yes	
CELL	Yes (C/S)	CELLS
CELL-COLOR	Yes (C/S)	
CELL-DATA	Yes (C/S)	
CELL-FONT	Yes (C/S)	
CELL-PROTECTION	Yes (C/S)	
CELLS	Yes	CELL
CENTER	Yes (C/S)	
CENTERED	Yes (C/S)	
CENTERED-HEADINGS	Yes (C/S)	
CENTURY-DATE	Yes (C/S)	
CF	Yes	
CH	Yes	
CHAIN	No	
CHAINING	Yes	
CHANGED	Yes (C/S)	
CHARACTER	Yes	
CHARACTERS	Yes	
CHECK-BOX	Yes (C/S)	
CLASS	Yes	
CLASS-ID	Yes	
CLASSIFICATION	Yes (C/S)	
CLEAR-SELECTION	Yes (C/S)	
CLINE	Yes (C/S)	

Reserved word	Implemented	Aliases
CLINES	Yes (C/S)	
CLOSE	Yes	
COBOL	Yes (C/S)	
CODE	Yes	
CODE-SET	Yes	
COL	Yes	
COLLATING	Yes	
COLOR	Yes	
COLORS	Yes (C/S)	COLOURS
COLOURS	Yes	COLORS
COLS	Yes	
COLUMN	Yes	
COLUMN-COLOR	Yes (C/S)	
COLUMN-DIVIDERS	Yes (C/S)	
COLUMN-FONT	Yes (C/S)	
COLUMN-HEADINGS	Yes (C/S)	
COLUMN-PROTECTION	Yes (C/S)	
COLUMNS	Yes	
COMBO-BOX	Yes (C/S)	
COMMA	Yes	
COMMAND-LINE	Yes	
COMMIT	Yes	
COMMON	Yes	
COMMUNICATION	Yes	
COMP	Yes	COMPUTATIONAL
COMP-0	Yes	COMPUTATIONAL-0
COMP-1	Yes	COMPUTATIONAL-1
COMP-10	Yes	COMP-15, DOUBLE, FLOAT-LONG
COMP-15	Yes	COMP-10, DOUBLE, FLOAT-LONG
COMP-2	Yes	COMPUTATIONAL-2

Reserved word	Implemented	Aliases
COMP-3	Yes	COMPUTATIONAL-3
COMP-4	Yes	COMPUTATIONAL-4
COMP-5	Yes	COMPUTATIONAL-5
COMP-6	Yes	COMPUTATIONAL-6
COMP-9	Yes	FLOAT, FLOAT-SHORT
COMP-N	Yes	COMPUTATIONAL-N
COMP-X	Yes	COMPUTATIONAL-X
COMPUTATIONAL	Yes	COMP
COMPUTATIONAL-0	Yes	COMP-0
COMPUTATIONAL-1	Yes	COMP-1
COMPUTATIONAL-2	Yes	COMP-2
COMPUTATIONAL-3	Yes	COMP-3
COMPUTATIONAL-4	Yes	COMP-4
COMPUTATIONAL-5	Yes	COMP-5
COMPUTATIONAL-6	Yes	COMP-6
COMPUTATIONAL-N	Yes	COMP-N
COMPUTATIONAL-X	Yes	COMP-X
COMPUTE	Yes	
CONDITION	Yes	
CONFIGURATION	Yes	
CONSTANT	Yes	
CONTAINS	Yes	
CONTENT	Yes	
CONTINUE	Yes	
CONTROL	Yes	
CONTROLS	Yes	
CONVERSION	Yes (C/S)	
CONVERTING	Yes	
COPY	Yes	
COPY-SELECTION	Yes (C/S)	

Reserved word	Implemented	Aliases
CORE-INDEX	Yes (C/S)	
CORR	Yes	CORRESPONDING
CORRESPONDING	Yes	CORR
COUNT	Yes	
CRT	Yes	
CRT-UNDER	Yes	
CSIZE	Yes (C/S)	
CURRENCY	Yes	
CURRENT	No (C/S)	
CURSOR	Yes	
CURSOR-COL	Yes (C/S)	
CURSOR-COLOR	Yes (C/S)	
CURSOR-FRAME-WIDTH	Yes (C/S)	
CURSOR-ROW	Yes (C/S)	
CURSOR-X	Yes (C/S)	
CURSOR-Y	Yes (C/S)	
CUSTOM-PRINT-TEMPLATE	Yes (C/S)	
CYCLE	Yes (C/S)	
CYL-INDEX	Yes (C/S)	
CYL-OVERFLOW	Yes (C/S)	
DASHED	Yes (C/S)	
DATA	Yes	
DATA-COLUMNS	Yes (C/S)	
DATA-POINTER	Yes	
DATA-TYPES	Yes (C/S)	
DATE	Yes	
DATE-COMPILED	Yes (C/S)	
DATE-ENTRY	Yes (C/S)	
DATE-MODIFIED	Yes (C/S)	
DATE-WRITTEN	Yes (C/S)	

Reserved word	Implemented	Aliases
DAY	Yes	
DAY-OF-WEEK	Yes	
DE	Yes	
DEBUGGING	Yes	
DECIMAL-POINT	Yes	
DECLARATIVES	Yes	
DEFAULT	Yes	
DEFAULT-BUTTON	Yes (C/S)	
DEFAULT-FONT	Yes	
DELETE	Yes	
DELIMITED	Yes	
DELIMITER	Yes	
DEPENDING	Yes	
DESCENDING	Yes	
DESTINATION	Yes	
DESTROY	Yes	
DETAIL	Yes	
DISABLE	Yes	
DISC	Yes (C/S)	
DISK	Yes (C/S)	
DISP	Yes (C/S)	
DISPLAY	Yes	
DISPLAY-1	Yes	
DISPLAY-COLUMNS	Yes (C/S)	
DISPLAY-FORMAT	Yes (C/S)	
DIVIDE	Yes	
DIVIDER-COLOR	Yes (C/S)	
DIVIDERS	Yes (C/S)	
DIVISION	Yes	
DOTDASH	Yes (C/S)	

Reserved word	Implemented	Aliases
DOTTED	Yes (C/S)	
DOUBLE	Yes	COMP-10, COMP-15, FLOAT-LONG
DOWN	Yes	
DRAG-COLOR	Yes (C/S)	
DROP-DOWN	Yes (C/S)	
DROP-LIST	Yes (C/S)	
DUPLICATES	Yes	
DYNAMIC	Yes	
EBCDIC	Yes (C/S)	
EC	Yes	
ECHO	Yes	
EDITING	No	
EGI	Yes	
ELEMENT	Yes (C/S)	
ELSE	Yes	
EMI	Yes	
EMPTY-CHECK	Yes	REQUIRED
ENABLE	Yes	
ENABLED	Yes (C/S)	
ENCODING	Yes (C/S)	
ENCRYPTION	Yes (C/S)	
END	Yes	
END-ACCEPT	Yes	
END-ADD	Yes	
END-CALL	Yes	
END-CHAIN	No	
END-COLOR	Yes (C/S)	
END-COMPUTE	Yes	
END-DELETE	Yes	
END-DISPLAY	Yes	

Reserved word	Implemented	Aliases
END-DIVIDE	Yes	
END-EVALUATE	Yes	
END-IF	Yes	
END-JSON	Yes	
END-MODIFY	Yes (C/S)	
END-MULTIPLY	Yes	
END-OF-PAGE	Yes	EOP
END-PERFORM	Yes	
END-READ	Yes	
END-RECEIVE	Yes	
END-RETURN	Yes	
END-REWRITE	Yes	
END-SEARCH	Yes	
END-SEND	Yes	
END-START	Yes	
END-STRING	Yes	
END-SUBTRACT	Yes	
END-UNSTRING	Yes	
END-WRITE	Yes	
END-XML	Yes	
ENGRAVED	Yes (C/S)	
ENSURE-VISIBLE	Yes (C/S)	
ENTRY	Yes	
ENTRY-CONVENTION	Yes (C/S)	
ENTRY-FIELD	Yes (C/S)	
ENTRY-REASON	Yes (C/S)	
ENVIRONMENT	Yes	
ENVIRONMENT-NAME	Yes	
ENVIRONMENT-VALUE	Yes	
EO	No	

Reserved word	Implemented	Aliases
EOL	Yes (C/S)	
EOP	Yes	END-OF-PAGE
EOS	Yes (C/S)	
EQUAL	Yes	EQUALS
EQUALS	Yes	EQUAL
ERASE	Yes (C/S)	
ERROR	Yes	
ESCAPE	Yes	
ESCAPE-BUTTON	Yes (C/S)	
ESI	Yes	
EVALUATE	Yes	
EVENT	Yes	
EVENT-LIST	Yes (C/S)	
EVERY	Yes (C/S)	
EXCEPTION	Yes	
EXCEPTION-OBJECT	No	
EXCEPTION-VALUE	Yes (C/S)	
EXCLUSIVE	Yes	
EXCLUSIVE-OR	No	
EXHIBIT	Yes	
EXIT	Yes	
EXPAND	Yes (C/S)	
EXPANDS	Yes (C/S)	
EXTEND	Yes	
EXTENDED-SEARCH	Yes (C/S)	
EXTERN	Yes (C/S)	
EXTERNAL	Yes	
EXTERNAL-FORM	Yes	
F	Yes (C/S)	
FACTORY	Yes	

Reserved word	Implemented	Aliases
FALSE	Yes	
FD	Yes	
FH--FCD	Yes (C/S)	
FH--KEYDEF	Yes (C/S)	
FILE	Yes	
FILE-CONTROL	Yes	
FILE-ID	Yes	
FILE-LIMIT	Yes (C/S)	
FILE-LIMITS	Yes (C/S)	
FILE-NAME	Yes (C/S)	
FILE-POS	Yes (C/S)	
FILL-COLOR	Yes (C/S)	
FILL-COLOR2	Yes (C/S)	
FILL-PERCENT	Yes (C/S)	
FILLER	Yes	
FINAL	Yes	
FINALLY	No	
FINISH-REASON	Yes (C/S)	
FIRST	Yes	
FIXED	Yes	
FIXED-FONT	Yes	
FIXED-WIDTH	Yes (C/S)	
FLAT	Yes (C/S)	
FLAT-BUTTONS	Yes (C/S)	
FLOAT	Yes	COMP-9, FLOAT-SHORT
FLOAT-BINARY-128	No	
FLOAT-BINARY-32	No	
FLOAT-BINARY-64	No	
FLOAT-DECIMAL-16	Yes	
FLOAT-DECIMAL-34	Yes	

Reserved word	Implemented	Aliases
FLOAT-EXTENDED	Yes	
FLOAT-INFINITY	No	
FLOAT-LONG	Yes	COMP-10, COMP-15, DOUBLE
FLOAT-NOT-A-NUMBER	No (C/S)	
FLOAT-SHORT	Yes	COMP-9, FLOAT
FLOATING	Yes	
FONT	Yes	
FOOTING	Yes	
FOR	Yes	
FOREGROUND-COLOR	Yes (C/S)	FOREGROUND-COLOUR
FOREGROUND-COLOUR	Yes	FOREGROUND-COLOR
FOREVER	Yes (C/S)	
FORMAT	Yes	
FRAME	Yes (C/S)	
FRAMED	Yes (C/S)	
FREE	Yes	
FROM	Yes	
FULL	Yes (C/S)	LENGTH-CHECK
FULL-HEIGHT	Yes (C/S)	
FUNCTION	Yes	
FUNCTION-ID	Yes	
FUNCTION-POINTER	Yes	
GENERATE	Yes	
GET	Yes	
GIVING	Yes	
GLOBAL	Yes	
GO	Yes	
GO-BACK	Yes (C/S)	
GO-FORWARD	Yes (C/S)	
GO-HOME	Yes (C/S)	

Reserved word	Implemented	Aliases
GO-SEARCH	Yes (C/S)	
GOBACK	Yes	
GRAPHICAL	Yes (C/S)	
GREATER	Yes	
GRID	Yes (C/S)	
GROUP	Yes	
GROUP-USAGE	No	
GROUP-VALUE	Yes (C/S)	
HANDLE	Yes	
HAS-CHILDREN	Yes (C/S)	
HEADING	Yes	
HEADING-COLOR	Yes (C/S)	
HEADING-DIVIDER-COLOR	Yes (C/S)	
HEADING-FONT	Yes (C/S)	
HEAVY	Yes (C/S)	
HEIGHT-IN-CELLS	Yes (C/S)	
HELP-ID	Yes (C/S)	
HEX	No (C/S)	
HIDDEN-DATA	Yes (C/S)	
HIGH-COLOR	Yes (C/S)	
HIGH-VALUE	Yes	HIGH-VALUES
HIGH-VALUES	Yes	HIGH-VALUE
HIGHLIGHT	Yes (C/S)	
HOT-TRACK	Yes (C/S)	
HSCROLL	Yes (C/S)	
HSCROLL-POS	Yes (C/S)	
I-O	Yes	
I-O-CONTROL	Yes	
ICON	Yes (C/S)	
ID	Yes	

