

GnuCOBOL Manual

for GnuCOBOL 3.0-dev

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GnuCOBOL (formerly OpenCOBOL) is a free COBOL compiler and runtime. `cobc` translates COBOL source to executable using intermediate C together with a designated C compiler and linker. `libcob` provides the necessary runtime.

This manual corresponds to GnuCOBOL 3.0-dev.

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1 Getting started

1.1 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 `-free` compiler option.

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

2 Compile

This chapter describes how to compile COBOL programs using GnuCOBOL.

2.1 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 help option.

2.1.1 Help options

The following switches display information about the compiler:

- `--help, -h` Display help screen (see Appendix A [Appendix A], page 28). No further actions will be taken.
- `--version` Display compiler version, author package date and executable build date. `-V` will also display version. 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.
- `-v` Verbosely display the programs invoked during compilation.
- `--list-reserved` Display reserved words (see Appendix B [Appendix B], page 33). A Y/N field shows if the word is supported.¹ The given options for reserved words specified for example by `-std` will be taken into account. No further actions will be taken except for further display options.
- `--list-intrinsics` Display intrinsic functions (see Appendix C [Appendix C], page 51). A Y/N field shows if the function is implemented. No further actions will be taken except for further display options.
- `--list-system` Display system routines (see Appendix D [Appendix D], page 54). No further actions will be taken except for further display options.
- `--list-mnemonics` Display mnemonic names (see Appendix E [Appendix E], page 56). No further actions will be taken except for further display options.

2.1.2 Build target

The `cobc` compiler 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.

By default, the compiler builds a dynamically loadable module.

¹ Support may be partial or complete.

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

- E** Preprocess only: compiler directives are executed, comment lines are removed and `COPY` statements are expanded. The output is saved in file `*.i`.
- C** Translation only. COBOL source files are translated into C files. The output is saved in 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(=<args>), -job(=<args>)**
 Run job after compilation. Either from executable with `-x`, or with `cobcrun` when compiling a module. Optional arguments, 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.
- o <file>** Place the output into <file>.

2.1.3 Source format

GnuCOBOL supports both fixed and free source format. The default format is the fixed format. This can be overridden either by the `>>SOURCE [FORMAT] [IS] {FIXED|FREE}` directive, or by one of the following options:

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

² The extension varies depending on your host.

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

2.1.4 Warning options

- W Enable every possible warning. This includes more information than `-Wall` would normally provide.
- Wall Enable all common warnings.
- 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`.
- Wunreachable Warn if statements are unreachable. This is *not* set with `-Wall`.

2.1.5 Configuration options

- std=<dialect> Compiler uses the given dialect to determine certain compiler features and warnings. See Appendix F [Compiler Configuration], page 58, and `config/*.conf`.
 Note: 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 may be removed by `-fno-reserved=word`. COBOL-85, X/Open COBOL, COBOL 2002 and COBOL 2014 are always "strict".

`-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

`-conf=<file>`

User-defined dialect configuration. See `-std=` above.

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 Appendix A [`cobc --help`], page 28.

2.1.6 Listing options

`-t=<file>`

Generate and place the standard print listing into `*.lst`.

-T=<file>

Generate and place a wide print listing into *.lst.

--tlines=<lines>

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

--tsymbols

Generate symbol table in listing.

-P(=<dir or file>)

Generate and place a preprocessed listing (old format) into *.lst.

-Xref

-X Generate cross reference in the listing.

Here is an example program listing with the -t -tsymbols option:

GnuCOBOL 2.0.0 test.cbl Mon Oct 17 10:23:45 2016 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 is specified (-T), the SEQUENCE columns are included in the listing.

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

```
GnuCOBOL 2.0.0    test.cbl                               Mon Oct 17 10:23:45 2016  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 and error in the compilation group:

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

2.1.7 Debug switches

- debug, -d Enable all run-time error checks.
- g Produce debugging information in the output.
- O Enable optimization of code size and execution speed. See `man gcc` for details.
- O2 Optimize even more.
- Os Optimize for size. Optimizer will favour code size over execution speed.
- ftrace Generate trace code (log executed procedures).
- ftraceall Generate trace code (log executed procedures and statements).
- fsyntax-only Check syntax only; don't emit any output.
- fdebugging-line Enable debugging lines (D in indicator column).

- `-fsource-location`
Generate source location code (implied by `-debug` or `-g`).
- `-fimplicit-init`
Do automatic initialization of the COBOL runtime system.
- `-fstack-check`
Enable PERFORM stack checking (implied by `-debug` or `-g`).
- `-fnotrunc`
Do not truncate binary fields according to PICTURE.

2.1.8 Miscellaneous

- `-ext <extension>`
Add default file extension.
- `-fmfcomment`
Treat lines with `*` or `/` in column 1 as comment (fixed-format only).
- `-acucomment`
Treat `|` as an inline comment marker.
- `-fsign=ASCII`
Numeric display sign ASCII (default on ASCII machines).
- `-fsign=EBCDIC`
Numeric display sign EBCDIC (default on EBCDIC machines).
- `-ffunctions-all`
Allow use of intrinsic functions without `FUNCTION` keyword.
- `-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).

2.2 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.

2.2.1 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);
```

Note 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.

2.2.2 Dynamic linking

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

2.2.2.1 Driver program

Compile all programs with the option `-m`:

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

This creates the shared object files `main.so` `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
```

(Note: You may set the variable via a runtime configuration file, see Appendix H [Runtime Configuration], page 64. You may also set the variable to directly point to the directory where you compiled the sources.)

Now execute your program:

```
$ cobcrun main
```

2.2.2.2 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

⁴ The extension used depends on your operating system.

⁵ The extension used depends on your operating system.

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

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

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
```

2.2.3 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
```

2.2.4 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
```

2.3 C interface

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

2.3.1 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 go on without any further COBOL calls).

```
#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`
```

2.3.2 Redirecting output to a (FILE *)

From a module written in C you may call `cob_set_runtime_option` to set the exact (FILE *) which trace data is to be written 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_EXPIMP void cob_set_runtime_option (enum cob_runtime_option_switch opt, void *)
```

So from your 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));
```

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

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

2.3.3 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.
    EXIT PROGRAM.
-----
```

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 these programs as follows:

```

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

```

2.3.4 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 these programs as follows:

```

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

```

2.3.5 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:

```

$ cc -c say.c
$ cobc -c -static -x hello.cob

```

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

2.3.6 Dynamic linking with C programs

You can create a dynamically-linked module from a C program by passing an option `-shared` to the C compiler:

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

3 Customize

3.1 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 ("")

3.2 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 Appendix H [Runtime Configuration], page 64.

4 Optimize

4.1 Optimize options

There are three compiler options for optimization: `-O`, `-Os` and `-O2`. 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.

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

4.2 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 Section 2.2.1 [Static linking], page 8)

4.3 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 Chapter 3 [Customize], page 15).

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

5 Debug

5.1 Debug options

The compiler option `-debug` can be used during the development of your programs. It enables all run-time error checking, such as subscript boundary checks and numeric data checks, and displays run-time errors with source locations.

6 Non-standard extensions

6.1 SELECT ASSIGN TO

<This section is in progress.>

6.2 Indexed file packages

<This section is in progress.>

6.3 Extended ACCEPT statement

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

```
ACCEPT variable-1
  LINE <line> COLUMN <column>
  WITH
    AUTO-SKIP | AUTO
    [PROTECTED] SIZE [IS] variable-2 | literal-2
END-ACCEPT.
```

6.3.1 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 word AUTO may be used for AUTO-SKIP.

The Right-Arrow key returns from the end of the field. The Left-Arrow key returns from the beginning. See Section 6.4 [ACCEPT special], page 19.

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

6.3.2 PROTECTED

PROTECTED is ignored. It is optional.

6.3.3 SIZE

The size of variable-1 to accept from the screen. It is optional.

SIZE <greater than zero>

If SIZE 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 SIZE 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 field accepts with its length.

6.4 ACCEPT special keys

Special keys are available for extended `ACCEPT` statements.

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

6.4.1 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 Section 6.3 [Extended `ACCEPT`], page 18.

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 Section 6.3 [Extended `ACCEPT`], page 18.

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

6.4.2 Backspace key

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

6.4.3 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.

6.4.4 End keys

The End key moves the cursor after the last non-space character.

The Alt-End key moves the cursor to the end of the field.

6.4.5 Home keys

The Home key moves the cursor to the first non-space character.

The Alt-Home key moves the cursor to the beginning of the field.

6.4.6 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 Appendix H [Runtime Configuration], page 64.

6.4.7 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.

6.5 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.
```

6.5.1 BELL

Ring the bell. It is optional.

