

COBXREF

A program to create cross references from Cobol source code with all copy statements included in along with all comments.

Set up and Usage Manual



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Support for Cobxref

Please read all of these notes before use along with the Changelog and README file if present and ensure that the latest entry at the top, matches the current source file version number.

The program version method used is: aa.bb.cc where aa = major, bb = minor and cc = build.

Latest version at <https://sourceforge.net/p/gnucobol/code/HEAD/tree/trunk/contrib/tools/cobxref>
or <https://sourceforge.net/projects/cobxref/files/>
or <http://applewood.linkpc.net/files/Cobxref-latest/>

Note that at Sourceforge, there are two Cobxref versions, one for IBM mainframes under MVS as well as this one for the GnuCobol compiler they are not cross compatible.

If using the applewood.linkpc.net url, you may find (but unlikely) Alpha releases present, that are under initial testing.

One's marked Beta are somewhat safer to use for production purposes.

Suggestions for updates to vbcoen at gmail.com

Message subject must be 'cobxref requests' or 'cobxref bugs' subject to the issue or problem.

And of course you can use the Cobxref website bug reporting tool for all of my tools.

As I have now reached the age of 77 the next section is getting even more important :(

If you would like to work on Cobxref or any other tools as well as ACAS etc, email me at vbcoen@gmail.com with your requirements / interests, etc and I will add you into the svn system or systems, with your known user name at Sourceforge and yes you must be registered.

Why is this program needed ?

One of the problems involved in programming in Cobol is the heavy usage of working storage definitions as well as procedural code. Quite often the programmer sets up variables of one type or another and ends up not fully using them or forgets where and when they are used. The same applies to section and paragraph names. Older versions of the GnuCobol compiler did not have such a facility and the current version does not go in to enough analysis to match my needs but saying this other compilers over the years, suffered similar problems with many not have an xref (cross reference) function at all or at least one that worked, and this is why there is a separate version for running under MVS 3.8J and the IBM ANSI Cobol compiler. For this one, see the Cobxref files section at Sourceforge and on my website under MVS3.8J

Cobxref for GnuCOBOL, produces a full listing of the code with copy libraries included, then produces various cross referenced reports by sections showing usage and also where both are not being used. [Note that the MVS version does not process COPY verbs at all although there is coding present for it to be added and this is due to the extra libraries that have to be installed as MVS load libraries for the processing of PDS datasets.]

While Cobxref is not often used during the coding stage it can be used towards the end and during testing to facilitate a satisfactory and timely conclusion in development.

I use it for all of the other Cobol Tools as well as applications developed and distributed via sourceforge and other websites as O/S (Open Source) with only the FSF license for re-use.

As examples see such Cobol tools as Printcbl, Dectrans and MySQL pre-compilers, as well as applications such as FlightlogC (for recording flight crew (pilots and others) flight times) and the Accounting software package ACAS which includes General and IRS (abbreviated version of similar to General but without profit centre or Branch recording), Purchase,& Sales Ledgers and Stock Control with support for Cobol files or using Mysql rdbms tables (others might be added at a later date subject to demand/requests).

Cobxref will also produce a printable listing of the Cobol program source that was used as input with all COPY files added, up to a maximum depth of 9.

This means a COPY verb calling a library that in turn calls another COPY verb and this is up to 8 levels in addition to the original source file. Note that the compiler will not go to this depth as the Cobol standard specifies source file plus four and many compilers do not go down to this level. Needless to say company standards and mainframe sites usually restrict the level count to two at most as it shows a poor control of the copy libraries per application within a project. Cobxref does not support usage of Panlavet style +++INCLUDES or similar.

Cobxref produces a listing breakdown of where variables are used by section within the procedure division namely and in order of:

CDF - Compiler Directing Facility - >>DEFINE CONSTANT & >>SET CONSTANT variables
File
Working-Storage
Local-Storage
Linkage
*Communication Not used in GnuCOBOL.
Report
Screen
Global and External variables

In addition breakdown are shown for system Functions, Conditions (88 levels), and Called processes both system and user defined as well as variables defined as Global when used with nested program

sources, with limited support for one's defined as External.

Entries within the Configuration Section is also supported, such as special-names.

Cobxref also includes both a module for obtaining the current GnuCOBOL compilers list of reserved words, intrinsic functions and system words and a cut down module of our Cobol tool Printcbl which is used for processing copy libraries see the next chapter Copy Support from (v2.00) for notes regarding support for the CDF and librarian COPY verb. Note all reserved words are a maximum of 63 character or less and the internal tables the same so no support for odd one's exceeding this size, well at least until that changes !

This program requires the use of the GnuCobol compiler v3, v4 and later to update all of the various reserved word tables and therefore will not work with any other compilers.