Reserved word	Implemented	Aliases
IDENTIFICATION	Yes	
IDENTIFIED	Yes	
IF	Yes	
IGNORE	Yes	
IGNORING	Yes (C/S)	
IMPLEMENTS	Yes (C/S)	
IN	Yes	
INDEPENDENT	Yes (C/S)	
INDEX	Yes	
INDEXED	Yes	
INDICATE	Yes	
INHERITS	Yes	
INITIAL	Yes	
INITIALISE	Yes	INITIALIZE
INITIALISED	Yes	INITIALIZED
INITIALIZE	Yes	INITIALISE
INITIALIZED	Yes (C/S)	INITIALISED
INITIATE	Yes	
INPUT	Yes	
INPUT-OUTPUT	Yes	
INQUIRE	Yes	
INSERT-ROWS	Yes (C/S)	
INSERTION-INDEX	Yes (C/S)	
INSPECT	Yes	
INSTALLATION	Yes (C/S)	
INTERFACE	Yes	
INTERFACE-ID	Yes	
INTERMEDIATE	Yes (C/S)	
INTERNAL	Yes	
INTO	Yes	

Reserved word	Implemented	Aliases
INTRINSIC	Yes (C/S)	
INVALID	Yes	
INVOKE	Yes	
IS	Yes	
ITEM	Yes (C/S)	
ITEM-TEXT	Yes (C/S)	
ITEM-TO-ADD	Yes (C/S)	
ITEM-TO-DELETE	Yes (C/S)	
ITEM-TO-EMPTY	Yes (C/S)	
ITEM-VALUE	Yes (C/S)	
JSON	Yes	
JUST	Yes	JUSTIFIED
JUSTIFIED	Yes	JUST
KEPT	Yes	
KEY	Yes	
KEYBOARD	Yes (C/S)	
LABEL	Yes	
LABEL-OFFSET	Yes (C/S)	
LARGE-FONT	Yes	
LARGE-OFFSET	Yes (C/S)	
LAST	Yes	
LAST-ROW	Yes (C/S)	
LAYOUT-DATA	Yes (C/S)	
LAYOUT-MANAGER	Yes	
LC_ALL	No (C/S)	
LC_COLLATE	No (C/S)	
LC_CTYPE	No (C/S)	
LC_MESSAGES	No (C/S)	
LC_MONETARY	No (C/S)	
LC_NUMERIC	No (C/S)	

Reserved word	Implemented	Aliases
LC_TIME	No (C/S)	
LEADING	Yes	
LEADING-SHIFT	Yes (C/S)	
LEAVE	Yes (C/S)	
LEFT	Yes	
LEFT-JUSTIFY	No	
LEFT-TEXT	Yes (C/S)	
LEFTLINE	Yes	
LENGTH	Yes	
LENGTH-CHECK	Yes	FULL
LESS	Yes	
LIKE	Yes	
LIMIT	Yes	
LIMITS	Yes	
LINAGE	Yes	
LINAGE-COUNTER	Yes	
LINE	Yes	
LINE-COUNTER	Yes	
LINE-SEQUENTIAL	Yes (C/S)	
LINES	Yes	
LINES-AT-ROOT	Yes (C/S)	
LINKAGE	Yes	
LIST-BOX	Yes (C/S)	
LM-RESIZE	Yes	
LOC	Yes (C/S)	
LOCAL-STORAGE	Yes	
LOCALE	Yes	
LOCATION	No (C/S)	
LOCK	Yes	
LOCK-HOLDING	Yes (C/S)	

Reserved word	Implemented	Aliases
LONG-DATE	Yes (C/S)	
LOW-COLOR	Yes (C/S)	
LOW-VALUE	Yes	LOW-VALUES
LOW-VALUES	Yes	LOW-VALUE
LOWER	Yes (C/S)	
LOWERED	Yes (C/S)	
LOWLIGHT	Yes (C/S)	
MAGNETIC-TAPE	Yes (C/S)	
MANUAL	Yes	
MASS-UPDATE	Yes (C/S)	
MASTER-INDEX	Yes (C/S)	
MAX-LINES	Yes (C/S)	
MAX-PROGRESS	Yes (C/S)	
MAX-TEXT	Yes (C/S)	
MAX-VAL	Yes (C/S)	
MEDIUM-FONT	Yes	
MEMORY	Yes (C/S)	
MENU	Yes (C/S)	
MERGE	Yes	
MESSAGE	Yes	
MESSAGE-TAG	No	
METHOD	Yes	
METHOD-ID	Yes	
MICROSECOND-TIME	Yes (C/S)	
MIN-VAL	Yes (C/S)	
MINUS	Yes	
MODAL	Yes (C/S)	
MODE	Yes	
MODELESS	Yes (C/S)	
MODIFY	Yes	

Reserved word	Implemented	Aliases
MODULES	Yes (C/S)	
MOVE	Yes	
MULTILINE	Yes (C/S)	
MULTIPLE	Yes	
MULTIPLY	Yes	
NAME	Yes (C/S)	
NAMED	Yes (C/S)	
NAMESPACE	Yes (C/S)	
NAMESPACE-PREFIX	Yes (C/S)	
NAT	No (C/S)	
NATIONAL	Yes	
NATIONAL-EDITED	Yes	
NATIVE	Yes	
NAVIGATE-URL	Yes (C/S)	
NEAREST-AWAY-FROM-ZERO	Yes (C/S)	
NEAREST-EVEN	Yes (C/S)	
NEAREST-TOWARD-ZERO	Yes (C/S)	
NEGATIVE	Yes	
NESTED	Yes	
NEW	Yes	
NEXT	Yes	
NEXT-ITEM	Yes (C/S)	
NO	Yes	
NO-AUTO-DEFAULT	Yes (C/S)	
NO-AUTOSEL	Yes (C/S)	
NO-BOX	Yes (C/S)	
NO-DIVIDERS	Yes (C/S)	
NO-ECHO	Yes	
NO-F4	Yes (C/S)	
NO-FOCUS	Yes (C/S)	

Reserved word	Implemented	Aliases
NO-GROUP-TAB	Yes (C/S)	
NO-KEY-LETTER	Yes (C/S)	
NO-SEARCH	Yes (C/S)	
NO-UPDOWN	Yes (C/S)	
NOMINAL	Yes (C/S)	
NONE	Yes (C/S)	
NONNUMERIC	Yes (C/S)	
NORMAL	Yes (C/S)	
NOT	Yes	
NOTAB	Yes (C/S)	
NOTHING	Yes	
NOTIFY	Yes (C/S)	
NOTIFY-CHANGE	Yes (C/S)	
NOTIFY-DBLCLICK	Yes (C/S)	
NOTIFY-SELCHANGE	Yes (C/S)	
NULL	Yes	NULLS
NULLS	Yes	NULL
NUM-COL-HEADINGS	Yes (C/S)	
NUM-ROWS	Yes (C/S)	
NUMBER	Yes	
NUMBERS	Yes	
NUMERIC	Yes	
NUMERIC-EDITED	Yes	
NUMERIC-FILL	No (C/S)	
OBJECT	Yes	
OBJECT-COMPUTER	Yes	
OBJECT-REFERENCE	No	
OCCURS	Yes	
OF	Yes	
OFF	Yes	

Reserved word	Implemented	Aliases
OK-BUTTON	Yes (C/S)	
OMITTED	Yes	
ON	Yes	
ONLY	Yes	
OPEN	Yes	
OPTIONAL	Yes	
OPTIONS	Yes	
OR	Yes	
ORDER	Yes	
ORGANISATION	Yes	ORGANIZATION
ORGANIZATION	Yes	ORGANISATION
OTHER	Yes	
OTHERS	Yes (C/S)	
OUTPUT	Yes	
OVERFLOW	Yes	
OVERLAP-LEFT	Yes (C/S)	OVERLAP-TOP
OVERLAP-TOP	Yes (C/S)	OVERLAP-LEFT
OVERLINE	Yes	
OVERRIDE	No	
PACKED-DECIMAL	Yes	
PADDING	Yes	
PAGE	Yes	
PAGE-COUNTER	Yes	
PAGE-SETUP	Yes (C/S)	
PAGED	Yes (C/S)	
PARAGRAPH	Yes (C/S)	
PARENT	Yes (C/S)	
PARSE	Yes (C/S)	
PARTIAL	Yes	
PASCAL	Yes (C/S)	

Reserved word	Implemented	Aliases
PASSWORD	Yes (C/S)	
PERFORM	Yes	
PERMANENT	Yes (C/S)	
PF	Yes	
PH	Yes	
PHYSICAL	Yes	
PIC	Yes	PICTURE
PICTURE	Yes	PIC
PIXEL	Yes (C/S)	PIXELS
PIXELS	Yes	PIXEL
PLACEMENT	Yes (C/S)	
PLUS	Yes	
POINTER	Yes	
POP-UP	Yes (C/S)	
POS	Yes (C/S)	
POSITION	Yes	
POSITION-SHIFT	Yes (C/S)	
POSITIVE	Yes	
PREFIXED	No (C/S)	
PRESENT	Yes	
PREVIOUS	Yes (C/S)	
PRINT	Yes (C/S)	
PRINT-NO-PROMPT	Yes (C/S)	
PRINT-PREVIEW	Yes (C/S)	
PRINTER	Yes (C/S)	
PRINTER-1	Yes (C/S)	
PRINTING	Yes	
PRIORITY	Yes	
PROCEDURE	Yes	
PROCEDURE-POINTER	Yes	PROGRAM-POINTER

Reserved word	Implemented	Aliases
PROCEDURES	Yes	
PROCEED	Yes	
PROCESSING	Yes (C/S)	
PROGRAM	Yes	
PROGRAM-ID	Yes	
PROGRAM-POINTER	Yes	PROCEDURE-POINTER
PROGRESS	Yes (C/S)	
PROHIBITED	Yes (C/S)	
PROMPT	Yes	
PROPERTIES	Yes (C/S)	
PROPERTY	Yes	
PROTECTED	Yes (C/S)	
PROTOTYPE	Yes	
PUBLIC	Yes	
PURGE	Yes	
PUSH-BUTTON	Yes (C/S)	
QUERY-INDEX	Yes (C/S)	
QUEUE	Yes	
QUOTE	Yes	QUOTES
QUOTES	Yes	QUOTE
RADIO-BUTTON	Yes (C/S)	
RAISE	Yes	
RAISED	Yes (C/S)	
RAISING	Yes	
RANDOM	Yes	
RD	Yes	
READ	Yes	
READ-ONLY	Yes (C/S)	
READERS	Yes (C/S)	
READY	Yes	

Reserved word	Implemented	Aliases
RECEIVE	Yes	
RECEIVED	Yes	
RECORD	Yes	
RECORD-DATA	Yes (C/S)	
RECORD-OVERFLOW	Yes (C/S)	
RECORD-TO-ADD	Yes (C/S)	
RECORD-TO-DELETE	Yes (C/S)	
RECORDING	Yes	
RECORDS	Yes	
RECURSIVE	Yes (C/S)	
REDEFINES	Yes	
REEL	Yes	
REFERENCE	Yes	
REFERENCES	Yes	
REFRESH	Yes (C/S)	
REGION-COLOR	Yes (C/S)	
RELATION	Yes (C/S)	
RELATIVE	Yes	
RELEASE	Yes	
REMAINDER	Yes	
REMARKS	Yes (C/S)	
REMOVAL	Yes	
RENAMES	Yes	
REORG-CRITERIA	Yes (C/S)	
REPEATED	Yes	
REPLACE	Yes	
REPLACING	Yes	
REPORT	Yes	
REPORTING	Yes	
REPORTS	Yes	