6.5.2 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.

6.5.3 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.

6.5.4 SIZE

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

SIZE <greater than zero>

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.

6.5.5 Figurative Constants

Certain figurative constants have special functions.

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 "1" Display spaces from **LINE** and **COLUMN** to the end of the line. This is the same as **WITH ERASE EOL**.

ALL "2" Clear the whole screen. This is the same as **WITH BLANK SCREEN**.

ALL "7" Ring the bell. This is the same as **WITH BELL**.

All other figurative constants display as a single character.

7 System Routines

For a complete list of supported system routines, see Appendix D [cobc -list-system], page 54.

7.1 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.

The return-char might contain the following:

- regular character if an option was recognized
- '?' if we have an undefined or ambiguous option
- '1' if we have a non-option (only if first byte of so is '-')
- '0' if valpoint != NULL and we are writing the return value to the specified address
- '-1' if we don't have any more options (or reach the first non-option if first byte of so is '+')

The return-codes of CBL_GC_GETOPT are:

- 1 if we've got a non-option (only if first byte of so is '-')
- 0 if valpoint != NULL and we are writing the return value to the specified address
- -1 if we don't have any more options (or reach the first non-option if first byte of so is '+')
- 2 if we have got an truncated option value in opt-val (because opt-val was too small)
- 3 if we got a regular answer from getopt

7.2 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.

```

7.3 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
```

7.4 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.

```

7.5 CBL_GC_WAITPID

CBL_GC_WAITPID allows you to wait until another system process ended. Additionally 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

```

Appendix A cobb --help

GnuCOBOL compiler for most COBOL dialects with lots of extensions

Usage: cobb [options]... file...

Options:

-h, -help	display this help and exit
-V, -version	display compiler version and exit
-i, -info	display compiler information (build/environment) and exit
-v, -verbose	display compiler version and the commands invoked by the compiler
-vv, -verbose=2	like -v but additional pass verbose option to assembler/compiler
-vvv, -verbose=3	like -vv but additional 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; see configuration files in directory config
-F, -free	use free source format
-fixed	use fixed source format (default)
-O, -O2, -O3, -Os	enable optimization
-OO	disable optimization
-g	enable C compiler debug / stack check / trace
-d, -debug	enable all run-time error checking
-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
--tsymbols	specify symbols in listing
-P[=<dir or file>]	generate preprocessed program listing (.lst)
-Xref	specify cross reference in listing
-I <directory>	add <directory> to copy/include search path
-L <directory>	add <directory> to library search path
-l <lib>	link the library <lib>
-A <options>	add <options> to the C compile phase

-Q <options>	add <options> to the C link phase
-D <define>	define <define> for COBOL compilation
-K <entry>	generate CALL to <entry> as static
-conf=<file>	user-defined dialect configuration; see -std
-list-reserved	display reserved words
-list-intrinsics	display intrinsic functions
-list-mnemonics	display mnemonic names
-list-system	display system routines
-save-temps[=<dir>]	save intermediate files
	- default: current directory
-ext <extension>	add file extension for resolving COPY

Warning options:

-W	enable all warnings
-Wall	enable most warnings (all except as noted below)
-Wno-<warning>	disable warning enabled by -W or -Wall
-Wno-unfinished	do not warn if unfinished features are used
	- ALWAYS active
-Wno-pending	do not warn if pending features are mentioned
	- ALWAYS active
-Wobsolete	warn if obsolete features are used
-Warchaic	warn if archaic features are used
-Wredefinition	warn incompatible redefinition of data items
-Wtruncate	warn field truncation from constant assignments
-Wpossible-truncate	warn possible field truncation
	- NOT set with -Wall
-Woverlap	warn overlapping MOVE items
-Wpossible-overlap	warn MOVE items that may overlap depending on variables
	- NOT set with -Wall
-Wparentheses	warn lack of parentheses around AND within OR
-Wstrict-typing	warn type mismatch strictly
-Wimplicit-define	warn implicitly defined data items
-Wcorresponding	warn CORRESPONDING with no matching items
-Winitial-value	warn if initial VALUE clause is ignored
-Wprototypes	warn missing FUNCTION prototypes/definitions
-Warithmetic-osvs	warn if arithmetic expression precision has changed
-Wcall-params	warn non 01/77 items for CALL params
	- NOT set with -Wall
-Wconstant-expression	warn expressions that always resolve to true/false
-Wcolumn-overflow	warn text after program-text area, FIXED format
	- NOT set with -Wall
-Wterminator	warn lack of scope terminator END-XXX
	- NOT set with -Wall
-Wlinkage	warn dangling LINKAGE items
	- NOT set with -Wall
-Wunreachable	warn likely unreachable statements
	- NOT set with -Wall
-Wno-dialect	do not warn dialect specific issues
	- ALWAYS active
-Wothers	do not warn different issues
	- ALWAYS active
-Werror	treat all warnings as errors

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

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

-fdefaultbyte=<value> initialize fields without VALUE to value
 - decimal 0..255 or any quoted character
 - default: initialize to picture

-fmax-errors=<number> maximum number of errors to report before
 compilation is aborted
 - default: 100

-fdump=<scope> dump data fields on abort, <scope> may be
 a combination of: ALL, WS, LS, RD, FD, SC

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

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

-ftrace generate trace code
 - executed SECTION/PARAGRAPH

-ftraceall generate trace code
 - executed SECTION/PARAGRAPH/STATEMENTS
 - turned on by -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/-g/-ftraceall

-fimplicit-init automatic initialization of the COBOL runtime system

-fstack-check PERFORM stack checking
 - turned on by -debug or -g

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

-fmfcomment '*' or '/' in column 1 treated as comment
 - FIXED format only

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

-fnotrunc allow numeric field overflow
 - non-ANSI behaviour

-fodoslide adjust items following OCCURS DEPENDING
 - implies -fcomplex-odo

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

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

Compiler dialect configuration options:

-freserved-words=<value> use of complete/fixed reserved words

```

-ftab-width=1..12      set number of spaces that are asumed for tabs
-ftext-column=72..255  set right margin for source (fixed format only)
-fpic-length=<number>  maximum number of characters allowed in the PICTURE character-string
-fword-length=1..61    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
-fassign-clause=<value>      set way of interpreting ASSIGN
-fbinary-size=<value>  binary byte size - defines the allocated bytes according to PIC
-fbinary-byteorder=<value>  binary byte order
-fscreen-section-rules=<value>    which compiler's rules to apply to SCREEN SECTION items
-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 complex OCCURS DEPENDING ON
-findirect-redefines    allow REDEFINES to other than last equal level number
-flarger-redefines-ok   allow larger REDEFINES items
-frelax-syntax-checks   allow certain syntax variations (e.g. REDEFINES position)
-frelax-level-hierarchy allow non-matching level numbers
-fselect-working        require ASSIGN USING items to be in WORKING-STORAGE
-fsticky-linkage        LINKAGE-SECTION items remain allocated between invocations
-fmove-ibm             MOVE operates as on IBM (left to right, byte by byte)
-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
-fconstant-folding      evaluate constant expressions at compile time
-fhostsign             allow hexadecimal value 'F' for NUMERIC test of signed PACKED DECIMAL
-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
-faccept-auto           set WITH AUTO clause as default for ACCEPT dest-item, instead of WITH
-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 the first item in a field DISPLAY goes at LINE 0 COL 0
-fdisplay-special-fig-consts  special behaviour of DISPLAY SPACE/ALL X'01'/ALL X'02'/ALL X'03'
-fbinary-comp-1         COMP-1 is a 16-bit signed integer
-fmove-non-numeric-lit-to-numeric-is-zero  imply zero in move of non-numeric literal to numeric
-fcomment-paragraphs=<support>    comment paragraphs in IDENTIFICATION DIVISION (AUTHOR, DATE, etc.)
-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
-fsynchronized-clause=<support>    SYNCHRONIZED clause
-fgoto-statement-without-name=<support>  GOTO statement without name
-fstop-literal-statement=<support>  STOP-literal statement
-fstop-identifier-statement=<support>  STOP-identifier 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, etc.
-ftitle-statement=<support>    listing-directive statement TITLE
-fentry-statement=<support>    ENTRY statement