Caution: Cobxref assumes all source code complies with the COBOL standard syntax which includes that all words including formulae must end with a space, comma or full stop. Therefore processing can get confused if you do something like :

```
move aa-var8(1:ix-8)to aa-mmr-length
```

No space before 'to'.

Where usage of the compiler (cobc) for your sources include -Wall etc to check for any indifferent syntax outside the normal Cobol standards allow it does not trap all of them.

For use with programs written to use a maximum size of 63 characters for user supplied data names, section, paragraph, program and module names you must be using the latest version of the code base for GnuCobol v3 as of and after, July 2023, i.e., v3.2 final.

There is one other abnormality in that if you use a variable which is also a reserved word, it will ignore such variables. There appears to be no solution other than avoid using such a variable name that is, a reserved word although the compiler should be issuing an error or warning message. A good example of this is using as a variable E which is a reserved word as it is a function - there are some others.

One last possible issue is that you MUST use Cobxref parameter 2 to specify the correct source format for the program being cross referenced, i.e., -FREE, -VARIABLE or by default as FIXED although this has been reduced with the latest Cobxref versions it still could result in a possible Cobxref abort with a range of different error messages but mostly saying similar to early end of source file for the program being cross referenced.

Note that provided the source code makes correct usage of >>SOURCE FIXED/VARIABLE/FREE cobxref should work correctly. It does not support any other of the possible formats that could be used with the GnuCobol compiler cobc. the >>SOURCE line should be the first line of source code but you may have a need to switch to other formats within the source code and cobxref will follow such changes.

If you get such an error, first check if you are using the correct format specification, Fixed, Variable or Free and that you have specified it as indicated above.

Copy Support from (v2.00)

Case is not sensitive, so ' COPY ' ' copy ' and any variation is OK, same as in GnuCOBOL. Both types of quotes (single and double but not mixed) as in "foo". All COPY statements MUST end with a period / full stop as per Cobol specifications.

- 1: COPY foo.
- 2: COPY "foo" (or 'foo').
- 3: COPY "foo.ext". different .ext **NOT** searched for.
- 4: COPY foo.ext different .ext **NOT** searched for (same as in 3).
- 5: for any COPY options adding IN | OF "../par" fully supported.
- 6: COPY filename.ext | IN | OF path | "relative path" | SUPPRESS | SUPPRESS PRINTING.
The SUPPRESS options only used for a report otherwise ignored.
7. Support for REPLACING sub clause:
Form 1A:: Word by word
1B:: Literal by literal
1C:: Identifier by Identifier
1D:: ==pseudo-text-1== by ==pseudo-text-2==
1E:: ==text-3== by ==text-4==

Cases 1 and 2 (if not found, then searched with .extensions of .CPY, .CBL, .COB (as well as lower case version of the same). This is not done if the extension is provided.

For 1D support for LEADING and TRAILING providing both fields are the same size.
This is because the GnuCOBOL function SUBSTITUTE does not have a LEADING or TRAILING function but it is now defined as such in the latest COBOL standard.
[When this is changed in the compiler, this function will be fully supported providing some one tells me.]

All all cases, searched in current directory and all search paths in order supplied up to a maximum of 10 paths only.

If both GnuCobol environment variables (COBCPY and COB_COPY_DIR) are set and they are the same, only one will be used otherwise search paths are added in read order with COBCPY first.

As per the Cobol standards **ALL COPY** statements **MUST** be followed directly with '.' (period).

Note: In 1 through 6) the **copy file name** and the **copy library** is **case sensitive**.

Replacing all, *other* than literals are **NOT** case sensitive.

Literals must be on same line. There is no support for continuation on the COPY statements or the source target but this allows for partial line by line replacement.

Warning:

When using fixed format source, it is the programmers **responsibility** to ensure that the replacing clause element fits within the area available and does NOT exceed column 72.
The same applies to the compiler. (See the ISO Cobol standards manual).

This means the result of a replace that exceeds column 72 is undefined but could extend beyond the Form B area. Also note that cc7 '-' is ignored. and replacing will use '"' & ' at end of source (cc70) and next line will have a quote on cc12.

This does not effect the operation of Cobxref which does not work with literals cross referencing wise.
Well that's the theory anyway.

Pre usage actions on first install

Program Source code Set up

1. As of version 2.0, Cobxref uses the compilers CDF facility and there are system changes that happen at the start of the source file that the various nested programs access to adjust the default set ups and these are within the section marked as CONFIGURATION SETTINGS.

You can change the first one if needed but the others are only there for programmer testing, but if changed can and will produce a **lot** of output on screen and in the output files.

The same is said if compiling cobxref with full debugging such as '-d -g -ftraceall' as the trace file will be LARGE - such as over 2Gb when running cobxref against itself and will be slow in running, possibly over five minutes depending on speed of your cpu and will slow down any other applications running.