Reserved word	Implemented	Aliases
REPOSITORY	Yes	
REQUIRED	Yes (C/S)	EMPTY-CHECK
REREAD	Yes (C/S)	
RERUN	Yes (C/S)	
RESERVE	Yes	
RESET	Yes	
RESET-GRID	Yes (C/S)	
RESET-LIST	Yes (C/S)	
RESET-TABS	Yes (C/S)	
RESIDENT	Yes (C/S)	
RESUME	No	
RETRY	Yes	
RETURN	Yes	
RETURNING	Yes	
REVERSE	Yes	
REVERSE-VIDEO	Yes (C/S)	
REVERSED	Yes	
REWIND	Yes	
REWRITE	Yes	
RF	Yes	
RH	Yes	
RIGHT	Yes	
RIGHT-ALIGN	Yes (C/S)	
RIGHT-JUSTIFY	No	
RIGHTLINE	Yes	
RIMMED	Yes (C/S)	
ROLLBACK	Yes	
ROUNDED	Yes	
ROUNDING	Yes (C/S)	
ROW-COLOR	Yes (C/S)	

Reserved word	Implemented	Aliases
ROW-COLOR-PATTERN	Yes (C/S)	
ROW-DIVIDERS	Yes (C/S)	
ROW-FONT	Yes (C/S)	
ROW-HEADINGS	Yes (C/S)	
ROW-PROTECTION	Yes (C/S)	
RUN	Yes	
S	Yes (C/S)	
SAME	Yes	
SAVE-AS	Yes (C/S)	
SAVE-AS-NO-PROMPT	Yes (C/S)	
SCREEN	Yes	
SCROLL	Yes (C/S)	
SCROLL-BAR	Yes (C/S)	
SD	Yes	
SEARCH	Yes	
SEARCH-OPTIONS	Yes (C/S)	
SEARCH-TEXT	Yes (C/S)	
SECONDS	Yes (C/S)	
SECTION	Yes	
SECURE	Yes (C/S)	
SECURITY	Yes (C/S)	
SEGMENT	Yes	
SEGMENT-LIMIT	Yes	
SELECT	Yes	
SELECT-ALL	Yes (C/S)	
SELECTION-INDEX	Yes (C/S)	
SELECTION-TEXT	Yes (C/S)	
SELF	Yes	
SELF-ACT	Yes (C/S)	
SEND	Yes	

Reserved word	Implemented	Aliases
SENTENCE	Yes	
SEPARATE	Yes	
SEPARATION	Yes (C/S)	
SEQUENCE	Yes	
SEQUENTIAL	Yes	
SET	Yes	
SHADING	Yes (C/S)	
SHADOW	Yes (C/S)	
SHARING	Yes	
SHORT-DATE	Yes (C/S)	
SHOW-LINES	Yes (C/S)	
SHOW-NONE	Yes (C/S)	
SHOW-SEL-ALWAYS	Yes (C/S)	
SIGN	Yes	
SIGNED	Yes	
SIGNED-INT	Yes	
SIGNED-LONG	Yes	
SIGNED-SHORT	Yes	
SIZE	Yes	
SMALL-FONT	Yes	
SORT	Yes	
SORT-MERGE	Yes	
SORT-ORDER	Yes (C/S)	
SOURCE	Yes	
SOURCE-COMPUTER	Yes	
SOURCES	No	
SPACE	Yes	SPACES
SPACE-FILL	No	
SPACES	Yes	SPACE
SPECIAL-NAMES	Yes	

Reserved word	Implemented	Aliases
SPINNER	Yes (C/S)	
SQUARE	Yes (C/S)	
STACK	No (C/S)	
STANDARD	Yes	
STANDARD-1	Yes	
STANDARD-2	Yes	
STANDARD-BINARY	Yes (C/S)	
STANDARD-DECIMAL	Yes (C/S)	
START	Yes	
START-X	Yes (C/S)	
START-Y	Yes (C/S)	
STATEMENT	No (C/S)	
STATIC	Yes (C/S)	
STATIC-LIST	Yes (C/S)	
STATUS	Yes	
STATUS-BAR	Yes (C/S)	
STATUS-TEXT	Yes (C/S)	
STDCALL	Yes (C/S)	
STEP	Yes (C/S)	
STOP	Yes	
STRING	Yes	
STRONG	Yes (C/S)	
STYLE	Yes (C/S)	
SUB-QUEUE-1	Yes	
SUB-QUEUE-2	Yes	
SUB-QUEUE-3	Yes	
SUBTRACT	Yes	
SUBWINDOW	Yes	
SUM	Yes	
SUPER	Yes	

Reserved word	Implemented	Aliases
SUPPRESS	Yes	
SYMBOL	Yes (C/S)	
SYMBOLIC	Yes	
SYNC	Yes	SYNCHRONISED, SYNCHRONIZED
SYNCHRONISED	Yes	SYNC, SYNCHRONIZED
SYNCHRONIZED	Yes	SYNC, SYNCHRONISED
SYSTEM-DEFAULT	Yes	
SYSTEM-INFO	Yes (C/S)	
SYSTEM-OFFSET	Yes	
TAB	Yes (C/S)	
TAB-TO-ADD	Yes (C/S)	
TAB-TO-DELETE	Yes (C/S)	
TABLE	Yes	
TALLYING	Yes	
TAPE	Yes (C/S)	
TEMPORARY	Yes (C/S)	
TERMINAL-INFO	Yes (C/S)	
TERMINATE	Yes	
TERMINATION-VALUE	Yes (C/S)	
TEST	Yes	
TEXT	Yes	
THAN	Yes	
THEN	Yes	
THREAD	Yes	
THREADS	Yes	
THROUGH	Yes	THRU
THRU	Yes	THROUGH
THUMB-POSITION	Yes (C/S)	
TILED-HEADINGS	Yes (C/S)	
TIME	Yes	

Reserved word	Implemented	Aliases
TIME-OUT	Yes (C/S)	TIMEOUT
TIMEOUT	Yes	TIME-OUT
TIMES	Yes	
TITLE	Yes (C/S)	
TITLE-POSITION	Yes (C/S)	
TO	Yes	
TOP	Yes	
TOP-LEVEL	No (C/S)	
TOWARD-GREATER	Yes (C/S)	
TOWARD-LESSER	Yes (C/S)	
TRACE	Yes (C/S)	
TRACK	Yes (C/S)	
TRACK-AREA	Yes (C/S)	
TRACK-LIMIT	Yes (C/S)	
TRACKS	Yes (C/S)	
TRADITIONAL-FONT	Yes	
TRAILING	Yes	
TRAILING-SHIFT	Yes (C/S)	
TRAILING-SIGN	No	
TRANSACTION	Yes	
TRANSFORM	Yes	
TRANSPARENT	Yes (C/S)	
TREE-VIEW	Yes (C/S)	
TRUE	Yes	
TRUNCATION	Yes (C/S)	
TYPE	Yes	
TYPEDEF	Yes	
U	Yes (C/S)	
UCS-4	Yes (C/S)	
UNBOUNDED	Yes (C/S)	

Reserved word	Implemented	Aliases
UNDERLINE	Yes (C/S)	
UNFRAMED	Yes (C/S)	
UNIT	Yes	
UNIVERSAL	No	
UNLOCK	Yes	
UNSIGNED	Yes	
UNSIGNED-INT	Yes	
UNSIGNED-LONG	Yes	
UNSIGNED-SHORT	Yes	
UNSORTED	Yes (C/S)	
UNSTRING	Yes	
UNTIL	Yes	
UP	Yes	
UPDATE	Yes	
UPDATERS	Yes (C/S)	
UPON	Yes	
UPPER	Yes (C/S)	
USAGE	Yes	
USE	Yes	
USE-ALT	Yes (C/S)	
USE-RETURN	Yes (C/S)	
USE-TAB	Yes (C/S)	
USER	Yes (C/S)	
USER-DEFAULT	Yes	
USING	Yes	
UTF-16	Yes (C/S)	
UTF-8	Yes (C/S)	
V	Yes (C/S)	
VAL-STATUS	Yes	VALIDATE-STATUS
VALID	Yes	

Reserved word	Implemented	Aliases
VALIDATE	Yes	
VALIDATE-STATUS	Yes	VAL-STATUS
VALIDATING	Yes (C/S)	
VALUE	Yes	
VALUE-FORMAT	Yes (C/S)	
VALUES	Yes	
VARIABLE	Yes (C/S)	
VARIANT	Yes	
VARYING	Yes	
VERTICAL	Yes (C/S)	
VERY-HEAVY	Yes (C/S)	
VIRTUAL-WIDTH	Yes (C/S)	
VISIBLE	Yes (C/S)	
VOLATILE	Yes	
VPADDING	Yes (C/S)	
VSCROLL	Yes (C/S)	
VSCROLL-BAR	Yes (C/S)	
VSCROLL-POS	Yes (C/S)	
VTOP	Yes (C/S)	
WAIT	Yes	
WEB-BROWSER	Yes (C/S)	
WHEN	Yes	
WIDTH	Yes (C/S)	
WIDTH-IN-CELLS	Yes (C/S)	
WINDOW	Yes	
WITH	Yes	
WORDS	Yes	
WORKING-STORAGE	Yes	
WRAP	Yes (C/S)	
WRITE	Yes	

Reserved word	Implemented	Aliases
WRITE-ONLY	Yes (C/S)	
WRITE-VERIFY	Yes (C/S)	
WRITERS	Yes (C/S)	
X	Yes (C/S)	
XML	Yes	
XML-DECLARATION	Yes (C/S)	
XML-SCHEMA	Yes (C/S)	
XOR	No	
Y	Yes (C/S)	
YYYYDDD	Yes (C/S)	
YYYYMMDD	Yes (C/S)	
ZERO	Yes	ZEROES, ZEROS
ZERO-FILL	No (C/S)	
ZEROES	Yes	ZERO, ZEROS
ZEROS	Yes	ZERO, ZEROES

11.2 Internal registers

Register	Imple-mented	Definition
'ADDRESS OF' phrase	Yes	USAGE POINTER
COB-CRT-STATUS	Yes	PICTURE 9(4) USAGE DISPLAY VALUE ZERO
DEBUG-ITEM	Yes	PICTURE X(n) USAGE DISPLAY
'LENGTH OF' phrase	Yes	CONSTANT USAGE BINARY-LONG
NUMBER-OF-CALL-PARAMETERS	Yes	USAGE BINARY-LONG
RETURN-CODE	Yes	GLOBAL USAGE BINARY-LONG VALUE ZERO
SORT-RETURN	Yes	GLOBAL USAGE BINARY-LONG VALUE ZERO
TALLY	Yes	GLOBAL PICTURE 9(5) USAGE BINARY VALUE ZERO
WHEN-COMPILED	Yes	CONSTANT PICTURE X(16) USAGE DISPLAY
XML-CODE	Yes	GLOBAL PICTURE S9(9) USAGE BINARY VALUE 0

Register	Imple-mented	Definition
XML-EVENT	Yes	GLOBAL USAGE DISPLAY PICTURE X(30) VALUE SPACE
XML-INFORMATION	Yes	GLOBAL PICTURE S9(9) USAGE BINARY VALUE 0
XML-NAMESPACE	Yes	GLOBAL PIC X ANY LENGTH
XML-NAMESPACE-PREFIX	Yes	GLOBAL PIC X ANY LENGTH
XML-NNAMESPACE	Yes	GLOBAL PIC N ANY LENGTH
XML-NNAMESPACE-PREFIX	Yes	GLOBAL PIC N ANY LENGTH
XML-NTEXT	Yes	GLOBAL PIC N ANY LENGTH
XML-TEXT	Yes	GLOBAL PIC X ANY LENGTH
JSON-CODE	Yes	GLOBAL PICTURE S9(9) USAGE BINARY VALUE 0
JSON-STATUS	Yes	GLOBAL PICTURE S9(9) USAGE BINARY VALUE 0

12 Intrinsic Functions

The following list of intrinsic functions was extracted from `cobc --list-intrinsics` and shows the names of the available functions, an implementation note and the number of parameters.