```

-fmove-noninteger-to-alphanumeric=<support> move noninteger to alphanumeric
 -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
 -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')
 -facu-literals=<support> ACUCOBOL-GT literals (#B #O #H #X)
 -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
 -fconstant-78=<support> constant with level 78 item (note: has left to right precedence)
 -fconstant-01=<support> constant with level 01 CONSTANT AS/FROM item
 -fperform-varying-without-by=<support> PERFORM VARYING without BY phrase (implies BY 1)
 -fprogram-prototypes=<support> CALL/CANCEL with program-prototype-name
 -freference-out-of-declaratives=<support> references to sections not in DECLARATIVES
 -fnumeric-value-for-edited-item=<support> numeric literals in VALUE clause of numeric
 -fincorrect-conf-sec-order=<support> incorrect order of CONFIGURATION SECTION paragraphs
 -fdefine-constant-directive=<support> allow >> DEFINE CONSTANT var AS literal
 -ffree-redefines-position=<support> REDEFINES clause not following entry-name in definition
 -frecord-delimiter=<support> RECORD DELIMITER clause
 -fsequential-delimiters=<support> BINARY-SEQUENTIAL and LINE-SEQUENTIAL phrases in RECORD
 -frecord-delim-with-fixed-recs=<support> RECORD DELIMITER clause on file with fixed-length
 -fmissing-statement=<support> missing statement (e.g. empty IF / PERFORM)
 where <support> is one of the following:
 '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> special register to enable

Report bugs to: bug-gnucobol@gnu.org

or (preferably) use the issue tracker via the home page.

GnuCOBOL home page: <http://www.gnu.org/software/gnucobol/>

General help using GNU software: <http://www.gnu.org/gethelp/>

Appendix B `cobc --list-reserved`

Reserved Words	Implemented
3-D	Yes (Context sensitive)
ABSENT	Yes
ACCEPT	Yes
ACCESS	Yes
ACTION	Yes (Context sensitive)
ACTIVE-CLASS	No
ACTIVE-X	Yes (Context sensitive)
ADD	Yes
ADDRESS	Yes
ADJUSTABLE-COLUMNS	Yes (Context sensitive)
ADVANCING	Yes
AFTER	Yes
ALIGNED	No
ALIGNMENT	Yes (Context sensitive)
ALL	Yes
ALLOCATE	Yes
ALPHABET	Yes
ALPHABETIC	Yes
ALPHABETIC-LOWER	Yes
ALPHABETIC-UPPER	Yes
ALPHANUMERIC	Yes
ALPHANUMERIC-EDITED	Yes
ALSO	Yes
ALTER	Yes
ALTERNATE	Yes
AND	Yes
ANY	Yes
ANYCASE	No
ARE	Yes
AREA	Yes (aliased with AREAS)
AREAS	Yes (aliased with AREA)
ARGUMENT-NUMBER	Yes
ARGUMENT-VALUE	Yes
ARITHMETIC	Yes (Context sensitive)
AS	Yes
ASCENDING	Yes
ASCII	Yes (Context sensitive)
ASSIGN	Yes
AT	Yes
ATTRIBUTE	Yes (Context sensitive)
AUTO	Yes (Context sensitive) (aliased with AUTO-SKIP, AUTOTERMINATE)
AUTO-DECIMAL	Yes (Context sensitive)
AUTO-SKIP	Yes (aliased with AUTO, AUTOTERMINATE)
AUTO-SPIN	Yes (Context sensitive)
AUTOMATIC	Yes
AUTOTERMINATE	Yes (aliased with AUTO, AUTO-SKIP)
AWAY-FROM-ZERO	Yes (Context sensitive)
B-AND	No

B-NOT	No
B-OR	No
B-XOR	No
BACKGROUND-COLOR	Yes (Context sensitive) (aliased with BACKGROUND-COLOUR)
BACKGROUND-COLOUR	Yes (aliased with BACKGROUND-COLOR)
BACKGROUND-HIGH	Yes
BACKGROUND-LOW	Yes
BACKGROUND-STANDARD	Yes
BAR	Yes (Context sensitive)
BASED	Yes
BEEP	Yes (aliased with BELL)
BEFORE	Yes
BELL	Yes (Context sensitive) (aliased with BEEP)
BINARY	Yes
BINARY-C-LONG	Yes
BINARY-CHAR	Yes
BINARY-DOUBLE	Yes (aliased with BINARY-LONG-LONG)
BINARY-INT	Yes (aliased with BINARY-LONG)
BINARY-LONG	Yes (aliased with BINARY-INT)
BINARY-LONG-LONG	Yes (aliased with BINARY-DOUBLE)
BINARY-SEQUENTIAL	Yes
BINARY-SHORT	Yes
BIT	No
BITMAP	Yes (Context sensitive)
BITMAP-END	Yes (Context sensitive)
BITMAP-HANDLE	Yes (Context sensitive)
BITMAP-NUMBER	Yes (Context sensitive)
BITMAP-START	Yes (Context sensitive)
BITMAP-TIMER	Yes (Context sensitive)
BITMAP-TRAILING	Yes (Context sensitive)
BITMAP-TRANSPARENT-COLOR	Yes (Context sensitive)
BITMAP-WIDTH	Yes (Context sensitive)
BLANK	Yes
BLINK	Yes (Context sensitive)
BLOCK	Yes
BOOLEAN	No
BOTTOM	Yes
BOX	Yes
BOXED	Yes
BUSY	Yes (Context sensitive)
BUTTONS	Yes (Context sensitive)
BY	Yes
BYTE-LENGTH	Yes (Context sensitive)
CALENDAR-FONT	Yes (Context sensitive)
CALL	Yes
CANCEL	Yes
CANCEL-BUTTON	Yes (Context sensitive)
CAPACITY	Yes (Context sensitive)
CARD-PUNCH	Yes (Context sensitive)
CARD-READER	Yes (Context sensitive)
CASSETTE	Yes (Context sensitive)
CCOL	Yes (Context sensitive)