1. See the line starting with:

```
>>SET CONSTANT C-Compiler-Line-Cnt AS 55
```

Change the number 55 if and **only** if the following applies:

Cobxref uses the field Compiler-Line-Cnt to hold the default cobc report page size of 55 so if you have changed the one in cobc sources or with a compiler option for any reason, you should consider changing this field to match before compiling it by changing the value as shown above which is preset as 55. There is built in support for use of Letter paper so that the above count is reduced by 4 assuming you are printing in portrait mode for landscape change the value appropriately bearing in mind the difference in Letter format, if used.

As Cobxref produces a print file with the name of the source file and extension of .lst you can pass it to your printer, however another option is to use the supplied extra script prtpdf to create a pdf file.

To use it you must also install enscript and ghostscript which if you are using Linux, obtain them from your distributions repositories and you might want to amend the prtpdf file to match up with your requirements but it is seriously recommended you only do **ONE** change at a time before testing as it is easy to mess it up.

2. See line starting with :

```
>>SET CONSTANT C-OS-Delimiter AS "/"
```

This is set for use in *nix environments which includes Linux, OSX and MSYS/MinGW etc.

I understand it will also work with Windows v10/11.

Change it for "\" if and **only** if, you are using a native version of the Cobol compiler built using Microsoft Visual Studio or a similar compiler.

There are other >>SET statements that are remarked out for use when testing.

Cobxref does check the value in the environment variables TMPDIR, TMP and TEMP in that order for a directory to store the working files at the same time it verifies the OS delimiter for being "\" or "/" as a safeguard. You must have full access to this temporary directory for create, read, write and delete.

3. The program will also examine the Environment Variable LC_TIME for producing the date printed in your local format and the values are :

en_GB to set to using the UK format (dd/mm/yyyy)

en_US to set to using the USA format (mm/dd/yyyy)

anything else, it is left as 3 = International and Unix format (yyyy/mm/dd).

You can add a check for other value/s for your country/region but please let the programmer know [by

email with subject Cobxref, so it can be added to the main source files held at the SF website areas.

If you do not normally use these two, you can also run Cobxref within a script that sets the LC_TIME value up using the command 'export LC_TIME=en_ABC' etc, before running Cobxref.

In all cases this, along with the time as hh:mm:ss:nn is printed in the headings.

Note that the time is updated for each heading printed as it acts as a simple way of seeing just how long it takes in milliseconds to run, looking at the first and last heading times.

4. You are now ready to compile and there is a supplied Linux script that will do it named `comp-cobxref.sh` which just runs:

```
cobc -x cobxref.cbl
chmod +x cobxref
```

You can now run :

```
mv cobxref ~/bin
```

or whatever other bin directory that is in your environment path variable.

The program has been tested with the GnuCobol v3 series of compilers.

5. You can now use it from any working directory for which you have full access.

6. Read the following notes on requirements and usage.

Cobxref Program Usage

Caution: This program has only been tested against source files that have gone through the GnuCobol compiler with **no** reported errors including missing space or periods (full stops) and I recommend that you do the same. If in doubt use cobc -W to build the program source first. The GnuCobol compiler (cobc) must be in the executables path as it is called by Cobxref.

Parameters for running Cobxref are in the form:

cobxref 1 [2 3 4 5 6 7 8 9 10 12] where parameters 3 through 10 are all optional with 11 & 12 and possibly hidden ones, only when requested by Cobxref technical support.

Note: Param 1 **Must** be first parameter, 2 through 8 can be in any order.
Param 2 **Must** be specified if using Free or Variable format sources in your program.
Params 3 through 8 as needed.
Param 9 for testing against other cross reference products only.
Param 10 Same as 9 followed by normal xref.
Params 11 and 12 are for programmer testing ONLY.
Param 13 For help the same as shown below.

- 1: SFN [Source File name] including any extensions (**Mandatory**)
- 2: -FREE Format selection if using the free source format.
 Omit if **only** using the fixed source format - just the same as for cobc.
 Incorrect usage of this parameter could produce a lot of error messages if NOT
 using the CDF options >>SOURCE FIXED | FREE | VARIABLE at the beginning
 of the source file and elsewhere when needed, on change of format, i.e.,
 copybook inclusion.
 -VARIABLE Same as FIXED but source can be up to 256 chars where cc73-80 -- 256 is also
 source code and not the reference area. See the GnuCobol Programming Guide
 for more details.
- 3: -R Do not print out the source code.
 Omit this option and cobxref will always do so, prior to the cross reference listings.
- 4: -L Reports all in lowercase (defaults to uppercase or actual case used).
- 5: -DR Displays **All** reserved words, followed by Functions then system calls and then stops.
 You **Must** still specify a source file even if a dummy (non existent file).
- 6: -VT Do not display messages when updating any reserved word tables.
 It is recommended, not to use this option so that you have confirmation that these have
 been updated.
 Warning: Any new release of the compiler usually adds new reserved words, etc.
- 7: -E Create compressed source file (same as cobc -E), by producing free format source in
 filename.src. Mostly used for testing cobxref otherwise not useful. Note that a extra file
 is created named SFN.pro that contains the extended sources with all COPY libraries
 included, it is overwritten every time cobxref is run. Useful if you wish to pass on to any
 one a copy of your source file with the COPY entries included.
- 8: -AX Produce Xrefs at end, of all program listings.
 This is not yet implemented - depends on requests.
- 9: -G Produces group print out in addition to normal so that comparing xref's