Intrinsic	Function	Implemented
ABS	Yes	1
ACOS	Yes	1
ANNUITY	Yes	2
ASIN	Yes	1
ATAN	Yes	1
BASECONVERT	No	3
BIT-OF	Yes	1
BIT-TO-CHAR	Yes	1
BOOLEAN-OF-INTEGER	No	2
BYTE-LENGTH	Yes	1
CHAR	Yes	1
CHAR-NATIONAL	No	1
COMBINED-DATETIME	Yes	2
CONCAT	Yes	Unlimited
CONCATENATE	Yes	Unlimited
CONTENT-LENGTH	Yes	1
CONTENT-OF	Yes	1
CONVERT	No	3
COS	Yes	1
CURRENCY-SYMBOL	Yes	0
CURRENT-DATE	Yes	0
DATE-OF-INTEGER	Yes	1
DATE-TO-YYYYMMDD	Yes	1
DAY-OF-INTEGER	Yes	1

Intrinsic	Function	Implemented
DAY-TO-YYYYDDD	Yes	1
DISPLAY-OF	No	1
E	Yes	0
EXCEPTION-FILE	Yes	0
EXCEPTION-FILE-N	No	0
EXCEPTION-LOCATION	Yes	0
EXCEPTION-LOCATION-N	No	0
EXCEPTION-STATEMENT	Yes	0
EXCEPTION-STATUS	Yes	0
EXP	Yes	1
EXP10	Yes	1
FACTORIAL	Yes	1
FIND-STRING	No	7
FORMATTED-CURRENT-DATE	Yes	1
FORMATTED-DATE	Yes	2
FORMATTED-DATETIME	Yes	4
FORMATTED-TIME	Yes	3
FRACTION-PART	Yes	1
HEX-OF	Yes	1
HEX-TO-CHAR	Yes	1
HIGHEST-ALGEBRAIC	Yes	1
INTEGER	Yes	1
INTEGER-OF-BOOLEAN	No	1
INTEGER-OF-DATE	Yes	1
INTEGER-OF-DAY	Yes	1
INTEGER-OF-FORMATTED-DATE	Yes	2
INTEGER-PART	Yes	1
LENGTH	Yes	1
LENGTH-AN	Yes	1
LOCALE-COMPARE	Yes	2

Intrinsic	Function	Implemented
LOCALE-DATE	Yes	1
LOCALE-TIME	Yes	1
LOCALE-TIME-FROM-SECONDS	Yes	1
LOG	Yes	1
LOG10	Yes	1
LOWER-CASE	Yes	1
LOWEST-ALGEBRAIC	Yes	1
MAX	Yes	Unlimited
MEAN	Yes	Unlimited
MEDIAN	Yes	Unlimited
MIDRANGE	Yes	Unlimited
MIN	Yes	Unlimited
MOD	Yes	2
MODULE-CALLER-ID	Yes	0
MODULE-DATE	Yes	0
MODULE-FORMATTED-DATE	Yes	0
MODULE-ID	Yes	0
MODULE-NAME	No	1
MODULE-PATH	Yes	0
MODULE-SOURCE	Yes	0
MODULE-TIME	Yes	0
MONETARY-DECIMAL-POINT	Yes	0
MONETARY-THOUSANDS-SEPARATOR	Yes	0
NATIONAL-OF	No	1
NUMERIC-DECIMAL-POINT	Yes	0
NUMERIC-THOUSANDS-SEPARATOR	Yes	0
NUMVAL	Yes	1
NUMVAL-C	Yes	2
NUMVAL-F	Yes	1
ORD	Yes	1

Intrinsic	Function	Implemented
ORD-MAX	Yes	Unlimited
ORD-MIN	Yes	Unlimited
PI	Yes	0
PRESENT-VALUE	Yes	Unlimited
RANDOM	Yes	0
RANGE	Yes	Unlimited
REM	Yes	2
REVERSE	Yes	1
SECONDS-FROM-FORMATTED-TIME	Yes	2
SECONDS-PAST-MIDNIGHT	Yes	0
SIGN	Yes	1
SIN	Yes	1
SQRT	Yes	1
STANDARD-COMPARE	No	2
STANDARD-DEVIATION	Yes	Unlimited
STORED-CHAR-LENGTH	Yes	1
SUBSTITUTE	Yes	Unlimited
SUBSTITUTE-CASE	Yes	Unlimited
SUM	Yes	Unlimited
TAN	Yes	1
TEST-DATE-YYYYMMDD	Yes	1
TEST-DAY-YYYYDDD	Yes	1
TEST-FORMATTED-DATETIME	Yes	2
TEST-NUMVAL	Yes	1
TEST-NUMVAL-C	Yes	2
TEST-NUMVAL-F	Yes	1
TRIM	Yes	1
UPPER-CASE	Yes	1
VARIANCE	Yes	Unlimited
WHEN-COMPILED	Yes	0

Intrinsic	Function	Implemented
YEAR-TO-YYYY	Yes	1

13 System routines

The following list of system routines was extracted from `cobc --list-system` and shows the names of the available system routines along with the number of parameters.

System routine	Parameters
SYSTEM	1
CBL_AND	3
CBL_ALARM_SOUND	0
CBL_BELL_SOUND	0
CBL_CHANGE_DIR	1
CBL_CHECK_FILE_EXIST	2
CBL_CLOSE_FILE	1
CBL_COPY_FILE	2
CBL_CREATE_DIR	1
CBL_CREATE_FILE	5
CBL_DELETE_DIR	1
CBL_DELETE_FILE	1
CBL_EQ	3
CBL_ERROR_PROC	2
CBL_EXIT_PROC	2
CBL_RUNTIME_ERROR	2
CBL_FLUSH_FILE	1
CBL_GET_CSR_POS	1
CBL_GET_CURRENT_DIR	3
CBL_GET_SCR_SIZE	2
CBL_IMP	3
CBL_NIMP	3
CBL_NOR	3
CBL_NOT	2
CBL_OPEN_FILE	5

System routine	Parameters
CBL_OR	3
CBL_READ_FILE	5
CBL_READ_KBD_CHAR	1
CBL_RENAME_FILE	2
CBL_SET_CSR_POS	1
CBL_TOLOWER	2
CBL_TOUPPER	2
CBL_WRITE_FILE	5
CBL_XOR	3
CBL_OPEN_VFILE	2
CBL_READ_VFILE	4
CBL_WRITE_VFILE	4
CBL_CLOSE_VFILE	1
CBL_GC_FORK	0
CBL_GC_GETOPT	6
CBL_GC_HOSTED	2
CBL_GC_NANOSLEEP	1
CBL_GC_PRINTABLE	1 - 2
CBL_GC_SET_SCR_SIZE	2
CBL_GC_WAITPID	1
CBL_OC_GETOPT	6
CBL_OC_HOSTED	2
CBL_OC_NANOSLEEP	1
CBL_GC_SCR_DUMP	1
CBL_GC_SCR_RESTORE	1
CBL_GC_WINDOW	2
CBL_GC_OPEN_VFILE64	2
CBL_GC_READ_VFILE64	4
CBL_GC_WRITE_VFILE64	4
CBL_GC_CLOSE_VFILE64	1

System routine	Parameters
C$CALLEDBY	1
C$CHDIR	2
C$COPY	3
C$DELETE	2
C$FILEINFO	2
C$GETPID	0
C$JUSTIFY	1 - 2
C$MAKEDIR	1
C$NARG	1
C$PARAMSIZE	1
C$PRINTABLE	1 - 2
C$SLEEP	1
C$TOLOWER	2
C$TOUPPER	2
EXTFH	2
X"91"	3
X"E4"	0
X"E5"	0
X"F4"	2
X"F5"	2

14 System names

The following list of system names was extracted from `cobc --list-mnemonics` and shows the system names categorized by their type.

14.1 System names: device

SYSIN, SYSIPT, STDIN, SYSOUT, SYSLIST, SYSLST, SYSPCH, SYSPUNCH, STDOUT, PRINT, PRINTER, PRINTER-1, SYSERR, STDERR, CONSOLE, ALTERNATE-CONSOLE, ALTERNATE

14.2 System names: feature

C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11, C12, S01, S02, S03, S04, S05, CSP, FORMFEED, TOP, CALL-CONVENTION

14.3 System names: switch

SWITCH-0, SWITCH-1, SWITCH-2, SWITCH-3, SWITCH-4, SWITCH-5, SWITCH-6, SWITCH-7, SWITCH-8, SWITCH-9, SWITCH-10, SWITCH-11, SWITCH-12, SWITCH-13, SWITCH-14, SWITCH-15, SWITCH-16, SWITCH-17, SWITCH-18, SWITCH-19, SWITCH-20, SWITCH-21, SWITCH-22, SWITCH-23, SWITCH-24, SWITCH-25, SWITCH-26, SWITCH-27, SWITCH-28, SWITCH-29, SWITCH-30, SWITCH-31, SWITCH-32, SWITCH-33, SWITCH-34, SWITCH-35, SWITCH-36

15 Exception names

The following list of exception names was extracted from `cobc --list-exceptions` and shows the exception names and if those are fatal (lead to a program abort).

All of those can be activated and deactivated, both directly and at group level, using `-fec`.

```
Exception Name
EC-ALL
  EC-ARGUMENT
    EC-ARGUMENT-FUNCTION (f)
    EC-ARGUMENT-IMP
  EC-BOUND
    EC-BOUND-FUNC-RET-VALUE
    EC-BOUND-IMP
    EC-BOUND-ODO (f)
    EC-BOUND-OVERFLOW (f)
    EC-BOUND-PTR (f)
    EC-BOUND-REF-MOD (f)
    EC-BOUND-SET (f)
    EC-BOUND-SUBSCRIPT (f)
    EC-BOUND-TABLE-LIMIT (f)
  EC-CONTINUE
    EC-CONTINUE-IMP
    EC-CONTINUE-LESS-THAN-ZERO
  EC-DATA
    EC-DATA-CONVERSION
    EC-DATA-IMP
    EC-DATA-INCOMPATIBLE (f)
    EC-DATA-NOT-FINITE (f)
    EC-DATA-OVERFLOW (f)
    EC-DATA-PTR-NULL (f)
    EC-DATA-NULL (f)
    EC-DATA-TRUNCATION
  EC-EXTERNAL
    EC-EXTERNAL-DATA-MISMATCH (f)
    EC-EXTERNAL-FILE-MISMATCH (f)
    EC-EXTERNAL-FORMAT-CONFLICT (f)
    EC-EXTERNAL-IMP
  EC-DELETE-FILE
```

```
    EC-DELETE-FILE-IMP
  EC-FLOW
    EC-FLOW-APPLY-COMMIT (f)
    EC-FLOW-COMMIT (f)
    EC-FLOW-GLOBAL-EXIT (f)
    EC-FLOW-GLOBAL-GOBACK (f)
    EC-FLOW-IMP
    EC-FLOW-RELEASE (f)
    EC-FLOW-REPORT (f)
    EC-FLOW-RETURN (f)
    EC-FLOW-ROLLBACK (f)
    EC-FLOW-SEARCH (f)
    EC-FLOW-USE (f)
  EC-FUNCTION
    EC-FUNCTION-ARG-OMITTED (f)
    EC-FUNCTION-IMP
    EC-FUNCTION-NOT-FOUND (f)
    EC-FUNCTION-PTR-INVALID (f)
    EC-FUNCTION-PTR-NULL (f)
  EC-I-O
    EC-I-O-AT-END
    EC-I-O-EOP
    EC-I-O-EOP-OVERFLOW
    EC-I-O-FILE-SHARING
    EC-I-O-IMP
    EC-I-O-INVALID-KEY
    EC-I-O-LINAGE (f)
    EC-I-O-LOGIC-ERROR (f)
    EC-I-O-PERMANENT-ERROR (f)
    EC-I-O-RECORD-CONTENT (f)
    EC-I-O-RECORD-OPERATION
    EC-I-O-RECORD-WARNING
  EC-IMP
    EC-IMP-ACCEPT
    EC-IMP-DISPLAY
    EC-IMP-UTC-UNKNOWN (f)
    EC-IMP-FEATURE-DISABLED
    EC-IMP-FEATURE-MISSING
  EC-LOCALE
    EC-LOCALE-IMP
    EC-LOCALE-INCOMPATIBLE
```

```
    EC-LOCALE-INVALID (f)
    EC-LOCALE-INVALID-PTR (f)
    EC-LOCALE-MISSING (f)
    EC-LOCALE-SIZE (f)
  EC-MCS
    EC-MCS-ABNORMAL-TERMINATION
    EC-MCS-IMP
    EC-MCS-INVALID-TAG
    EC-MCS-MESSAGE-LENGTH
    EC-MCS-NO-REQUESTER
    EC-MCS-NO-SERVER
    EC-MCS-NORMAL-TERMINATION
    EC-MCS-REQUESTOR-FAILED
  EC-OO
    EC-OO-ARG-OMITTED (f)
    EC-OO-CONFORMANCE (f)
    EC-OO-EXCEPTION (f)
    EC-OO-IMP
    EC-OO-METHOD (f)
    EC-OO-NULL (f)
    EC-OO-RESOURCE (f)
    EC-OO-UNIVERSAL (f)
  EC-ORDER
    EC-ORDER-IMP
    EC-ORDER-NOT-SUPPORTED (f)
  EC-OVERFLOW
    EC-OVERFLOW-IMP
    EC-OVERFLOW-STRING
    EC-OVERFLOW-UNSTRING
  EC-PROGRAM
    EC-PROGRAM-ARG-MISMATCH (f)
    EC-PROGRAM-ARG-OMITTED (f)
    EC-PROGRAM-CANCEL-ACTIVE (f)
    EC-PROGRAM-IMP
    EC-PROGRAM-NOT-FOUND (f)
    EC-PROGRAM-PTR-NULL (f)
    EC-PROGRAM-RECURSIVE-CALL (f)
    EC-PROGRAM-RESOURCES (f)
  EC-RAISING
    EC-RAISING-IMP
    EC-RAISING-NOT-SPECIFIED (f)
```

```
  EC-RANGE
    EC-RANGE-IMP
    EC-RANGE-INDEX (f)
    EC-RANGE-INSPECT-SIZE (f)
    EC-RANGE-INVALID
    EC-RANGE-PERFORM-VARYING (f)
    EC-RANGE-PTR (f)
    EC-RANGE-SEARCH-INDEX
    EC-RANGE-SEARCH-NO-MATCH
  EC-REPORT
    EC-REPORT-ACTIVE (f)
    EC-REPORT-COLUMN-OVERLAP (f)
    EC-REPORT-FILE-MODE (f)
    EC-REPORT-IMP
    EC-REPORT-INACTIVE (f)
    EC-REPORT-LINE-OVERLAP
    EC-REPORT-NOT-TERMINATED
    EC-REPORT-PAGE-LIMIT
    EC-REPORT-PAGE-WIDTH
    EC-REPORT-SUM-SIZE (f)
    EC-REPORT-VARYING (f)
  EC-SCREEN
    EC-SCREEN-FIELD-OVERLAP
    EC-SCREEN-IMP
    EC-SCREEN-ITEM-TRUNCATED
    EC-SCREEN-LINE-NUMBER
    EC-SCREEN-STARTING-COLUMN
  EC-SIZE
    EC-SIZE-ADDRESS (f)
    EC-SIZE-EXPONENTIATION (f)
    EC-SIZE-IMP
    EC-SIZE-OVERFLOW (f)
    EC-SIZE-TRUNCATION (f)
    EC-SIZE-UNDERFLOW (f)
    EC-SIZE-ZERO-DIVIDE (f)
  EC-SORT-MERGE
    EC-SORT-MERGE-ACTIVE (f)
    EC-SORT-MERGE-FILE-OPEN (f)
    EC-SORT-MERGE-IMP
    EC-SORT-MERGE-RELEASE (f)
    EC-SORT-MERGE-RETURN (f)
```

```
    EC-SORT-MERGE-SEQUENCE (f)
  EC-STORAGE
    EC-STORAGE-IMP
    EC-STORAGE-NOT-ALLOC
    EC-STORAGE-NOT-AVAIL
  EC-USER
  EC-VALIDATE
    EC-VALIDATE-CONTENT
    EC-VALIDATE-FORMAT
    EC-VALIDATE-IMP
    EC-VALIDATE-RELATION
    EC-VALIDATE-VARYING (f)
  EC-XML
    EC-XML-CODESET (f)
    EC-XML-CODESET-CONVERSION (f)
    EC-XML-COUNT (f)
    EC-XML-DOCUMENT-TYPE (f)
    EC-XML-IMPLICIT-CLOSE (f)
    EC-XML-INVALID (f)
    EC-XML-NAMESPACE (f)
    EC-XML-STACKED-OPEN (f)
    EC-XML-RANGE (f)
    EC-XML-IMP (f)
  EC-JSON
    EC-JSON-IMP (f)
```