CD	Yes
CELL	Yes (Context sensitive) (aliased with CELLS)
CELL-COLOR	Yes (Context sensitive)
CELL-DATA	Yes (Context sensitive)
CELL-FONT	Yes (Context sensitive)
CELL-PROTECTION	Yes (Context sensitive)
CELLS	Yes (aliased with CELL)
CENTER	Yes (Context sensitive)
CENTERED-HEADINGS	Yes (Context sensitive)
CENTURY-DATE	Yes (Context sensitive)
CF	Yes
CH	Yes
CHAIN	No
CHAINING	Yes
CHARACTER	Yes
CHARACTERS	Yes
CHECK-BOX	Yes (Context sensitive)
CLASS	Yes
CLASS-ID	No
CLASSIFICATION	Yes (Context sensitive)
CLEAR-SELECTION	Yes (Context sensitive)
CLINE	Yes (Context sensitive)
CLINES	Yes (Context sensitive)
CLOSE	Yes
COBOL	Yes (Context sensitive)
CODE	Yes
CODE-SET	Yes
COL	Yes
COLLATING	Yes
COLOR	Yes
COLORS	Yes (Context sensitive) (aliased with COLOURS)
COLOURS	Yes (aliased with COLORS)
COLS	Yes
COLUMN	Yes
COLUMN-COLOR	Yes (Context sensitive)
COLUMN-DIVIDERS	Yes (Context sensitive)
COLUMN-FONT	Yes (Context sensitive)
COLUMN-HEADINGS	Yes (Context sensitive)
COLUMN-PROTECTION	Yes (Context sensitive)
COLUMNS	Yes
COMBO-BOX	Yes (Context sensitive)
COMMA	Yes
COMMAND-LINE	Yes
COMMIT	Yes
COMMON	Yes
COMMUNICATION	Yes
COMP	Yes (aliased with COMPUTATIONAL)
COMP-1	Yes (aliased with COMPUTATIONAL-1)
COMP-2	Yes (aliased with COMPUTATIONAL-2)
COMP-3	Yes (aliased with COMPUTATIONAL-3)
COMP-4	Yes (aliased with COMPUTATIONAL-4)
COMP-5	Yes (aliased with COMPUTATIONAL-5)

COMP-6	Yes (aliased with COMPUTATIONAL-6)
COMP-X	Yes (aliased with COMPUTATIONAL-X)
COMPUTATIONAL	Yes (aliased with COMP)
COMPUTATIONAL-1	Yes (aliased with COMP-1)
COMPUTATIONAL-2	Yes (aliased with COMP-2)
COMPUTATIONAL-3	Yes (aliased with COMP-3)
COMPUTATIONAL-4	Yes (aliased with COMP-4)
COMPUTATIONAL-5	Yes (aliased with COMP-5)
COMPUTATIONAL-6	Yes (aliased with COMP-6)
COMPUTATIONAL-X	Yes (aliased with COMP-X)
COMPUTE	Yes
CONDITION	Yes
CONFIGURATION	Yes
CONSTANT	Yes
CONTAINS	Yes
CONTENT	Yes
CONTINUE	Yes
CONTROL	Yes
CONTROLS	Yes
CONVERSION	Yes (Context sensitive)
CONVERTING	Yes
COPY	Yes
COPY-SELECTION	Yes (Context sensitive)
CORR	Yes (aliased with CORRESPONDING)
CORRESPONDING	Yes (aliased with CORR)
COUNT	Yes
CRT	Yes
CRT-UNDER	Yes
Csize	Yes (Context sensitive)
CURRENCY	Yes
CURSOR	Yes
CURSOR-COL	Yes (Context sensitive)
CURSOR-COLOR	Yes (Context sensitive)
CURSOR-FRAME-WIDTH	Yes (Context sensitive)
CURSOR-ROW	Yes (Context sensitive)
CURSOR-X	Yes (Context sensitive)
CURSOR-Y	Yes (Context sensitive)
CUSTOM-PRINT-TEMPLATE	Yes (Context sensitive)
CYCLE	Yes (Context sensitive)
DASHED	Yes (Context sensitive)
DATA	Yes
DATA-COLUMNS	Yes (Context sensitive)
DATA-POINTER	No
DATA-TYPES	Yes (Context sensitive)
DATE	Yes
DATE-ENTRY	Yes (Context sensitive)
DAY	Yes
DAY-OF-WEEK	Yes
DE	Yes
DEBUGGING	Yes
DECIMAL-POINT	Yes
DECLARATIVES	Yes

DEFAULT	Yes
DEFAULT-BUTTON	Yes (Context sensitive)
DEFAULT-FONT	Yes
DELETE	Yes
DELIMITED	Yes
DELIMITER	Yes
DEPENDING	Yes
DESCENDING	Yes
DESTINATION	Yes
DESTROY	Yes
DETAIL	Yes
DISABLE	Yes
DISC	Yes (Context sensitive)
DISK	Yes (Context sensitive)
DISPLAY	Yes
DISPLAY-COLUMNS	Yes (Context sensitive)
DISPLAY-FORMAT	Yes (Context sensitive)
DIVIDE	Yes
DIVIDER-COLOR	Yes (Context sensitive)
DIVIDERS	Yes (Context sensitive)
DIVISION	Yes
DOTDASH	Yes (Context sensitive)
DOTTED	Yes (Context sensitive)
DOUBLE	Yes (aliased with FLOAT-LONG)
DOWN	Yes
DRAG-COLOR	Yes (Context sensitive)
DROP-DOWN	Yes (Context sensitive)
DROP-LIST	Yes (Context sensitive)
DUPLICATES	Yes
DYNAMIC	Yes
EBCDIC	Yes (Context sensitive)
EC	Yes
ECHO	Yes
EGI	Yes
ELSE	Yes
EMI	Yes
EMPTY-CHECK	Yes (aliased with REQUIRED)
ENABLE	Yes
END	Yes
END-ACCEPT	Yes
END-ADD	Yes
END-CALL	Yes
END-CHAIN	No
END-COLOR	Yes (Context sensitive)
END-COMPUTE	Yes
END-DELETE	Yes
END-DISPLAY	Yes
END-DIVIDE	Yes
END-EVALUATE	Yes
END-IF	Yes
END-MODIFY	Yes (Context sensitive)
END-MULTIPLY	Yes

END-OF-PAGE	Yes (aliased with EOP)
END-PERFORM	Yes
END-READ	Yes
END-RECEIVE	Yes
END-RETURN	Yes
END-REWRITE	Yes
END-SEARCH	Yes
END-START	Yes
END-STRING	Yes
END-SUBTRACT	Yes
END-UNSTRING	Yes
END-WRITE	Yes
ENGRAVED	Yes (Context sensitive)
ENSURE-VISIBLE	Yes (Context sensitive)
ENTRY	Yes
ENTRY-CONVENTION	Yes (Context sensitive)
ENTRY-FIELD	Yes (Context sensitive)
ENTRY-REASON	Yes (Context sensitive)
ENVIRONMENT	Yes
ENVIRONMENT-NAME	Yes
ENVIRONMENT-VALUE	Yes
EO	No
EOL	Yes (Context sensitive)
EOP	Yes (aliased with END-OF-PAGE)
EOS	Yes (Context sensitive)
EQUAL	Yes (aliased with EQUALS)
EQUALS	Yes (aliased with EQUAL)
ERASE	Yes (Context sensitive)
ERROR	Yes
ESCAPE	Yes
ESCAPE-BUTTON	Yes (Context sensitive)
ESI	Yes
EVALUATE	Yes
EVENT	Yes
EVENT-LIST	Yes (Context sensitive)
EXCEPTION	Yes
EXCEPTION-OBJECT	No
EXCEPTION-VALUE	Yes (Context sensitive)
EXCLUSIVE	Yes
EXIT	Yes
EXPAND	Yes (Context sensitive)
EXPANDS	No (Context sensitive)
EXTEND	Yes
EXTERN	Yes (Context sensitive)
EXTERNAL	Yes
EXTERNAL-FORM	Yes
F	Yes
FACTORY	No
FALSE	Yes
FD	Yes
FILE	Yes
FILE-CONTROL	Yes