with Microfocus or IBM can be more easily done. Used for testing Only.

- 10: -BOTH Produces xref report as for -G followed by normal xref lists.
- 11: -TEST Produces testing info (and this can be a *lot* of output).
 Used for Debugging by or on behalf of programmers.
- 12: -V Verbose output - for testing only - can be a *lot* of output.

Note where comment 'for testing' is shown they will not apply unless in testing mode.

Running just as cobxref will produce above help list.

Normally, just call as 'cobxref sfm.cbl -FREE' (if your program sources are in the free format).

Where sfm = source file name.

Cobxref will normally produce two files:

- | | |
|--------------------|--|
| sourcefilename.pro | The output from copying over all copybooks (if present). Can be deleted.
The file includes all found copybooks. that can be used as input to the compiler or cobxref etc. |
| sourcefilename.lst | The file containing the source and cross reference listings as requested.. |

Cobxref also creates :

- | | |
|------------|--|
| Partnn.tmp | Temporary work file holding unsorted xref data. |
| Partnn.tmp | Temporary sorted work file holding sorted xref data. Both files are small. |
- These files are stored on your temporary directory, location depends on compiler set up but often in ~/tmp. They can be deleted if you need to, but can help if Cobxref bugs are suspected or found.
nn is 01 and 02 for the first nested program, incremented by 2 for all others in the source file.

The use of these files is because Cobol programs can exceed 500,000 lines of code and the use of tables requires a declared limit and that (Murphy 's Law says) will be exceeded regardless of size.

This next file is only created if requested by usage of parameter -E.

- | | |
|---------|---|
| sfm.src | Contains free formatted source with extra spaces removed and file is the same as running cobc with --save-temps but without blank or comment lines as well as trailing comments. This file which is smaller than the cobol source file can also be deleted unless needed for bug reporting.
There is not a lot of use for this file but as the data is created for use internally it is available in a file at the end of run. This option has been removed so is file is deleted at end of run. |
|---------|---|

Cobxref will during the run, produce up to three displays reporting on the updating of the internal tables of the various reserved word types against the installed version of GnuCOBOL compiler see Messages used in get-reserved-lists within Cobxref page 18 for more information.

These displays will be:

Msg13 Intrinsic word table was successfully updated
Msg14 Reserve word table was successfully updated
Msg15 System word table was successfully updated

It is normal for these to appear for GnuCOBOL v3.n and later.

If these messages do NOT appear check that the GC program cobc is accessible in the directory you are using.

This action can be turned off by parameter '-VT' if required but it is recommended that you do not.

When processing copy libraries, the contents of the GnuCOBOL environment variables COBCPY and COB_COPY_DIR are searched for the libraries after looking in the current directory.

Note that if both env. vars. are found and have the same contents, then just one is used, otherwise they are searched in order of COBCPY then COB_COPY_DIR

There is a total of 10 paths allowed, so only the first 10 are used.

e.g., if both env. variables are used and you have:

```
COBCPY=a:b:c:d:e:f  
COB_COPY_DIR=g:h:i:j:k:l:m
```

Only, a through i are searched, as well as the directory containing the source program.

Any errors found during processing such as not finding a copy book along with any warnings or information messages will appear in the updated source file (.pro) and in the cobxref listings.

These messages are prefixed with the comment flags '>' or '*>>' so they do not get flagged by the compiler if using the .pro file as input.*

*The prefix's '**>>E ', or '**~>>P ' is used to high light possible issues. There are others.*

Cobxref processes all >>SET and >>DEFINE CONSTANT statements and treats them the same as GLOBAL but they are active until the next END PROGRAM statement is read, as this is what the compiler does according to Simon, However these are used within cobxref at the start and appear to be active for all of the nested programs. So, if this is valid then the way cobxref deals with them can be wrong as the cross reference listing will only show them until the END PROGRAM is read.

So, either cobc is wrong or cobxref. !