16 Compiler Configuration

The following list was extracted from `config/default.conf`.

```
# Value: any string
name: "GnuCOBOL"

# Value: enum
standard-define         0
# NOTE: see enum cb_std_def, defined in cobc/cobc.h.
#        CB_STD_GC = 0,
#        CB_STD_MF,
#        CB_STD_IBM,
#        CB_STD_MVS,
#        CB_STD_BS2000,
#        CB_STD_ACU,
#        CB_STD_RM,
#        CB_STD_85,
#        CB_STD_2002,
#        CB_STD_2014

# Default source reference-format; values: FIXED, FREE, COBOL85,
# VARIABLE, XOPEN, XCARD, CRT, TERMINAL, COBOLX
format:             auto

# Value: int
tab-width:          8
text-column:            72
# Maximum word-length for COBOL words / Programmer defined words
# Be aware that GC checks the word length against COB_MAX_WORDLEN
# first (currently 63)
word-length:            63

# Maximum literal size in general
literal-length:         8191

# Maximum numeric literal size (absolute maximum: 38)
numeric-literal-length:     38

# Maximum number of characters allowed in the character-string (max. 255)
```

```
pic-length:         255

# Enable AREACHECK by default, for reference formats other than {fixed,free}
areacheck:          no

# Default assign type
# Value: 'dynamic', 'external'
assign-clause:          dynamic

# If yes, file names are resolved at run time using
# environment variables.
# For example, given ASSIGN TO "DATAFILE", the file name will be
#  1. the value of environment variable 'DD_DATAFILE' or
#  2. the value of environment variable 'dd_DATAFILE' or
#  3. the value of environment variable 'DATAFILE' or
#  4. the literal "DATAFILE"
# If no, the value of the assign clause is the file name.
#
filename-mapping:       yes

# Alternate formatting of numeric fields
pretty-display:         yes

# Allow complex OCCURS DEPENDING ON
complex-odo:            no

# Adjust position of items following OCCURS DEPENDING
odoslide:           no

# Do ISAM indexes with DUPLICATES get compressed
keycompress:            0

# Allow REDEFINES to other than last equal level number
indirect-redefines:     no

# Binary byte size - defines the allocated bytes according to PIC
# Value:         signed  unsigned  bytes
#                ------  --------  -----
# '2-4-8'        1 -  4    same        2
#                5 -  9    same        4
#               10 - 18    same        8
```

```
#
# '1-2-4-8'      1 -  2    same        1
#                3 -  4    same        2
#                5 -  9    same        4
#               10 - 18    same        8
#
# '1--8'         1 -  2    1 -  2      1
#                3 -  4    3 -  4      2
#                5 -  6    5 -  7      3
#                7 -  9    8 -  9      4
#               10 - 11   10 - 12      5
#               12 - 14   13 - 14      6
#               15 - 16   15 - 16      7
#               17 - 18   17 - 18      8
#
binary-size:            1-2-4-8

# Numeric truncation according to ANSI
binary-truncate:        yes

# Binary byte order
# Value: 'native', 'big-endian'
binary-byteorder:       big-endian

# Allow larger REDEFINES items other than 01 non-external
larger-redefines:       error

# Allow certain syntax variations (eg. REDEFINES position)
relax-syntax-checks:        no

# Allow zero length reference-modification
# (only checked with active EC-BOUND-REF-MOD)
ref-mod-zero-length:        yes

# Perform type OSVS - If yes, the exit point of any currently
# executing perform is recognized if reached.
perform-osvs:           no

# Compute intermediate decimal results like IBM OSVS
arithmetic-osvs:        no
```

```
# MOVE like IBM (mvc); left to right, byte by byte
move-ibm:           no

# LOCAL-STORAGE SECTION implies RECURSIVE attribute
local-implies-recursive:    no

# If yes, LINKAGE SECTION items remain allocated
# between invocations.
sticky-linkage:         no

# If yes, allow non-matching level numbers
relax-level-hierarchy:      no

# If yes, evaluate constant expressions at compile time
constant-folding:       yes

# Allow Hex 'F' for NUMERIC test of signed PACKED DECIMAL field
hostsign:           no

# If yes, set WITH UPDATE clause as default for ACCEPT dest-item,
# except if WITH NO UPDATE clause is used
accept-update:          no

# If yes, set WITH AUTO clause as default for ACCEPT dest-item,
# except if WITH TAB clause is used
accept-auto:            no

# If yes, DISPLAYs and ACCEPTs are, by default, done on the CRT (i.e., using
# curses).
console-is-crt:         no

# If yes, allow redefinition of the current program's name. This prevents its
# use in a prototype-format CALL/CANCEL statement.
program-name-redefinition:  yes

# If yes, NO ECHO/NO-ECHO/OFF is the same as SECURE (hiding input with
# asterisks, not spaces).
no-echo-means-secure:       no

# If yes, the first item in a field screen ACCEPT/DISPLAY (e.g. DISPLAY x UPON
# CRT) is located after the previous ACCEPT/DISPLAY (as though LINE 0 COL 0 had
```

```
# been specified).
line-col-zero-default:      yes

# If yes, then REPORT, COLUMN may have any of PLUS num, + num, or +num
# to define a relative column position
# If no, then COLUMN +num is not accepted due to signed numeric
report-column-plus:     yes

# If yes, DISPLAY SPACES acts as ERASE EOS, DISPLAY X"01" acts as ERASE EOL,
# DISPLAY X"02" acts as BLANK SCREEEN and DISPLAY X"07" acts as BELL. Note
# DISPLAY LOW-VALUE is excluded from this; it will always just position the
# cursor.
display-special-fig-consts: no

# If yes, COMP-1 is a signed 16-bit integer and any PICTURE clause is ignored.
binary-comp-1:          no

# If yes, POINTER is handled as BINARY-DOUBLE UNSIGNED instead of its own class
numeric-pointer:        no

# auto-adjust to zero like MicroFocus does
move-non-numeric-lit-to-numeric-is-zero: no

# If yes, implicitly define a variable for an ASSIGN DYNAMIC which does not
# match an existing data item.
implicit-assign-dynamic-var:    yes

# If yes, ACCEPT and DISPLAY statements accept device names using mnemonics
device-mnemonics:       no

# full clauses in XML PARSE - and adjusted XML-EVENTs
xml-parse-xmlss:        yes

# What rules to apply to SCREEN SECTION items clauses
screen-section-rules:       gc

# Whether DECIMAL-POINT IS COMMA has effect in XML/JSON GENERATE
dpc-in-data:            xml

# Functionality of JUSTIFY for INITIALIZE verb and initialization of storage
init-justify:           no
```

```
# Bounds against which to check subscripts (full, max, record)
subscript-check:        full

# Dialect features
# Value: 'ok', 'warning', 'archaic', 'obsolete', 'skip', 'ignore', 'error',
#        'unconformable'

alter-statement:            obsolete
comment-paragraphs:         obsolete
control-division:           unconformable
partial-replace-when-literal-src:   obsolete
call-overflow:              archaic
data-records-clause:            obsolete
debugging-mode:             ok
use-for-debugging:          ok
listing-statements:         skip        # may be a user-defined word
title-statement:            skip        # may be a user-defined word
entry-statement:            ok
goto-statement-without-name:        obsolete
label-records-clause:           obsolete
memory-size-clause:         obsolete
move-noninteger-to-alphanumeric:    error
move-figurative-constant-to-numeric:    archaic
move-figurative-space-to-numeric:   error
move-figurative-quote-to-numeric:   obsolete
multiple-file-tape-clause:      obsolete
next-sentence-phrase:           archaic
odo-without-to:             warning
odo-last-varlen:            ok
padding-character-clause:       obsolete
occurs-max-length-without-subscript:    no
section-segments:           ignore
stop-literal-statement:         obsolete
stop-identifier-statement:      obsolete
stop-error-statement:           unconformable
same-as-clause:             ok
type-to-clause:             ok
usage-type:             ok
synchronized-clause:            ok
sync-left-right:            ok
```

```
special-names-clause:           ok
top-level-occurs-clause:        ok
value-of-clause:            obsolete
numeric-boolean:            ok
hexadecimal-boolean:            ok
national-literals:          ok
hexadecimal-national-literals:      ok
national-character-literals:        warning

acu-literals:               unconformable
hp-octal-literals:          unconformable
ebcdic-symbolic-characters:     no
word-continuation:          warning
length-in-data-division:        yes
depending-on-not-fixed:         warning
not-exception-before-exception:     ok
accept-display-extensions:      ok
renames-uncommon-levels:        ok
symbolic-constant:          ok
constant-78:                ok
constant-01:                ok
perform-varying-without-by:     ok
reference-out-of-declaratives:      warning
# Is reference modification required to be within the single field
reference-bounds-check:         warning
program-prototypes:         ok
call-convention-mnemonic:       ok
call-convention-linkage:        ok
numeric-value-for-edited-item:      ok
incorrect-conf-sec-order:       ok
define-constant-directive:      archaic
free-redefines-position:        warning
records-mismatch-record-clause:     warning
record-delimiter:           ok
sequential-delimiters:          ok
record-delim-with-fixed-recs:       ok
record-sequential-advancing:        warning
missing-statement:          warning
missing-period:             warning     # when format not in {fixed,free}
zero-length-literals:           ok
xml-generate-extra-phrases:     ok
```

```
continue-after:             ok
goto-entry:             warning
binary-sync-clause:         ignore
nonnumeric-with-numeric-group-usage:    ok
assign-variable:            ok
assign-using-variable:          ok
assign-ext-dyn:             ok
assign-disk-from:           ok
vsam-status:                ignore
self-call-recursive:            skip
record-contains-depending-clause:   unconformable
align-record:               0
align-opt:              no
defaultbyte:                 init        # GC inits as INITIALIZE ALL TO VALUE THEN
TO DEFAULT,
                            # with INDEXED BY variables initialized to 1
picture-l:              ok

# use complete word list; synonyms and exceptions are specified below
reserved-words:     default

# not-reserved:
# Value: Word to be taken out of the reserved words list
not-reserved:   TERMINAL
#not-reserved:  TRANSACTION
not-reserved:   EXAMINE

# reserved:
#   Entries of the form word-1=word-2 define word-1 as an alias for default
# reserved word word-2. No spaces are allowed around the equal sign.
reserved:   AUTO-SKIP=AUTO
reserved:   AUTOTERMINATE=AUTO
reserved:   BACKGROUND-COLOUR=BACKGROUND-COLOR
reserved:   BEEP=BELL
reserved:   BINARY-INT=BINARY-LONG
reserved:   BINARY-LONG-LONG=BINARY-DOUBLE
reserved:   CELLS=CELL
reserved:   COLOURS=COLORS
reserved:   EMPTY-CHECK=REQUIRED
reserved:   EQUALS=EQUAL
reserved:   FOREGROUND-COLOUR=FOREGROUND-COLOR
```

```
reserved:   HIGH-VALUES=HIGH-VALUE
reserved:   INITIALISE=INITIALIZE
reserved:   INITIALISED=INITIALIZED
reserved:   LENGTH-CHECK=FULL
reserved:   LOW-VALUES=LOW-VALUE
reserved:   ORGANISATION=ORGANIZATION
reserved:   PIXELS=PIXEL
reserved:   SYNCHRONISED=SYNCHRONIZED
reserved:   TIMEOUT=TIME-OUT
reserved:   ZEROES=ZERO
reserved:   ZEROS=ZERO
```