FILE-ID	Yes
FILE-NAME	Yes (Context sensitive)
FILE-POS	Yes (Context sensitive)
FILL-COLOR	Yes (Context sensitive)
FILL-COLOR2	Yes (Context sensitive)
FILL-PERCENT	Yes (Context sensitive)
FILLER	Yes
FINAL	Yes
FINISH-REASON	Yes (Context sensitive)
FIRST	Yes
FIXED	Yes
FIXED-FONT	Yes
FIXED-WIDTH	Yes (Context sensitive)
FLAT	Yes (Context sensitive)
FLAT-BUTTONS	Yes (Context sensitive)
FLOAT	Yes (aliased with FLOAT-SHORT)
FLOAT-BINARY-128	No
FLOAT-BINARY-32	No
FLOAT-BINARY-64	No
FLOAT-DECIMAL-16	Yes
FLOAT-DECIMAL-34	Yes
FLOAT-EXTENDED	No
FLOAT-INFINITY	No
FLOAT-LONG	Yes (aliased with DOUBLE)
FLOAT-NOT-A-NUMBER	No (Context sensitive)
FLOAT-SHORT	Yes (aliased with FLOAT)
FLOATING	Yes
FONT	Yes
FOOTING	Yes
FOR	Yes
FOREGROUND-COLOR	Yes (Context sensitive) (aliased with FOREGROUND-COLOUR)■
FOREGROUND-COLOUR	Yes (aliased with FOREGROUND-COLOR)
FOREVER	Yes (Context sensitive)
FORMAT	No
FRAME	Yes (Context sensitive)
FRAMED	Yes (Context sensitive)
FREE	Yes
FROM	Yes
FULL	Yes (Context sensitive) (aliased with LENGTH-CHECK)■
FULL-HEIGHT	Yes (Context sensitive)
FUNCTION	Yes
FUNCTION-ID	Yes
FUNCTION-POINTER	No
GENERATE	Yes
GET	No
GIVING	Yes
GLOBAL	Yes
GO	Yes
GO-BACK	Yes (Context sensitive)
GO-FORWARD	Yes (Context sensitive)
GO-HOME	Yes (Context sensitive)
GO-SEARCH	Yes (Context sensitive)

GOBACK	Yes
GRAPHICAL	Yes
GREATER	Yes
GRID	Yes (Context sensitive)
GROUP	Yes
GROUP-USAGE	No
GROUP-VALUE	Yes (Context sensitive)
HANDLE	Yes
HAS-CHILDREN	Yes (Context sensitive)
HEADING	Yes
HEADING-COLOR	Yes (Context sensitive)
HEADING-DIVIDER-COLOR	Yes (Context sensitive)
HEADING-FONT	Yes (Context sensitive)
HEAVY	Yes (Context sensitive)
HEIGHT-IN-CELLS	Yes (Context sensitive)
HIDDEN-DATA	Yes (Context sensitive)
HIGH-COLOR	Yes (Context sensitive)
HIGH-VALUE	Yes (aliased with HIGH-VALUES)
HIGH-VALUES	Yes (aliased with HIGH-VALUE)
HIGHLIGHT	Yes (Context sensitive)
HOT-TRACK	Yes (Context sensitive)
HSCROLL	Yes (Context sensitive)
HSCROLL-POS	Yes (Context sensitive)
I-O	Yes
I-O-CONTROL	Yes
ICON	Yes
ID	Yes
IDENTIFICATION	Yes
IDENTIFIED	Yes
IF	Yes
IGNORE	Yes
IGNORING	Yes (Context sensitive)
IMPLEMENTS	No (Context sensitive)
IN	Yes
INDEPENDENT	Yes
INDEX	Yes
INDEXED	Yes
INDICATE	Yes
INHERITS	No
INITIAL	Yes
INITIALISE	Yes (aliased with INITIALIZE)
INITIALISED	Yes (aliased with INITIALIZED)
INITIALIZE	Yes (aliased with INITIALISE)
INITIALIZED	Yes (aliased with INITIALISED)
INITIATE	Yes
INPUT	Yes
INPUT-OUTPUT	Yes
INQUIRE	Yes
INSERT-ROWS	Yes (Context sensitive)
INSERTION-INDEX	Yes (Context sensitive)
INSPECT	Yes
INTERFACE	No

INTERFACE-ID	No
INTERMEDIATE	Yes (Context sensitive)
INTO	Yes
INTRINSIC	Yes (Context sensitive)
INVALID	Yes
INVOKE	No
IS	Yes
ITEM	Yes (Context sensitive)
ITEM-TEXT	Yes (Context sensitive)
ITEM-TO-ADD	Yes (Context sensitive)
ITEM-TO-DELETE	Yes (Context sensitive)
ITEM-TO-EMPTY	Yes (Context sensitive)
ITEM-VALUE	Yes (Context sensitive)
JUST	Yes (aliased with JUSTIFIED)
JUSTIFIED	Yes (aliased with JUST)
KEPT	Yes
KEY	Yes
KEYBOARD	Yes (Context sensitive)
LABEL	Yes
LABEL-OFFSET	Yes (Context sensitive)
LARGE-FONT	Yes
LARGE-OFFSET	Yes (Context sensitive)
LAST	Yes
LAST-ROW	Yes (Context sensitive)
LAYOUT-DATA	Yes (Context sensitive)
LAYOUT-MANAGER	Yes
LC_ALL	No (Context sensitive)
LC_COLLATE	No (Context sensitive)
LC_CTYPE	No (Context sensitive)
LC_MESSAGES	No (Context sensitive)
LC_MONETARY	No (Context sensitive)
LC_NUMERIC	No (Context sensitive)
LC_TIME	No (Context sensitive)
LEADING	Yes
LEADING-SHIFT	Yes (Context sensitive)
LEFT	Yes
LEFT-JUSTIFY	No
LEFT-TEXT	Yes (Context sensitive)
LEFTLINE	Yes
LENGTH	Yes
LENGTH-CHECK	Yes (aliased with FULL)
LESS	Yes
LIMIT	Yes
LIMITS	Yes
LINAGE	Yes
LINAGE-COUNTER	Yes
LINE	Yes
LINE-COUNTER	Yes
LINE-SEQUENTIAL	Yes
LINES	Yes
LINES-AT-ROOT	Yes (Context sensitive)
LINKAGE	Yes

LIST-BOX	Yes (Context sensitive)
LM-RESIZE	Yes
LOCAL-STORAGE	Yes
LOCALE	Yes
LOCK	Yes
LONG-DATE	Yes (Context sensitive)
LOW-COLOR	Yes (Context sensitive)
LOW-VALUE	Yes (aliased with LOW-VALUES)
LOW-VALUES	Yes (aliased with LOW-VALUE)
LOWER	Yes (Context sensitive)
LOWERED	Yes (Context sensitive)
LOWLIGHT	Yes (Context sensitive)
MAGNETIC-TAPE	Yes (Context sensitive)
MANUAL	Yes
MASS-UPDATE	Yes (Context sensitive)
MAX-LINES	Yes (Context sensitive)
MAX-PROGRESS	Yes (Context sensitive)
MAX-TEXT	Yes (Context sensitive)
MAX-VAL	Yes (Context sensitive)
MEDIUM-FONT	Yes
MEMORY	Yes (Context sensitive)
MENU	Yes
MERGE	Yes
MESSAGE	Yes
METHOD	No
METHOD-ID	No
MIN-VAL	Yes (Context sensitive)
MINUS	Yes
MODE	Yes
MODIFY	Yes
MODULES	Yes
MOVE	Yes
MULTILINE	Yes (Context sensitive)
MULTIPLE	Yes
MULTIPLY	Yes
NAME	Yes (Context sensitive)
NATIONAL	Yes
NATIONAL-EDITED	Yes
NATIVE	Yes
NAVIGATE-URL	Yes (Context sensitive)
NEAREST-AWAY-FROM-ZERO	Yes (Context sensitive)
NEAREST-EVEN	Yes (Context sensitive)
NEAREST-TOWARD-ZERO	Yes (Context sensitive)
NEGATIVE	Yes
NESTED	Yes
NEW	Yes
NEXT	Yes
NEXT-ITEM	Yes (Context sensitive)
NO	Yes
NO-AUTO-DEFAULT	Yes (Context sensitive)
NO-AUTOSEL	Yes (Context sensitive)
NO-BOX	Yes (Context sensitive)