Compiler Requirements for building Cobxref

Any version that supports:

Functions:

1. SUBSTITUTE
2. SUBSTITUTE-CASE
3. CURRENT-DATE
4. UPPER-CASE
5. LOWER-CASE
6. STORED-CHAR-LENGTH

Called Procedures:

7. SYSTEM
8. CBL_CHECK_FILE_EXIST
9. CBL_CLOSE_FILE
10. CBL_DELETE_FILE
11. CBL_GET_CURRENT_DIR
12. CBL_OPEN_FILE
13. CBL_READ_FILE

14. Environment variable capture e.g.:

accept Cobcpy	from Environment "COBCPY".
accept Cob_Copy_Dir	from Environment "COB_COPY_DIR"
accept Arg-Number	from argument-number.
accept Arg-Value	from argument-value

15. The Compiler fully supports the runtime directives :

- list-reserved
- list-intrinsics
- list-system

As far as I know all versions from v2 do so, but not tested against older ones. There will be a problem with v1.1 and Substitute if you do not have the patches installed, and it will not support (15) any way.

It is recommended that you upgrade your compiler to version 2.2 or better still, to v3.2 or later.

All current development, testing and production is with the v3.2 series and final specifically.

TODO List in Copy library processing (within PrintCbl)

1. None.

Noticeable changes since v1.07

1. Support for multiple depths for copy statements instead of 1, i.e., copy within a copy is depth 2. It will now go to a depth of 9, e.g., source with nine copy within copy.

According to the Cobol standards, GnuCOBOL should go to 5 levels at least. which when last checked it does but that was some versions ago.

2. Support for up to 50 REPLACING sub-clauses per COPY.

3. Limitations for current version based on tables sizes etc.:

- A. Total number of copy's with copy's within original source file 9, e.g., depth 9.
- B. Maximum number of REPLACING clauses with a COPY: 50.
- C. Maximum size of a Replacing Source or Target field: 2048 bytes/Chars.
- D. Maximum size of complete COPY statement: 1 MB (1024 * 1024).
- E. Maximum file buffer size: 1 MB. [Source files are read in 1 MB blocks].
- F. Warning, Error, Caution messages held in table currently 10 in English.
- G. Maximum size of a free format source line: 255 Chars [as per Cobol standards]. Ditto Variable format.
- H. Maximum number of source file extensions: 7 [cpy, CPY, cbl, CBL, cob, COB] and space.

4. Support for REPLACING LEADING, TRAILING sub-clauses added.

These are processed by the program providing both source and target are the **same** size.

Special source user changes now only done at the source file beginning in GnuCOBOL CDF section. See Program Source code Set up page 8.

Msg17 added if cobxref find bad Cobol syntax i.e., missing space between words.

Also see Appendix A for more information on changes.

4. Support for CDF >>DEFINE CONSTANT variable and >>SET CONSTANT variable as of v2.03.

5. As for 4. they remain active until a END PROGRAM is read. See comments above regarding this. Note this may work correctly or the same as the GnuCobol compiler. I guarantee nothing :)

Literal treatment within PrintCbl module

Please note the way (or not) literals are processed.

No processing takes place of continuation of literals both in the COPY clause or the source code as such.

So if you need to change one line of literal you only need to specify the content of that one line in a COPY statement (but only for cobxref).

E.g., copy library source code:

03 filler pic x any length value "This is an example of left hand heads"

03 filler pic x any length value " but this is an extension line of more rubbish" &
" as such makes absolutely no sense".

COPY foo.bar replacing

"This is an example of left hand heads" by "Top form for Fred"

" but this is an extension line of more rubbish" by "Centre heading 1"

" as such makes absolutely no sense" by "Page number ".

Also if in line 3 of source, started in fixed form as:

- " as such makes absolutely no sense".

It should also work.

NOTE that it has always been the responsibility of the programmer that when using fixed format sources to ensure that replacing clauses will result in the same limitations of no line exceeding column 72. This applies to the compiler as well as per the Cobol standards.

Therefore PrintCbl does not check it under all circumstances however the replacing clauses are checked and correct sizing maintained, where ever possible.

Within cobxref, literals are ignored for cross reference processing anyway but the listing might look a bit strange and can be ignored.

Messages used in Cobxref

Processing breakdown

The caution, warning and error messages are broken down by what sub system within Cobxref produced them namely Cobxref itself, get-reserved-lists or printcbl.

To help understand them, a simple indication of the steps run is now provided:

Cobxref starts by running get-reserved-lists which in turn runs cobc to output the various sets of reserved words and these are then used to update the one's held within its tables.