17 Module loader `cobcrun` options

The following list of options was extracted from `cobcrun --help` and shows all available options for the module loader with a short description.

`-h, --help`
: display this help and exit

`-V, --version`
: display version information for cobcrun + runtime and exit

`-dumpversion`
: display runtime version and exit

`-i, --info`
: display runtime information (build/environment)

`-v, --verbose`
: display extended output with –info

`-c file, --config=file`
: set runtime configuration from <file>

`-r, --runtime-config`
: display current runtime configuration (value and origin for all settings)

`-M module, --module=module`
: set entry point module name and/or load path where `-M` module prepends any directory to the dynamic link loader library search path and any basename to the module preload list (`COB_LIBRARY_PATH` and/or `COB_PRELOAD`)

18 Runtime configuration

The following list was extracted from `config/runtime.cfg`.

18.1 General instructions

The initial `runtime.cfg` file is found in the `$COB_CONFIG_DIR` , which defaults to installdir/gnucobol/config (see `cobcrun --info` for the local path that is configured). The environment variable `COB_RUNTIME_CONFIG` may define a different runtime configuration file to read.

If settings are included in the runtime environment file multiple times then the last setting value is used, no warning occurs.

Settings via environment variables always take precedence over settings that are given in runtime configuration files. And the environment is checked after completing processing of the runtime configuration file(s)

All values set to string variables or environment variables are checked for ${envvar} and replacement is done at the time of the setting. You can also specify a default value for the case that envvar is not set: `${envvar:default}` (the format `${envvar:-default}` is supported, too).

Any environment variable may be set with the directive `setenv` .

Example

```
setenv COB_LIBARAY_PATH ${LD_LIBRARY_PATH}
```

Any environment variable may be unset with the directive `unsetenv` (one var per line).

Example

```
unsetenv COB_LIBRARY_PATH
```

Runtime configuration files can `include`other files with the directive `include` .

Example

```
include my-runtime-configuration-file
```

To `include`another configuration file only if it is present use the directive `includeif` . You can also use ${envvar} inside this.

Example

```
includeif ${HOME}/mygc.cfg
```

If you want to reset a parameter to its default value use `reset parametername` .

Most runtime variables have boolean values, some are switches, some have string values, integer values (if not explicit noted: unsigned) and some are size values. The boolean values will be evaluated as following: to true: `1`, `Y`, `ON`, `YES`, `TRUE` (no matter of case) to false: `0`, `N`, `OFF`.

A `size` value is an unsigned integer optionally followed by '`K`', '`M`', or '`G`' for '`kilo`', '`mega`' or '`giga`'.

Variables of type string can be of three different kinds: regular string, file name, and path list All those may contain the following escape sequences: $$ process id $f executable filename (full path) $b executable basename (anything after the last separator) # $d date (yyyymmdd) $t time (hhmmss)

For convenience a parameter in the `runtime.cfg` file may be defined by using either the environment variable name or the parameter name. In most cases the environment variable name is the parameter name (in upper case) with the prefix `COB_` .

For a complete list of the settings in use see `cobcrun --runtime-config` .

Note: If you want to *slightly* speed up a program's startup time, remove all of the comments from the actual real configuration file that is processed.

18.2 General environment

```
Environment name:  COB_DISABLE_WARNINGS
  Parameter name:  disable_warnings
         Purpose:  turn off runtime warning messages
            Type:  boolean
         Default:  false
         Example:  DISABLE_WARNINGS  TRUE

Environment name:  COB_ENV_MANGLE
  Parameter name:  env_mangle
         Purpose:  names checked in the environment would get non alphanumeric
                   change to '_'
            Type:  boolean
         Default:  false
         Example:  ENV_MANGLE  TRUE

Environment name:  COB_SET_DEBUG
  Parameter name:  debugging_mode
         Purpose:  to enable USE ON DEBUGGING procedures that were active
                   during compile-time because of WITH DEBUGGING MODE,
                   otherwise the code generated will be skipped
            Type:  boolean
         Default:  false
         Example:  COB_SET_DEBUG  1

Environment name:  COB_STDIN_FILE
  Parameter name:  stdin_file
```

```
         Purpose:  to define where COBOL stdin input should be read from
            Type:  string (file) ; may use $-sequences
            Note:  file is opened for read-only
         Default:  stdin
         Example:  STDIN_FILE  ${HOME}/stdin.$$

Environment name:  COB_STDOUT_FILE
  Parameter name:  stdout_file
         Purpose:  to define where COBOL stdout output should go
            Type:  string (file) ; may use $-sequences
            Note:  file is opened for append if name starts with "+"
         Default:  stdout
         Example:  STDOUT_FILE  ${HOME}/stdout.$$

Environment name:  COB_STDERR_FILE
  Parameter name:  stderr_file
         Purpose:  to define where COBOL stderr output should go
            Type:  string (file) ; may use $-sequences
            Note:  file is opened for append if name starts with "+"
         Default:  stderr
         Example:  STDERR_FILE  ${HOME}/stderr.$$

Environment name:  COB_SET_TRACE
  Parameter name:  set_trace
         Purpose:  to enable COBOL trace feature
            Type:  boolean
         Default:  false
         Example:  SET_TRACE  TRUE

Environment name:  COB_TRACE_FILE
  Parameter name:  trace_file
         Purpose:  to define where COBOL trace output should go
            Type:  string (file) ; may use $-sequences
            Note:  file is opened for append if name starts with "+"
         Default:  stderr
         Example:  TRACE_FILE  ${HOME}/mytrace.$$

Environment name:  COB_TRACE_FORMAT
  Parameter name:  trace_format
         Purpose:  to define format of COBOL trace output
            Type:  string
```

```
         Default:  "%P %S Line: %L"
                   %P is replaced by Program-Id/Function-Id minimal length 29
                      with prefix
                   %I is replaced by Program-Id/Function-Id variable length,
                      without prefix
                   %L is replaced by Line number, right justified, length 6
                   %S is replaced by statement type and name
                   %F is replaced by source file name
         Example:  TRACE_FORMAT  "Line: %L %S"
            Note:  format of GC2.2 and older:
                   "PROGRAM-ID: %I     Line: %L    %S"

Environment name:  COB_TRACE_IO
  Parameter name:  trace_io
         Purpose:  define if I/O details should be added to trace
            Type:  boolean
         Default:  false
         Example:  TRACE_IO true

Environment name:  COB_SIGNAL_REGIME
  Parameter name:  signal_regime
         Purpose:  to enable control over how the signal handler of the
                   runtime is registered for the signals used by the runtime
            Type:  0   registers the signal handler to all default signals
                   1   registers the signal handler to all default signals
                       for which no other handler has been registered
                   2   skips signal handler registration for all signals
         Default:  0
         Example:  core_signal_regime 2
            Note:  In environments where two different handlers must coexist,
                   the runtime's signal handler can be manually called by an
                   external signal handler. If the signal handler is skipped
                   for a signal, any runtime functionality that depends on it
                   will not work. This may lead to undefined behavior because
                   the runtime will be unable to clean up properly.

Environment name:  COB_CORE_ON_ERROR
  Parameter name:  core_on_error
         Purpose:  to enable operating system handling of signals and to
                   raise an ABORT signal on runtime error instead of the
                   default error handling, which will commonly kill the
```

```
                process after creating a coredump
           Type:  0   means catching all default signals and do full
                      internal error handling as done in versions pre 3.2
                      along with full internal handling of COBOL runtime
                      errors
                  1   means to forward any signals; whatever happens
                      by means of system signal handers will happen,
                      which may include creating coredumps and killing
                      the process before libcob does any cleanup; preserve
                      full internal handling of COBOL runtime errors
                  2   is identical to 1, but on runtime errors explicit
                      raises SIGABRT after displaying it along with the
                      stacktrace and after doing minimal cleanup
                  3   similar to 2, but instead of raising SIGABRT execute
                      "gcore -a -o NAME $$" (where $$ is the process id and
                      NAME is specified by COB_CORE_FILENAME) as early as
                      possible before doing the normal internal error
                      handling; if the command does not work or if a signal
                      handler was executed before a SIGABRT is raised
        Default:  0
        Example:  core_on_error 3
           Note:  If the operating system kills the process as part of the
                  signal handling no COBOL centric dump will be created and
                  no cleanup will be done either.
                  When catching a signal (for example 11) it will be
                  returned as exit code of the process, the generated
                  coredumps store the reason for the error in the variable
                  "runtime_err_str".

Environment name:  COB_CORE_FILENAME
  Parameter name:  core_filename
        Purpose:  to adjust the default name or specify a folder for a
                  COB_CORE_ON_ERROR=3 generated coredump
           Type:  string
        Default:  ./core.libcob
        Example:  core_filename /home/me/SomeApp.core

Environment name:  COB_STACKTRACE
  Parameter name:  stacktrace
        Purpose:  to disable stacktrace creation on abort
           Type:  boolean
```

```
         Default:  true
         Example:  stacktrace  no

Environment name:  COB_DUMP_FILE
  Parameter name:  dump_file
         Purpose:  to define where COBOL dump output should go
            Note:  the -fdump=all compile option prepares for dump;
                   file is opened for append if name starts with "+";
                   may be disabled by setting it to "NONE"
            Type:  string (file) ; may use $-sequences
         Default:  stderr
         Example:  DUMP_FILE  ${HOME}/mytrace.log

Environment name:  COB_DUMP_WIDTH
  Parameter name:  dump_width
         Purpose:  to define COBOL dump line length
            Type:  integer
         Default:  100
         Example:  dump_width 120

Environment name:  COB_STATS_RECORD
  Parameter name:  stats_record
         Purpose:  define if I/O statistics should be written
            Type:  boolean
         Default:  false
         Example:  STATS_RECORD true

Environment name:  COB_STATS_FILE
  Parameter name:  stats_file
         Purpose:  to define where COBOL I/O statistics should be written
                   The file is appended to
            Type:  string
         Default:  stderr
         Example:  STATS_FILE  ${HOME}/mystats.txt

Environment name:  COB_CURRENT_DATE
  Parameter name:  current_date
         Purpose:  specify an alternate Date/Time to be returned to ACCEPT
                   statement; this is used for testing purposes or to tweak
                   a missing offset, partial setting is allowed
            Type:  numeric string in format YYYYDDMMHHMISS or date string
```

```
                  or seconds since the epoch as @SSSSSSSS
         Default:  the operating system date is used
         Example:  COB_CURRENT_DATE "2026/03/16 16:40:52"
                   current_date YYYYMMDDHHMMSS+01:00

Environment name:  COB_PROF_ENABLE
  Parameter name:  prof_enable
         Purpose:  to enable profiling for modules compiled with profiling;
                   note that this disables physical cancel
            Type:  boolean
         Default:  false
         Example:  prof_enable yes

Environment name:  COB_PROF_FILE
  Parameter name:  prof_file
         Purpose:  to define where COBOL profiling output should go
            Type:  string (file) ; may use $-sequences
            Note:  the -fprof compile option prepares for profiling;
                   file is opened for append if name starts with "+"
         Default:  cob-prof-$b-$$-$d-$t.csv
         Example:  prof_file  ${HOME}/$$-prof.csv

Environment name:  COB_PROF_MAX_DEPTH
  Parameter name:  prof_max_depth
         Purpose:  the number of sections and paragraphs that can be nested;
                   if the nesting level is higher than this threshold,
                   profiling is disabled automatically
            Type:  integer
         Default:  8192
         Example:  prof_max_depth  8192

Environment name:  COB_PROF_FORMAT
  Parameter name:  prof_format
         Purpose:  to define the format of the columns in the profiling CSV file.
            Type:  string a comma separated list of fields, with %m for module,
                   %s for section, %p for paragraph, %e for entry, %w for
                   location, %k for kind (PROGRAM,SECTION,PARAGRAPH,ENTRY)
                   %f for file, %i for PID, %t for time in nano-seconds,
                   %h for human-readable time, %n for number of calls
         Default:  %m,%s,%p,%e,%w,%k,%t,%h,%n
         Example:  prof_format %m,%s,%p,%e,%w,%k,%t,%h,%n
```