NO-DIVIDERS	Yes (Context sensitive)
NO-ECHO	Yes
NO-F4	Yes (Context sensitive)
NO-FOCUS	Yes (Context sensitive)
NO-GROUP-TAB	Yes (Context sensitive)
NO-KEY-LETTER	Yes (Context sensitive)
NO-SEARCH	Yes (Context sensitive)
NO-UPDOWN	Yes (Context sensitive)
NONE	No (Context sensitive)
NORMAL	Yes (Context sensitive)
NOT	Yes
NOTAB	Yes (Context sensitive)
NOTHING	Yes
NOTIFY	Yes (Context sensitive)
NOTIFY-CHANGE	Yes (Context sensitive)
NOTIFY-DBLCLICK	Yes (Context sensitive)
NOTIFY-SELCHANGE	Yes (Context sensitive)
NULL	Yes (aliased with NULLS)
NULLS	Yes (aliased with NULL)
NUM-COL-HEADINGS	Yes (Context sensitive)
NUM-ROWS	Yes (Context sensitive)
NUMBER	Yes
NUMBERS	Yes
NUMERIC	Yes
NUMERIC-EDITED	Yes
OBJECT	Yes
OBJECT-COMPUTER	Yes
OBJECT-REFERENCE	No
OCCURS	Yes
OF	Yes
OFF	Yes
OK-BUTTON	Yes (Context sensitive)
OMITTED	Yes
ON	Yes
ONLY	Yes
OPEN	Yes
OPTIONAL	Yes
OPTIONS	Yes
OR	Yes
ORDER	Yes
ORGANISATION	Yes (aliased with ORGANIZATION)
ORGANIZATION	Yes (aliased with ORGANISATION)
OTHER	Yes
OUTPUT	Yes
OVERFLOW	Yes
OVERLAP-LEFT	Yes (Context sensitive) (aliased with OVERLAP-TOP)■
OVERLAP-TOP	Yes (Context sensitive) (aliased with OVERLAP-LEFT)■
OVERLINE	Yes
OVERRIDE	No
PACKED-DECIMAL	Yes
PADDING	Yes
PAGE	Yes

PAGE-COUNTER	Yes
PAGE-SETUP	Yes (Context sensitive)
PAGED	Yes (Context sensitive)
PARAGRAPH	Yes (Context sensitive)
PARENT	Yes (Context sensitive)
PASSWORD	Yes (Context sensitive)
PERFORM	Yes
PERMANENT	Yes (Context sensitive)
PF	Yes
PH	Yes
PHYSICAL	Yes
PIC	Yes (aliased with PICTURE)
PICTURE	Yes (aliased with PIC)
PIXEL	Yes (Context sensitive) (aliased with PIXELS)
PIXELS	Yes (aliased with PIXEL)
PLACEMENT	Yes (Context sensitive)
PLUS	Yes
POINTER	Yes
POP-UP	Yes
POSITION	Yes
POSITION-SHIFT	Yes (Context sensitive)
POSITIVE	Yes
PREFIXED	No (Context sensitive)
PRESENT	Yes
PREVIOUS	Yes
PRINT	Yes (Context sensitive)
PRINT-NO-PROMPT	Yes (Context sensitive)
PRINT-PREVIEW	Yes (Context sensitive)
PRINTER	Yes (Context sensitive)
PRINTER-1	Yes (Context sensitive)
PRINTING	Yes
PRIORITY	Yes
PROCEDURE	Yes
PROCEDURE-POINTER	Yes (aliased with PROGRAM-POINTER)
PROCEDURES	Yes
PROCEED	Yes
PROGRAM	Yes
PROGRAM-ID	Yes
PROGRAM-POINTER	Yes (aliased with PROCEDURE-POINTER)
PROGRESS	Yes (Context sensitive)
PROHIBITED	Yes (Context sensitive)
PROMPT	Yes
PROPERTIES	Yes (Context sensitive)
PROPERTY	Yes
PROTECTED	Yes
PROTOTYPE	No
PURGE	Yes
PUSH-BUTTON	Yes (Context sensitive)
QUERY-INDEX	Yes (Context sensitive)
QUEUE	Yes
QUOTE	Yes (aliased with QUOTES)
QUOTES	Yes (aliased with QUOTE)

RADIO-BUTTON	Yes (Context sensitive)
RAISE	No
RAISED	Yes (Context sensitive)
RAISING	No
RANDOM	Yes
RD	Yes
READ	Yes
READ-ONLY	Yes (Context sensitive)
RECEIVE	Yes
RECORD	Yes
RECORD-DATA	Yes (Context sensitive)
RECORD-TO-ADD	Yes (Context sensitive)
RECORD-TO-DELETE	Yes (Context sensitive)
RECORDING	Yes
RECORDS	Yes
RECURSIVE	Yes (Context sensitive)
REDEFINES	Yes
REEL	Yes
REFERENCE	Yes
REFERENCES	Yes
REFRESH	Yes (Context sensitive)
REGION-COLOR	Yes (Context sensitive)
RELATION	No (Context sensitive)
RELATIVE	Yes
RELEASE	Yes
REMAINDER	Yes
REMOVAL	Yes
RENAMES	Yes
REPLACE	Yes
REPLACING	Yes
REPORT	Yes
REPORTING	Yes
REPORTS	Yes
REPOSITORY	Yes
REQUIRED	Yes (Context sensitive) (aliased with EMPTY-CHECK)■
RESERVE	Yes
RESET	Yes
RESET-GRID	Yes (Context sensitive)
RESET-LIST	Yes (Context sensitive)
RESET-TABS	Yes (Context sensitive)
RESUME	No
RETRY	Yes
RETURN	Yes
RETURNING	Yes
REVERSE	Yes
REVERSE-VIDEO	Yes (Context sensitive)
REVERSED	Yes
REWIND	Yes
REWRITE	Yes
RF	Yes
RH	Yes
RIGHT	Yes

RIGHT-ALIGN	Yes (Context sensitive)
RIGHT-JUSTIFY	No
RIMMED	Yes (Context sensitive)
ROLLBACK	Yes
ROUNDED	Yes
ROUNDING	Yes (Context sensitive)
ROW-COLOR	Yes (Context sensitive)
ROW-COLOR-PATTERN	Yes (Context sensitive)
ROW-DIVIDERS	Yes (Context sensitive)
ROW-FONT	Yes (Context sensitive)
ROW-HEADINGS	Yes (Context sensitive)
ROW-PROTECTION	Yes (Context sensitive)
RUN	Yes
S	Yes
SAME	Yes
SAVE-AS	Yes (Context sensitive)
SAVE-AS-NO-PROMPT	Yes (Context sensitive)
SCREEN	Yes
SCROLL	Yes (Context sensitive)
SCROLL-BAR	Yes (Context sensitive)
SD	Yes
SEARCH	Yes
SEARCH-OPTIONS	Yes (Context sensitive)
SEARCH-TEXT	Yes (Context sensitive)
SECONDS	Yes (Context sensitive)
SECTION	Yes
SECURE	Yes (Context sensitive)
SEGMENT	Yes
SEGMENT-LIMIT	Yes
SELECT	Yes
SELECT-ALL	Yes (Context sensitive)
SELECTION-INDEX	Yes (Context sensitive)
SELECTION-TEXT	Yes (Context sensitive)
SELF	No
SELF-ACT	Yes (Context sensitive)
SEND	Yes
SENTENCE	Yes
SEPARATE	Yes
SEPARATION	Yes (Context sensitive)
SEQUENCE	Yes
SEQUENTIAL	Yes
SET	Yes
SHADING	Yes (Context sensitive)
SHADOW	Yes
SHARING	Yes
SHORT-DATE	Yes (Context sensitive)
SHOW-LINES	Yes (Context sensitive)
SHOW-NONE	Yes (Context sensitive)
SHOW-SEL-ALWAYS	Yes (Context sensitive)
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 (Context sensitive)
SOURCE	Yes
SOURCE-COMPUTER	Yes
SOURCES	No
SPACE	Yes (aliased with SPACES)
SPACE-FILL	No
SPACES	Yes (aliased with SPACE)
SPECIAL-NAMES	Yes
SPINNER	Yes (Context sensitive)
SQUARE	Yes (Context sensitive)
STANDARD	Yes
STANDARD-1	Yes
STANDARD-2	Yes
STANDARD-BINARY	Yes (Context sensitive)
STANDARD-DECIMAL	Yes (Context sensitive)
START	Yes
START-X	Yes (Context sensitive)
START-Y	Yes (Context sensitive)
STATEMENT	No (Context sensitive)
STATIC	Yes (Context sensitive)
STATIC-LIST	Yes (Context sensitive)
STATUS	Yes
STATUS-BAR	Yes (Context sensitive)
STATUS-TEXT	Yes (Context sensitive)
STDCALL	Yes (Context sensitive)
STEP	Yes
STOP	Yes
STRING	Yes
STRONG	No (Context sensitive)
STYLE	Yes (Context sensitive)
SUB-QUEUE-1	Yes
SUB-QUEUE-2	Yes
SUB-QUEUE-3	Yes
SUBTRACT	Yes
SUBWINDOW	Yes
SUM	Yes
SUPER	No
SUPPRESS	Yes
SYMBOL	No (Context sensitive)
SYMBOLIC	Yes
SYNC	Yes (aliased with SYNCHRONISED, SYNCHRONIZED)
SYNCHRONISED	Yes (aliased with SYNC, SYNCHRONIZED)
SYNCHRONIZED	Yes (aliased with SYNC, SYNCHRONISED)
SYSTEM-DEFAULT	Yes
SYSTEM-OFFSET	Yes
TAB	Yes (Context sensitive)