Then the parameters passed to Cobxref are read in and verified, next printcbl is run, to include any copy verbs creating a new source file (.pro) and this is then used by Cobxref as input to create a compressed file with all excess spaces (more than one) removed which is then used as source to produce the cross references. The pro file is used for listing the sources. The compressed file can be retained using -E and is named with the file extension of .src but it does not look pretty but is exactly what the compiler does to your source file. A later version of cobxref may well not retain this file as its main usage is for testing cobxref.

The messages are mostly prefixed by a message number in the form of Msgnn where nn is :

01 through 10, 18 & 19 and these are from Cobxref.

11 through 16 are from get-reserved-lists.

21 through 31 are from printcbl.

Some of these messages are output to the updated source file by PrintCbl prefixed by '*>> '.

Displays from Cobxref:

1. Msg1 Aborting: No input stream
2. Msg2 Aborting: Early eof on source
3. Msg3 Aborting: Git table Error before sort
4. Msg4 Logic Error:Lost1 wsFoundWord2 numeric? = xyz
5. Msg5 Logic Error:Lost2 wsFoundWord2 = xyz
6. Msg6 Error: Con table size needs > 5000
7. Msg7 bb050 Error: Logic error
8. Msg8 Error: Eof on source again - This can appear once, when processing nested programs.
9. Msg9 Error: File not present Try Again!
10. Msg10 Error: Git Table size exceeds 10,000
11. Msg17 Error: Cobol Syntax missing space
12. Msg18 Error: Eof on source possible logic error at aa047 ASSUMING again
13. Msg19 Possible prob. with cobc and therefore with no reserved word list

Message Explanations:

1. No data found in sorted temporary work file, unless an empty source file was used should not happen possibly a Cobol sort error - attempts to continue but more mesg1 can occur.
2. Unexpected end of copy source file - Aborted processing.
3. Unexpected problem prior to sorting the GIT table as count is negative.
Suspected programming error - report the error and counts to support (see inside front cover) - Aborted.
4. Suspected programming error - report to support (see inside front cover) - Aborted.
5. Suspected programming error - report to support (see inside front cover) - Aborted.
6. Conditions table of 5,000 exceeded - continues but new one's found will not be added. This table records 88 levels against their corresponding variable data element. Report it as you have a *very* large program needing this table to be set higher.
7. Suspected programming error - report to support (see inside front cover) - Continuing.
8. Got a EOF (end of file) condition more than once, suspected programming error - report to support (see inside front cover) but attempting to continue but check that you have specified

the source format in cobxref parameters such as FIXED, VARIABLE, FREE. This can occur once if running with nested programs in the source file.

9. Cannot open the file created by printcbl containing copy libraries if any - Aborted.
10. Global Data table exceeds 10,000 will attempt to continue but xref will be inaccurate. Report to support (see inside front cover) - should not be happening!
11. Suspected missing space between words such as xfz)to where space should be before 'to'.
This message continues with debug information displayed and inserted in the listing to help find the source line with the problem. Fix your source and rerun.
12. Suspected programming error - report to support (see inside front cover) - Aborted.
13. get-reserved-lists could not obtain the reserved word list whole or in part. - Continuing but also see msg 11, 12.

Some of the aborted messages such as msg2, 3, 5, 7 and 8 can relate to not using the correct source format as a Cobxref parameter 2 i.e., -FREE, -VARIABLE or -FIXED and you are not using the CDF command >>SOURCE FREE | VARIABLE | FIXED, or the source is incomplete.

Cobxref does not at this time support any other source format types.
Check your program source and use the right one and retry.

Also check if all **four** divisions are present and likewise any **required** associated sections.

WARNING: Cobxref will not like very abbreviated sources as in a test program such as a basic hello world- - See previous comment.

Messages used in get-reserved-lists within Cobxref

Displays from get-reserved-lists:

1. Msg11 Cannot run 'cobc --list-intrinsics', cobc not in path?
2. Msg12 Cannot run 'cobc --list-reserved', cobc not in path?
3. Msg13 Cannot run 'cobc --list-sytem', cobc not in path?
4. Msg14 Intrinsic word table was successfully updated
5. Msg15 Reserve word table was successfully updated
6. Msg16 System word table was successfully updated
7. Msg19 Possible prob. with cobc and therefore with no reserved word list updates

Message Explanations:

1. Cannot run cobc aborting. Program is not in program search path. Correct and rerun.
2. Same as 1.
3. Information only.
4. Information only.
5. Same as 1.
6. Information only.
7. See 1, 2 & 5 Cobxref will run without having an up to date reserved, function or system list but some references to reserved words, functions and system calls will be incorrect.

When running versions 3.0 and later, of the compiler, it is normal for messages 4, 5 and 6 to be displayed.