18.3 Call environment

```
Environment name:  COB_LIBRARY_PATH
  Parameter name:  library_path
         Purpose:  paths for dynamically-loadable modules
            Type:  string (path list)
            Note:  the default paths .:/installpath/extras are always
                   added to the given paths
         Example:  LIBRARY_PATH    /opt/myapp/test:/opt/myapp/production

Environment name:  COB_PRE_LOAD
  Parameter name:  pre_load
         Purpose:  modules that are loaded during startup, can be used
                   to CALL COBOL programs or C functions that are part
                   of a module library
            Type:  string
            Note:  the listed modules should NOT normally include extensions,
                   the runtime will use the correct one for the environment,
                   COB_LIBRARY_PATH  is used to locate the modules;
                   as an exception to this rule, a full path can be used to
                   specify libraries that are not included in  COB_LIBRARY_PATH
                   or that do not match the standard COBOL naming convention
         Example:  PRE_LOAD   cobol_function_library:external_c_library:/path/to.so

Environment name:  COB_LOAD_CASE
  Parameter name:  load_case
         Purpose:  resolve ALL called program names to UPPER or LOWER case
            Type:  Only use  UPPER  or  LOWER
         Default:  if not set program names in CALL are case sensitive
         Example:  LOAD_CASE  UPPER

Environment name:  COB_PHYSICAL_CANCEL
  Parameter name:  physical_cancel
         Purpose:  physically unload a dynamically-loadable module on CANCEL,
                   this frees some RAM and allows the change of modules during
                   run-time but needs more time to resolve CALLs (both to
                   active and not-active programs)
            Note:  elements in COB_PRE_LOAD always use physical_cancel=0
           Alias:  default_cancel_mode, LOGICAL_CANCELS (0 = yes)
            Type:  TRUE/YES/1  unload module on CANCEL
                   FALSE/NO/0  unload module on STOP RUN only
                   NEVER       never unload module, only useful for profilers
```

```
                            and tracing tools that do a post-mortem lookup
                            of function address
         Default:  false
         Example:  PHYSICAL_CANCEL  TRUE

Environment name:  COB_LOAD_GLOBAL
  Parameter name:  load_global
         Purpose:  tell the system loader to provide symbols in CALLed
                   programs globally, allowing symbols to be found for linked
                   libraries later
            Type:  boolean
            Note:  COBOL CALLs will always find symbols in already CALLed or
                   pre-loaded modules; elements in COB_PRE_LOAD are always
                   global; this setting is mostly an advise to the system, not
                   all systems are capable of loading libraries global/local
         Default:  false
         Example:  load_global true
```

18.4 File I/O

```
Environment name:  COB_VARSEQ_FORMAT
  Parameter name:  varseq_format
         Purpose:  declare format to be used for variable length sequential files
                Type:   0     means 2 byte record length (big-endian) plus 2 NULs
precedes record
                  1    means 4 byte record length (big-endian) precedes record
                 2    means 4 byte record length (local machine int) precedes record
                3    means 2 byte record length (local machine short) precedes record
                  b32  means 'type 2' above but the 'int' is in Big-Endian format
                 l32  means 'type 2' above but the 'int' is in Little-Endian format
                  mf   means create the file in Micro Focus compatible format
         Default:  0
         Example:  VARSEQ_FORMAT 1

Environment name:  COB_VARREL_FORMAT
  Parameter name:  varrel_format
         Purpose:  declare format to be used for variable length relative files
            Type:  gc   means 'size_t' record length (local machine) precedes
                        maximum length data record
                   mf   means file is in Micro Focus format
                   b32  means Big-Endian 32-bit 'int' record length precedes data
```

```
                  b64  means Big-Endian 64-bit 'int' record length precedes data
                  l32  means Little-Endian 32-bit 'int' record length precedes data
                  l64  means Little-Endian 64-bit 'int' record length precedes data
         Default: gc
            NOTE: 'gc' results in files which cannot be used if copied between
                  machines of different hardware architecture
         Example: VARREL_FORMAT mf

Environment name: COB_FIXREL_FORMAT
  Parameter name: fixrel_format
         Purpose: declare format to be used for fixed length relative
                  files (different types and lengths preceding each record)
            Type: b32  means 4 byte record length (big-endian)
                  l32  means 4 byte record length (little-endian)
                  b64  means 8 byte record length (big-endian)
                  l64  means 8 byte record length (little-endian)
                  mf   means Micro Focus default
                  gc   means 'size_t' with record length precedes data record
         Default: gc
            NOTE: 'gc' results in files which cannot be used if copied between
                  machines of different hardware architecture
         Example: FIXREL_FORMAT B32

Environment name: COB_FILE_PATH
  Parameter name: file_path
         Purpose: define default location(s) where data files are stored
            Type: file path directory list
         Default: .  (current directory)
         Example: FILE_PATH ${HOME}/mydata
 Unix/Linux list: FILE_PATH ${HOME}/mydata:${PROJECT}/datafiles
    Windows list: FILE_PATH C:\proja\mydata;D:\projb\yourdata;.

Environment name: COB_FILE_DICTIONARY
  Parameter name: file_dictionary
         Purpose: define when a file format description is written
                  is written to 'asgname.dd'
            Type: false   means never write
                  no      means never write
                  true    means write for BDB or LMDB only
                  min     means write for BDB or LMDB only
                  always  means write for all file types
```

```
                  max     means write for all file types
         Default:  min
         Example:  file_dictionary always

Environment name:  COB_FILE_DICTIONARY_PATH
  Parameter name:  file_dictionary_path
         Purpose:  define where the 'asgname.dd' is written
            Type:  file path directory
         Default:  .  (current directory)
         Example:  FILE_DICTIONARY_PATH ${HOME}/mystuff

Environment name:  COB_BDB_BYTEORDER
  Parameter name:  bdb_byteorder
         Purpose:  Defines the byte order to be used for BDB
            Type:  native        - use the system byte order
                   big-endian    - use big-endian order
                   little-endian - use little-endian order
         Default:  native
         Example:  bdb_byteorder big-endian

Environment name:  COB_FILE_FORMAT
  Parameter name:  file_format
         Purpose:  Declares if all files in the program should be in
                   Micro Focus compatible format or old GnuCOBOL 3 format.
            Type:  mf   means create files in Micro Focus compatible format
                   gc   means create files in old GnuCOBOL 3 format
         Default:  GC   (depends on compiler build --with-file-format= )
         Example:  FILE_FORMAT = MF

Environment name:  COB_LS_FIXED
  Parameter name:  ls_fixed
         Purpose:  Defines if LINE SEQUENTIAL files should be fixed length
                   (or variable, by removing trailing spaces)
           Alias:  STRIP_TRAILING_SPACES  (0 = yes)
            Type:  boolean
         Default:  false
            Note:  This setting is most useful if you want to REWRITE those
                   files.
         Example:  LS_FIXED TRUE

Environment name:  COB_LS_VALIDATE
```

```
  Parameter name:  ls_validate
         Purpose:  Defines for LINE SEQUENTIAL files that the data should be
                   validated as it is read (status 09) / written (status 71).
            Type:  boolean
         Default:  true (per COBOL 2022)
            Note:  If active effectively disables COB_LS_NULLS.
         Example:  LS_VALIDATE FALSE

Environment name:  COB_LS_NULLS
  Parameter name:  ls_nulls
         Purpose:  Defines for LINE SEQUENTIAL files what to do with data
                   which is not DISPLAY type.  This could happen if a LINE
                   SEQUENTIAL record has BINARY/COMP data fields in it.
                   This option is only for GnuCOBOL format files
            Type:  boolean
         Default:  true (for MF files) otherwise false
            Note:  The TRUE setting will insert a null character x"00" before
                   those values to escape them, and redo on read-in plus
                   validating that they only occur after a null character.
                   Decreases LINE SEQUENTIAL performance and prevents writing
                   escape sequences or formatting within the data.
                   Only checked if COB_LS_VALIDATE is disabled.
         Example:  LS_NULLS = TRUE

Environment name:  COB_LS_SPLIT
  Parameter name:  ls_split
         Purpose:  Defines for LINE SEQUENTIAL files what to do when a record
                   is longer than the program handles. If 'ls_split=true' then
                   the data is returned as multiple records with io status 06,
                   otherwise the record is truncated, io status set to 04 and
                   the file skips to the next LF.
            Type:  boolean
         Default:  true (per COBOL 2022)
         Example:  LS_SPLIT = FALSE

Environment name:  COB_LS_INSTAB
  Parameter name:  ls_instab
         Purpose:  Defines for LINE SEQUENTIAL files that multiple spaces
                   should be replaced by a TAB character, assuming a 'tab set'
                   value of 8. Each TAB means to skip to the next column that
                   is a multiple of 8
```

```
                  Similar to Micro Focus INSERTTAB=ON option
           Type:  boolean
        Default:  false
        Example:  LS_INSTAB = TRUE

Environment name:  COB_SHARE_MODE
  Parameter name:  share_mode
        Purpose:  Defines what file sharing option should be used
           Type:  -- choice of values ---
                  none - nothing overrides application code
                  read - files opened as SHARE READ ONLY
                  all  - files opened as SHARE ALL OTHERS
                  no   - files opened as SHARE NO OTHERS
        Default:  none
        Example:  share_mode = ALL

Environment name:  COB_RETRY_MODE
  Parameter name:  retry_mode
        Purpose:  Defines what I/O retry sharing option should be used
           Type:  --- choice of values ---
                  none    - nothing overrides application code
                  never   - I/O is never retried
                  forever - I/O will be retried until success
        Default:  none
        Example:  retry_mode = never

Environment name:  COB_RETRY_TIMES
  Parameter name:  retry_times
        Purpose:  Defines how many times I/O should be retried
           Type:  integer
        Default:  0
        Example:  retry_times = 10

Environment name:  COB_RETRY_SECONDS
  Parameter name:  retry_seconds
        Purpose:  Defines how many seconds I/O should be retried
           Type:  integer
        Default:  0
        Example:  retry_seconds = 6

Environment name:  COB_KEYCHECK
```

```
  Parameter name:  keycheck
         Purpose:  Must INDEXED file keys match COBOL SELECT exactly
            Type:  boolean
         Default:  true
         Example:  keycheck = off

Environment name:  COB_DUPS_AHEAD
  Parameter name:  dups_ahead
         Purpose:  Should INDEXED file handler return status 02 for dups
            Type:  -- choice of values ---
                   default - yes, if the low level I/O routine handles it
                   never   - Even if 02 is return from xISAM, ignore it
                   always  - fisam/foci/fodbc should do extra work to compute
         Default:  default
         Example:  dups_ahead = never

Environment name:  COB_SYNC
  Parameter name:  sync
         Purpose:  Should the file be synced to disk after each write/update
            Type:  boolean
         Default:  false
         Example:  SYNC: TRUE

Environment name:  COB_FILE_ROLLBACK
  Parameter name:  rollback
         Purpose:  Should file updates be recorded for later COMMIT/ROLLBACK
            Type:  boolean
         Default:  false
         Example:  rollback=TRUE

Environment name:  COB_FILE_VBISAM
  Parameter name:  file_vbisam
         Purpose:  Should ISAM files be created in the old VB-ISAM format
            Type:  boolean
         Default:  false
         Example:  file_vbisam=TRUE

Environment name:  COB_FILE_ISNODAT
  Parameter name:  file_isnodat
         Purpose:  Should ISAM 'data file' have the '.dat' extension or not
                   (The ISAM 'index file' will always have a '.idx' extension)
```

```
            Type:  boolean
         Default:  false
         Example:  file_isnodat=TRUE

Environment name:  COB_STOP_RUN_COMMIT
  Parameter name:  stop_run_commit
         Purpose:  On STOP RUN with updates pending should it COMMIT
            Type:  boolean
         Default:  false
                   When 'false' a ROLLBACK of pending updates will be done
         Example:  stop_run_commit=true

Environment name:  COB_HEAP_MEMORY
  Parameter name:  heap_memory
         Purpose:  Defines how much RAM to use when allocating segments
                   of memory to be used by the VIRTAUL HEAP functions.
            Type:  size  but must be between 16K and 64M
         Default:  1M
         Example:  HEAP_MEMORY 1M

Environment name:  COB_HEAP_MEMORY_64
  Parameter name:  heap_memory_64
         Purpose:  Defines how much RAM to use when allocating segments
                   of memory to be used by the VIRTAUL HEAP functions
                   when using the 64 bit READ / WRITE VFILE versions.
            Type:  size  but must be >= 256K
         Default:  64M
         Example:  HEAP_MEMORY_64 128M

Environment name:  COB_SORT_MEMORY
  Parameter name:  sort_memory
         Purpose:  Defines how much RAM to assign for sorting data
                   if this size is exceeded the  SORT  will be done
                   on disk instead of memory
            Type:  size  but must be more than 1M
         Default:  128M
         Example:  SORT_MEMORY 64M

Environment name:  COB_SORT_CHUNK
  Parameter name:  sort_chunk
         Purpose:  Defines how much RAM to assign for sorting data in chunks
```

```
            Type:  size  but must be within 128K and 16M
         Default:  256K
         Example:  SORT_CHUNK 1M

Environment name:  COB_SEQ_CONCAT_NAME
  Parameter name:  seq_concat_name
         Purpose:  Does DD_asgname hold multiple input file names
            Type:  boolean
         Default:  false
         Example:  seq_concat_name = true

Environment name:  COB_SEQ_CONCAT_SEP
  Parameter name:  seq_concat_sep
         Purpose:  Character separating file names
            Type:  char
         Default:  +
         Example:  seq_concat_sep = '&'
```