TAB-TO-ADD	Yes (Context sensitive)
TAB-TO-DELETE	Yes (Context sensitive)
TABLE	Yes
TALLYING	Yes
TAPE	Yes (Context sensitive)
TEMPORARY	Yes (Context sensitive)
TERMINATE	Yes
TERMINATION-VALUE	Yes (Context sensitive)
TEST	Yes
TEXT	Yes
THAN	Yes
THEN	Yes
THREAD	Yes
THREADS	Yes
THROUGH	Yes (aliased with THRU)
THRU	Yes (aliased with THROUGH)
THUMB-POSITION	Yes (Context sensitive)
TILED-HEADINGS	Yes (Context sensitive)
TIME	Yes
TIME-OUT	Yes (Context sensitive) (aliased with TIMEOUT)
TIMEOUT	Yes (aliased with TIME-OUT)
TIMES	Yes
TITLE	Yes (Context sensitive)
TITLE-POSITION	Yes (Context sensitive)
TO	Yes
TOP	Yes
TOWARD-GREATER	Yes (Context sensitive)
TOWARD-LESSER	Yes (Context sensitive)
TRADITIONAL-FONT	Yes
TRAILING	Yes
TRAILING-SHIFT	Yes (Context sensitive)
TRAILING-SIGN	No
TRANSFORM	Yes
TRANSPARENT	Yes (Context sensitive)
TREE-VIEW	Yes (Context sensitive)
TRUE	Yes
TRUNCATION	Yes (Context sensitive)
TYPE	Yes
TYPDEF	No
U	Yes
UCS-4	No (Context sensitive)
UNBOUNDED	Yes (Context sensitive)
UNDERLINE	Yes (Context sensitive)
UNFRAMED	Yes (Context sensitive)
UNIT	Yes
UNIVERSAL	No
UNLOCK	Yes
UNSIGNED	Yes
UNSIGNED-INT	Yes
UNSIGNED-LONG	Yes
UNSIGNED-SHORT	Yes
UNSORTED	Yes (Context sensitive)

UNSTRING	Yes
UNTIL	Yes
UP	Yes
UPDATE	Yes
UPON	Yes
UPPER	Yes (Context sensitive)
USAGE	Yes
USE	Yes
USE-ALT	Yes (Context sensitive)
USE-RETURN	Yes (Context sensitive)
USE-TAB	Yes (Context sensitive)
USER	Yes (Context sensitive)
USER-DEFAULT	Yes
USING	Yes
UTF-16	No (Context sensitive)
UTF-8	No (Context sensitive)
V	Yes
VAL-STATUS	No
VALID	No
VALIDATE	Yes
VALIDATE-STATUS	No
VALUE	Yes (aliased with VALUES)
VALUE-FORMAT	Yes (Context sensitive)
VALUES	Yes (aliased with VALUE)
VARIABLE	Yes
VARIANT	Yes
VARYING	Yes
VERTICAL	Yes (Context sensitive)
VERY-HEAVY	Yes (Context sensitive)
VIRTUAL-WIDTH	Yes (Context sensitive)
VPADDING	Yes (Context sensitive)
VSCROLL	Yes (Context sensitive)
VSCROLL-BAR	Yes (Context sensitive)
VSCROLL-POS	Yes (Context sensitive)
VTOP	Yes (Context sensitive)
WAIT	Yes
WEB-BROWSER	Yes (Context sensitive)
WHEN	Yes
WIDTH	Yes (Context sensitive)
WIDTH-IN-CELLS	Yes (Context sensitive)
WINDOW	Yes
WITH	Yes
WORDS	Yes
WORKING-STORAGE	Yes
WRAP	Yes (Context sensitive)
WRITE	Yes
X	Yes (Context sensitive)
Y	Yes (Context sensitive)
YYYYDDD	Yes (Context sensitive)
YYYYMMDD	Yes (Context sensitive)
ZERO	Yes (aliased with ZEROES, ZEROS)
ZERO-FILL	No (Context sensitive)

ZEROES	Yes (aliased with ZERO, ZEROS)
ZEROS	Yes (aliased with ZERO, ZEROES)

Extra (obsolete) context sensitive words

AUTHOR
DATE-COMPILED
DATE-MODIFIED
DATE-WRITTEN
INSTALLATION
REMARKS
SECURITY

Internal registers	Implemented	Definition
ADDRESS OF	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■

Appendix C `cobc --list-intrinsics`

Intrinsic Function	Implemented	Parameters
ABS	Yes	1
ACOS	Yes	1
ANNUITY	Yes	2
ASIN	Yes	1
ATAN	Yes	1
BOOLEAN-OF-INTEGER	No	2
BYTE-LENGTH	Yes	1 - 2
CHAR	Yes	1
CHAR-NATIONAL	No	1
COMBINED-DATETIME	Yes	2
CONCATENATE	Yes	Unlimited
COS	Yes	1
CURRENCY-SYMBOL	Yes	0
CURRENT-DATE	Yes	0
DATE-OF-INTEGER	Yes	1
DATE-TO-YYYYMMDD	Yes	1 - 3
DAY-OF-INTEGER	Yes	1
DAY-TO-YYYYDDD	Yes	1 - 3
DISPLAY-OF	No	1 - 2
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
FORMATTED-CURRENT-DATE	Yes	1
FORMATTED-DATE	Yes	2
FORMATTED-DATETIME	Yes	4 - 5
FORMATTED-TIME	Yes	3 - 4
FRACTION-PART	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 - 2
LENGTH-AN	Yes	1
LOCALE-COMPARE	Yes	2 - 3
LOCALE-DATE	Yes	1 - 2
LOCALE-TIME	Yes	1 - 2
LOCALE-TIME-FROM-SECONDS	Yes	1 - 2
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-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 - 2
NUMERIC-DECIMAL-POINT	Yes	0
NUMERIC-THOUSANDS-SEPARATOR	Yes	0
NUMVAL	Yes	1
NUMVAL-C	Yes	2
NUMVAL-F	Yes	1
ORD	Yes	1
ORD-MAX	Yes	Unlimited
ORD-MIN	Yes	Unlimited
PI	Yes	0
PRESENT-VALUE	Yes	Unlimited
RANDOM	Yes	0 - 1
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 - 4
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 - 2