Messages used in PrintCbl within Cobxref

Listings from PrintCbl module:

1. Msg21 Error: Too many levels (9) of COPY
3. Msg22 Error: Copy File Not Found
4. Msg27 Error: Cannot Find File, & tried six different .Exts
5. Msg28 Error: Abnormal end of input
6. Msg29 Caution: One or more replacing sources not found
7. Msg25 (P): On Read. Ret.code = nn
8. Info: Total Copy Depth Used = nn
9. Caution messages issued = nn
15. Msg32 Error: Recursive Copy File Name = CFN - Above is IGNORED

Displays from PrintCbl module:

1. Msg21 Error: Too many levels (9) of COPY
2. Msg23 Error: File Not Found
5. Msg28 Error: Abnormal end of input
7. Msg25 (P): On Read. Ret.code = nn
11. Msg24 (P): File Not Closed? = xxx.yyy
12. Msg26 Error: When opening I/P file got = nn
13. Msg31 (P): Bad RT on Get-Directory
14. Errors: Note and Hit return to quit

Message Explanations:

1. Your program exceeded nine levels of copy e.g., source file copy calls copy that calls 9+.
2. Source file not found, program aborts process or copy level.
3. Cannot find the file specified in the Copy statement that has the extension in the name.
4. Cannot find the file specified in the Copy statement that does not have an extension.
5. Unexpected end of file. You did *NOT* terminate a copy statement with a full stop / period!
6. Listed after a copy statement when one or more replacing sources possibly NOT found in the copy file.
7. Possible program issue, file terminated with unexpected error condition. Please report this to the lead programmer listed on inside front cover via email with any other helpful details.
8. Information: As it says. Printed at end of source listing along with number of copy files not found (see line after each copy statement and warning if any Caution (see 6.) messages listed.
9. Warning that one or more message 6. listed. Also see (8).
10. Unused.
11. Possible program issue, unexpected error value when closing file. Please report this to the lead programmer listed on inside front cover via email with any other helpful details.
12. Possible program issue, unexpected error value when opening file but was tested present. Please report this to the lead programmer listed on inside front cover via email with any other helpful details - program aborts.
13. Failure when trying to get the current directory. This would be caused by a compiler error.
14. As it says and process will abort, issued after some of the above messages.
15. Copy file name is used recursively, it is ignored.

Messages related to a file error could relate to a hard disk problem when reading or writing a file. Are you out of disk space or has your SDD has not been trimmed ?

Messages in the listing will be prefixed by *>>, *>>>, *>C, *>>E or *>>P so that they stand out. The prefix ">C" is for the original COPY statement that is remarked out in Free and variable format and for fixed just an asterisk in cc7. There is always an ">>> Info" message as the last entry in the source listing element giving totals.

These is ignored by the GnuCobol compiler. if the .pro file is used as input.

Appendix A - Update Log

Since v1.07

1. Cobxref now accepts both fixed and free Cobol formats and does not process the sfh.i created from cobc -E option. This was a feature requested by Roger While and is no longer needed. Should never have removed the COPY processing code !
2. All COPY verbs **must** be terminated by a period / full stop as per the Cobol standard.
3. Any Cobol source must go through the compiler error and be major warning free.
4. Support for FUNCTION-ID in addition to PROGRAM-ID but all other sub clauses are ignored.
5. Full support for System calls as well as User defined one's and these are reported on.
6. Clean up help screen.
7. Add to manual regarding default copy libs are from COBCPY and COB_COPY_DIR as well as current source directory.
8. Website address updated for linkpc.net.
9. Updated copyright notices and replaced references to GnuCobol.
10. Documentation clean ups.
11. Cobxref as well as the other modules, now uses CDF facilities for preset user site variables. See start of source code for each module.
12. Debug lines copy statements now ignored both formats.
13. Renamed warning and error messages to tie up with Printcbl.
14. Code brought in to line with Printcbl but with reporting code removed.
15. Various bugs fixed regarding fixed format and CB (copy book) processing with non literal CB's and one's without extension specified.
16. Minor listing tidy ups.
17. At program start, use base source file name for headings until program / function ID found.
18. Reporting multi programs (nested) by adding new field to sorting records for the current active program/function name. Reporting is still the same.
19. New program parameter function to turn on block xrefs for nested program source. See (18). Activated by parameter -AX ----- Not yet added as subject to user requests.
20. Using new parameter option -E program will create a source file the same as cobc -E but without any blank or comment lines. This data is exactly the same as processed through Cobxref after COPY verbs processed and all extra spaces above one removed to aid processing. There are some possible bugs that could occur where this file output is handy for diagnostics otherwise of no use to most users.
21. Cobxref no longer will process COPY words in comment areas (cobc does via -T option).
22. All comments are ignored including floating.
23. When replacing text without pseudo option it will only replace text with space before and after and not any text within text as only pseudo can. For more details on this and many others see the Changelog supplied with the program that gives a detailed breakdown of bugs,fixes and new features but this is a programmers aid only !
24. New parameter -VT to turn off messages for updating the various internal reserved word tables in module get-reserved-lists. I find it handy but when running many sources through cobxref it can get a little tiresome but it does prove that the compiler is installed and is accessible.
25. Using pseudo replacing does on all examples of the from code and it is the only option that will.
26. Replacing using literals does an exact match only with continuation characters ignored such as - in cc7 (fixed) and '&' for both.
27. Complete tidy up of all messages both displayed and printed - includes renaming same.
28. Lots more, see the Changelog if really interested.
29. Updated printcbl module to match changes in printcbl program. Fixed bug regarding fixed format - using wrong field when testing for it and both fixed and free 88's clashed and GC did not report the issue.