18.5 File I/O database specfic for OCI and ODBC

```
Environment name:  COB_SCHEMA_DSN
         Purpose:  Defines the DSN name for connecting to the database.
                   (DSN is commonly defined in /usr/local/etc/odbc.ini or
                   /etc/odbc.ini)
            Type:  string
         Example:  COB_SCHEMA_DSN = testdb

Environment name:  COB_SCHEMA_CON
         Purpose:  Defines the complete database connection string,
                   normally DSN is enough.
            Type:  string
         Example:  COB_SCHEMA_CON = "what goes here"

Environment name:  COB_SCHEMA_SID
         Purpose:  Defines the Oracle SID name for connecting to the database.
            Type:  string
         Example:  COB_SCHEMA_SID = mydb

Environment name:  COB_SCHEMA_UID
         Purpose:  Defines the Oracle UID name for connecting to the database.
            Type:  string
```

```
         Example:  COB_SCHEMA_UID = myname

Environment name:  COB_SCHEMA_PWD
         Purpose:  Defines the Oracle PWD value for connecting to the database.
            Type:  string
         Example:  COB_SCHEMA_PWD = mypassword
```

18.6 Screen I/O

```
Environment name:  COB_BELL
  Parameter name:  bell
         Purpose:  Defines how a request for the screen to beep is handled
            Type:  FLASH, SPEAKER, FALSE, BEEP
         Default:  BEEP
         Example:  BELL SPEAKER

Environment name:  COB_REDIRECT_DISPLAY
  Parameter name:  redirect_display
         Purpose:  Defines if DISPLAY output should be sent to 'stderr'
            Type:  boolean
         Default:  false
         Example:  redirect_display Yes

Environment name:  COB_SCREEN_ESC
  Parameter name:  screen_esc
         Purpose:  Enable handling of ESC key during ACCEPT
            Type:  boolean
         Default:  false
            Note:  is only evaluated if COB_SCREEN_EXCEPTIONS is active
         Example:  screen_esc Yes

Environment name:  COB_SCREEN_EXCEPTIONS
  Parameter name:  screen_exceptions
         Purpose:  enable exceptions for function keys during ACCEPT
            Type:  boolean
         Default:  false
         Example:  screen_exceptions Yes

Environment name:  COB_TIMEOUT_SCALE
  Parameter name:  timeout_scale
         Purpose:  specify translation in milliseconds for ACCEPT clauses
```

```
                  BEFORE TIME value / AFTER TIMEOUT
            Type: integer
                  0 means 1000 (Micro Focus COBOL compatible), 1 means 100
                  (ACUCOBOL compatible), 2 means 10, 3 means 1
         Default: 0
            Note: the minimum and possible maximum value depend on the
                  screenio library used
         Example: timeout_scale 3

Environment name: COB_INSERT_MODE
  Parameter name: insert_mode
         Purpose: specify default insert mode for ACCEPT; 0=off, 1=on
            Type: boolean
         Default: false
            Note: also sets the cursor type (if available)
         Example: insert_mode Y

Environment name: COB_HIDE_CURSOR
  Parameter name: hide_cursor
         Purpose: hide the cursor; 0=visible, 1=hidden
            Type: boolean
         Default: false
         Example: hide_cursor Y

Environment name: COB_MOUSE_FLAGS
  Parameter name: mouse_flags
         Purpose: specify which mouse events will be sent as function key
                  to the application during ACCEPT and how they will be
                  handled
            Type: int (by bits)
         Default: 1
            Note: 0 disables the mouse cursor, any other value enables it,
                  any value containing 1 will enable internal handling (click
                  to position, double-click to enter).
                  See copy/screenio.cpy for list of events and their values.
           Alias: MOUSE_FLAGS
         Example: 11 (enable internal handling => 1, left press => 2,
                      double-click => 8; 1+2+8=11)

Environment name: COB_MOUSE_INTERVAL
  Parameter name: mouse_interval
```

```
         Purpose:  specifies the maximum time (in thousands of a second)
                   that can elapse between press and release events for them
                   to be recognized as a click.
            Type:  int (0 - 166)
         Default:  100
            Note:  0 disables the click resolution (instead press + release
                   are recognized), also disables positioning by mouse click

Environment name:  COB_DISPLAY_PRINT_PIPE
  Parameter name:  display_print_pipe
         Purpose:  Defines command line used for sending output of
                   DISPLAY UPON PRINTER to (via pipe)
                   This is very similar to Micro Focus COBPRINTER
            Note:  Each executed DISPLAY UPON PRINTER statement causes a
                   new invocation of command-line (= new process start).
                   Each invocation receives the data referenced in
                   the DISPLAY statement and is followed by an
                   end-of-file condition.
                   COB_DISPLAY_PRINT_FILE, if set, takes precedence
                   over COB_DISPLAY_PRINT_PIPE.
           Alias:  COBPRINTER
            Type:  string
         Default:  not set
         Example:  print 'cat >>/tmp/myprt.log'

Environment name:  COB_DISPLAY_PRINT_FILE
  Parameter name:  display_print_file
         Purpose:  Defines file to be appended to by DISPLAY UPON PRINTER
            Note:  Each DISPLAY UPON PRINTER opens, appends and closes the file.
            Type:  string ; may use $-sequences
         Default:  not set
         Example:  display_printer '/tmp/myprt.log'

Environment name:  COB_DISPLAY_PUNCH_FILE
  Parameter name:  display_punch_file
         Purpose:  Defines file to be created on first
                   DISPLAY UPON SYSPUNCH/SYSPCH
            Note:  The file will be only be closed on runtime exit.
            Type:  string ; may use $-sequences
         Default:  not set
         Example:  display_punch './punch_$$.out'
```

```
Environment name:  COB_LEGACY
  Parameter name:  legacy
         Purpose:  keep behavior of former runtime versions, currently only
                   for setting screen attributes for non input fields and
                   disabling blinking on some systems
            Type:  boolean
         Default:  not set
         Example:  legacy true

Environment name:  COB_EXIT_WAIT
  Parameter name:  exit_wait
         Purpose:  to wait on main program exit if an extended screenio
                   DISPLAY was issued without an ACCEPT following
            Type:  boolean
         Default:  true
         Example:  COB_EXIT_WAIT off

Environment name:  COB_EXIT_MSG
  Parameter name:  exit_msg
         Purpose:  string to display if COB_EXIT_WAIT is processed, set to ''
                   if no actual display but an ACCEPT should be done
            Type:  string
         Default:  'end of program, please press a key to exit' (localized)
         Example:  COB_EXIT_MSG ''
```

18.7 Report I/O

```
Environment name:  COB_COL_JUST_LRC
  Parameter name:  col_just_lrc
         Purpose:  If true, then COLUMN defined as LEFT, RIGHT or CENTER
                   will have the data justified within the field limits
                   If false, then the data is just copied into the column as is
            Type:  boolean
         Default:  TRUE
         Example:  col_just_lrc True
```

18.8 File I/O Environment Variables and/or dictionary file

```
Before a file is opened a check is done for environment variables that
may define various attributes of the file
```

```
First a check is made for attributes for files of the same ORGANIZATION
IX_OPTIONS for INDEXED, SQ_OPTIONS for SEQUENTIAL, RL_OPTIONS for RELATIVE
LS_OPTIONS for LINE SEQUENTIAL, LA_OPTIONS for LINE ADVANCING SEQUENTIAL
If none of these are present, it then checks for IO_OPTIONS

Then an additional check is done for IO_asgnmame where 'asgname' was
the ASSIGN EXTERNAL name used in the program

The environment variable (or dictionary file) may contain any of the
following keywords, separated by spaces and/or commas

You can specify just the keyword and it is assumed to mean set to true,
or no-keyword (or no_keyword or nokeyword) which means set to false,
or keyword=true or keyword=false.  The valid keywords are:
Keyword       Meaning
=========     ======================================================
type=xx       Set file organization where 'xx' is one of
              IX = INDEXED, SQ = SEQUENTIAL, RL = RELATIVE
              LS = LINE SEQUENTIAL, LA = LINE ADVANCING
mf            Set file to Micro Focus compatible format
gc            Set to original GNU Cobol default format
recsz         The size for fixed size record file
maxsz         Maximum record size for variable length records
minsz         Minimum record size for variable length records
ls_nulls      Do NUL insertion before characters less than a SPACE,
              Default: false
ls_validate   Validate data for LINE Sequential Files, Default: true
crlf          Lines end with CR LF (Windows format for text files)
lf            Lines end with LF (Unix format for text files)
sync          Sync all writes to disk
B32           Use 32-bit Big-Endian format 'int' as record length
L32           Use 32-bit Little-Endian format 'int' as record length
B64           Use 64-bit Big-Endian format 'int' or 'size_t' as record length
L64           Use 64-bit Little-Endian format 'int' or 'size_t' as record length
trace         Enable I/O trace when program execution tracing is enabled
stats         Write I/O statistic information on file close
retry_times   Default number of times to retry I/O
retry_seconds Number of seconds between I/O retry attempts
retry_forever Retry I/O forever
retry_never   Never retry I/O operations
ignore_lock   Ignore record locks
```

```
advancing_lock Advance to the next record if lock condition
share_all     Share file with ALL others
share_read    Share file for READ only
share_no      Share file with NO others
 ---- For INDEXED files -----
format=ixhandler  INDEXED file format: CISAM,DISAM,VBISAM,VBCISAM,OCI,ODBC,BDB,LMDB
format=auto   INDEXED file format is determined by inspecting the file
dups_ahead=   default,never,always
rollback=     yes, no
                 (OCI & ODBC will 'autocommit' each update is not defined and not
APPLY COMMIT)
              (fileio will handle COMMIT/ROLLBACK for all other files)
nkeys=n       number of indexes
key1=(loc:len)     loc (zero relative) of key, len of key
key2=(loc:len,loc:len ...)     define composite index
dupn=Y         index allows dups
 ---- For INDEXED BDB files -----
big_endian    Set internal 'int' byte order to BIG ENDIAN
little_endian Set internal 'int' byte order to LITTLE ENDIAN
```

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