UPPER-CASE	Yes	1
VARIANCE	Yes	Unlimited
WHEN-COMPILED	Yes	0
YEAR-TO-YYYY	Yes	1 - 3

Appendix D `cobc --list-system`

System routine	Parameters
SYSTEM	1
CBL_AND	3
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_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
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_GC_FORK	0
CBL_GC_GETOPT	6
CBL_GC_HOSTED	2
CBL_GC_NANOSLEEP	1
CBL_GC_PRINTABLE	1 - 2
CBL_GC_WAITPID	1
CBL_OC_GETOPT	6
CBL_OC_HOSTED	2
CBL_OC_NANOSLEEP	1
C\$CALLED BY	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
X"91"	2
X"E4"	0
X"E5"	0
X"F4"	2
X"F5"	2

Appendix E `cobc --list-mnemonics`

System names

SYSIN	device name
SYSIPT	device name
STDIN	device name
SYSOUT	device name
SYSLIST	device name
SYSLST	device name
STDOUT	device name
PRINT	device name
PRINTER	device name
PRINTER-1	device name
SYSERR	device name
STDERR	device name
CONSOLE	device name
C01	feature name
C02	feature name
C03	feature name
C04	feature name
C05	feature name
C06	feature name
C07	feature name
C08	feature name
C09	feature name
C10	feature name
C11	feature name
C12	feature name
CSP	feature name
FORMFEED	feature name
CALL-CONVENTION	feature name
SWITCH-0	switch name
SWITCH-1	switch name
SWITCH-2	switch name
SWITCH-3	switch name
SWITCH-4	switch name
SWITCH-5	switch name
SWITCH-6	switch name
SWITCH-7	switch name
SWITCH-8	switch name
SWITCH-9	switch name
SWITCH-10	switch name
SWITCH-11	switch name
SWITCH-12	switch name
SWITCH-13	switch name
SWITCH-14	switch name
SWITCH-15	switch name
SWITCH-16	switch name
SWITCH-17	switch name
SWITCH-18	switch name
SWITCH-19	switch name

SWITCH-20	switch name
SWITCH-21	switch name
SWITCH-22	switch name
SWITCH-23	switch name
SWITCH-24	switch name
SWITCH-25	switch name
SWITCH-26	switch name
SWITCH-27	switch name
SWITCH-28	switch name
SWITCH-29	switch name
SWITCH-30	switch name
SWITCH-31	switch name
SWITCH-32	switch name
SWITCH-33	switch name
SWITCH-34	switch name
SWITCH-35	switch name
SWITCH-36	switch name

Appendix F Compiler Configuration

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

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

# Value: enum
standard-define                                0
#      CB_STD_OC = 0,
#      CB_STD_MF,
#      CB_STD_IBM,
#      CB_STD_MVS,
#      CB_STD_BS2000,
#      CB_STD_ACU,
#      CB_STD_85,
#      CB_STD_2002,
#      CB_STD_2014

# 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 61)
word-length:                                61

# 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

# Value: 'mf', 'ibm'
#
assign-clause:                               mf

# 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

# 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
larger-redefines-ok:            no

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

# 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

# SELECT RELATIVE KEY and ASSIGN fields must be in WORKING-STORAGE
select-working:                          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, DISPLAY SPACES acts as ERASE EOS, DISPLAY X"01" acts as ERASE EOL,
# DISPLAY X"02" acts as BLANK SCREEN 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
```



```

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

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

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

alter-statement:                obsolete
comment-paragraphs:            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
padding-character-clause:       obsolete
section-segments:              ignore
stop-literal-statement:        obsolete
stop-identifier-statement:     obsolete
synchronized-clause:          ok
top-level-occurs-clause:       ok
value-of-clause:               obsolete
numeric-boolean:               ok
hexadecimal-boolean:           ok
national-literals:             ok
hexadecimal-national-literals: ok
acu-literals:                  unconformable
word-continuation:             warning
not-exception-before-exception: ok
accept-display-extensions:     ok
renames-uncommon-levels:      ok
constant-78:                   ok
constant-01:                   ok
perform-varying-without-by:    ok
program-prototypes:            ok
reference-out-of-declaratives: warning
numeric-value-for-edited-item: ok

```

```

incorrect-conf-sec-order:          ok
define-constant-directive:        archaic
free-redefines-position:          warning
record-delimiter:                  ok
sequential-delimiters:             ok
record-delim-with-fixed-recs:     ok
missing-statement:                 error

```

```

# 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

```

```

# 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:    VALUES=VALUE
reserved:    ZEROES=ZERO
reserved:    ZEROS=ZERO

```

Appendix G cobcrun --help

COBOL driver program for GnuCOBOL modules

Usage: cobcrun [options] PROGRAM [parameter ...]
 or: cobcrun options

Options:

-h, -help	display this help and exit
-V, -version	display cobcrun and runtime version and exit
-i, -info	display runtime information (build/environment)
-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)

Report bugs to: bug-gnucobol@gnu.org

or (preferably) use the issue tracker via the home page.

GnuCOBOL home page: <http://www.gnu.org/software/gnucobol/>

General help using GNU software: <http://www.gnu.org/gethelp/>

Appendix H Runtime configuration

The following list was extracted from `config/runtime.cfg`.

H.1 General instructions

The initial `runtime.cfg` file is found in the `$COB_CONFIG_DIR/config` (`COB_CONFIG_DIR` defaults to `installdir/gnucobol`). 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.

Any environment variable may be set with the directive `setenv` . Example: `setenv COB_LIBRARY_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 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 integer optionally followed by `K`, `M`, or `G` for kilo, mega or giga.

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_` .

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

H.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_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 : \$\$ is replaced by process id
 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"

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
 Type: string : \$\$ is replaced by process id
 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_CURRENT_DATE
 Parameter name: current_date
 Purpose: specify an alternate Date/Time to be returned to ACCEPT clauses this is used for testing purposes or to tweak a missing offset partial setting is allowed
 Type: numeric string in format YYYYDDMMHH24MISS or date string
 Default: the operating system date is used
 Example: COB_CURRENT_DATE "2016/03/16 16:40:52"
 current_date YYYYMMDDHHMMSS+01:00

H.3 Call environment

Environment name: COB_LIBRARY_PATH
 Parameter name: library_path
 Purpose: paths for dynamically-loadable modules
 Type: string
 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 modules listed should NOT include extensions, the runtime will use the right ones on the various platforms, COB_LIBRARY_PATH is used to locate the modules
 Example: PRE_LOAD COBOL_function_library:external_c_library

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)

Alias: default_cancel_mode, LOGICAL_CANCEL (0 = yes)

Type: boolean (evaluated for true only)

Default: false

Example: PHYSICAL_CANCEL TRUE

H.4 File I/O

Environment name: COB_VARSEQ_FORMAT

Parameter name: varseq_format

Purpose: declare format used for variable length sequential files

- different types and lengths precede each record
- 'length' is the data length, does not include the prefix

Type: 0 means 2 byte record length (big-endian) + 2 NULs

1 means 4 byte record length (big-endian)

2 means 4 byte record length (local machine int)

3 means 2 byte record length (big-endian)

Default: 0

Example: VARSEQ_FORMAT 1

Environment name: COB_FILE_PATH

Parameter name: file_path

Purpose: define default location where data files are stored

Type: file path directory

Default: . (current directory)

Example: FILE_PATH \${HOME}/mydata

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

Example: LS_FIXED TRUE

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 COMP data fields in it.

Type: boolean

Default: false

Note: The TRUE setting will handle files that contain COMP data in a similar manner to the method used by Micro Focus

Example: LS_NULL = TRUE

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_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

H.5 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
 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_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
 Default: not set
 Example: display_printer '/tmp/myprt.log'

Environment name: COB_LEGACY

Parameter name: legacy
Purpose: keep behaviour of former runtime versions, currently only for setting screen attributes for non input fields
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 ''

H.6 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

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