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!":

```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:

```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. 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.
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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=co85
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=co2002, -std=co2014
COBOL 2002 / COBOL 2014 without any vendor extensions, use `-Warchaic` and `-Wobsolete` if archaic/obsolete features should be flagged

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

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

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

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

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

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

-std=<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:

```cobol
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'.
000008 01 SETUP-REC.
000009      05 FL1 PIC X(04).
000010      05 FL2 PIC ZZZZ.
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

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

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).
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2.1.8 Miscellaneous

- **-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.

2.2 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:

```bash
$ 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`.

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

```c
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`.

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`.

---

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 `cbbc_init(0, NULL)` if you do not want to pass command line arguments to COBOL.

You can compile your C program as follows:
```
c -c `cob-config --cflags` main.c
```
The compiled object must be linked with libcob as follows:
```
c -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:

```c
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 */
};
```

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()
```
Chapter 2: Compile

{  
  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:

```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:

```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:

```bash
$ cc -c say.c
$ cobc -c -static -x hello.cob
```
$ ccbc -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
$ ccbc -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 `--config=<file>`.

For displaying the current runtime settings you can use the option `--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
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).
```
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.
Chapter 7: System Routines

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.

```plaintext
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
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. Additional you can check the process’ return code.

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

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

GnuCOBOL compiler for most COBOL dialects with lots of extensions

Usage: cobc [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,
  see configuration files in directory config
-F, -free use free source format
-fixed use fixed source format (default)
-O, -O2, -O3, -Os enable optimization
-O0 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
--symbols specify symbols in listing
-P=[dir or file] generate preprocessed program listing (.1st)
-Xref specify cross reference in listing
-I <directory> add <directory> to copy/include search path
-L <directory> add <directory> to library search path
-1 <lib> link the library <lib>
-A <options> add <options> to the C compile phase
Appendix A: cobc --help

-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
-Wtruncates warn field truncation from constant assignments
-Wpossible-truncates 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
Appendix A: cobc --help

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

Compiler options:
-ffsign=[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
Appendix A: cobc --help

-ftab-width=1..12 set number of spaces that are assumed 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 item clauses
-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 field
-fprogram-name-redefinition program names don't lead to a reserved identifier
-faccept-update set WITH UPDATE clause as default for ACCEPT dest-item, instead of
-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, not LINE 1 COL 1
-fdisplay-special-fig-consts special behaviour of DISPLAY SPACE/ALL X'01'/ALL X'02'/ALL X'07'
-fbinary-comp-1 COMP-1 is a 16-bit signed integer
-fmove-non-numeric-lit-to-numeric-is-zero imply zero in move of non-numeric literal to numeric items
-fcomment-paragraphs=<support> comment paragraphs in IDENTIFICATION DIVISION (AUTHOR, DATE-WRITTEN, ...)
-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
-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
-fdo-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 in expressions)
-fconstant-01=<support> constant with level 01 CONSTANT AS/FROM item
-fperform-varying-without-by=<support> PERFORM VARYING without BY phrase (implies BY 1)
-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-edited items
-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 DELIMITER
-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) (aliased with AUTO-SKIP, AUTOTERMINATE)
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
Appendix B: cobc --list-reserved

<table>
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(All values are marked as (Context sensitive) unless specified otherwise.)
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Appendix B: cobc --list-reserved

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
ENCARVED 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
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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)
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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)
Appendix B: cobb --list-reserved

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 (aliiased with NULLS)
NULLS Yes (aliiased 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
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ORGANIZATION Yes (aliiased with ORGANISATION)
OTHER Yes
OUTPUT Yes
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Appendix B: cobc --listreserved

UNSTRING Yes
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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-COLLS 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)
YYYYMDDD Yes (Context sensitive)
ZERO Yes (aliased with ZEROES, ZEROS)
ZERO-FILL No (Context sensitive)
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X"E5" 0
X"F4" 2
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Appendix E  cobc --list-mnemonics

System names
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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
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SWITCH-9        switch name
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| 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
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-rcs: 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"

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
Appendix H: Runtime configuration

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_CANCELS (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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