- 30. Re-match messages against this manual etc.
- 31. Replacing Leading | Trailing pseudo where size of both fields are exactly the same.
- 32. Added support for user supplied name for data, section, paragraph, program & module being up to 63 characters long. In the xref listings any thing over 32 is on a line of its own.
- 33. Fixed bug if page number > 127 (data field too small).
- 34. Minor tidy up of grammar and fact in this manual, to match current issued Cobxref version.
- 35. Additional comments in the manual regarding COPY processing and the SUBSTITUTE function as needed to handle correctly when it has 'LAST' and 'FIRST' functionality as per the current Cobol standards.
- 36. Support for Global and External variables when using nested programs in source file.
- 37. Support for CDF DEFINE and SET with CONSTANT only.
- 38. Added new param -BOTH to provide xref as in -G followed by the normal xref by groups.
- 39. Cleared out all outstanding bugs.
- 40. 2.03.05: Tidied up msg numbers for module get-reserved-lists as they were out of number/logic order. Moved the 'END PROGRAM' statements to the end of source to protect any >>SET's to remain in scope. Added support for out of scope of CDF SET and DEFINE vars by removing from GIT table on reading a END PROGRAM statement added extra message Msg3 (moving all other down one) to protect against error in the git-table-count not mapping to the delete-cnt before table-sort - No shouldn't happen but JIC.
I do not know if this is the way the compiler handles the scope of these as Simon says one thing and the compiler appears to do some thing different - see earlier comments regarding.
- 41. 2.03.06: - Support for VARIABLE source format with wource length same as FREE, and \$SET (treated as >>SET. for others see text file Changelog.
- 42. 2.03.14 - Removed parameter option -H & --H. as processed without any parameters.
- 43. 2.03.15 - The code for "CALL" did not allow for words STATIC or STDCALL preceding routine name and therefore those names appeared in cross reference instead.

Appendix B - Copy statement Formats

WARNING: This does NOT mean that all variants are implemented in a given version of GnuCOBOL.

With definitions as per ISO/IEC 1989:2014 CD 1.1 (E) taken verbatim.

7.2.1.2 Source text and library text

Source text is the primary input to the compiler for a single compilation group. Library text is secondary input to the compiler as a result of processing a COPY statement.

The source text and library text processed by text manipulation consists of indicators, character-strings, comments, and separators. A character-string is either a text-word or the word 'COPY'.

7.2.1.3 Pseudo-text

Pseudo-text is an operand in the REPLACE statement and in the REPLACING phrase of the COPY statement.

Pseudo-text may be any sequence of zero or more text-words, comments, and the separator space bounded by, but not including, pseudo-text delimiters. The opening pseudo-text delimiter and the closing pseudo-text delimiter consist of the two contiguous COBOL characters '=='.

7.2.1.4 Text-words

A text-word is a character-string in source text or in library text that constitutes an element processed by text manipulation. A text-word may be one of the following:

- 1) a separator, except for: a space; a pseudo-text delimiter; and the opening and closing delimiters for alphanumeric, boolean, and national literals. In determining which character sequences form text-words, the colon, the right parenthesis, and the left parenthesis characters, in any context except within alphanumeric or national literals, are treated as separators;
- 2) an alphanumeric, boolean, or national literal including the opening and closing delimiters that bound the literal;
- 3) any other sequence of contiguous COBOL characters bounded by separators, except for: comments and the word 'COPY'.

7.2.2 COPY statement

The COPY statement incorporates library text into a COBOL compilation group.

7.2.2.1 General format

7.2.2.2 Syntax rules

- 1) A COPY statement may be specified anywhere in source text or in library text that a character-string or a separator, other than the closing delimiter of a literal, may appear except that a COPY statement shall not appear within a COPY statement.
- 2) A COPY statement shall be preceded by a space except when it is the first statement in a compilation group.
- 3) Within one COBOL library, each text-name shall be unique.
- 4) A concatenation expression or figurative constant shall not be specified for literal-1, literal-2, literal-3, or literal-4.
- 5) Literal-1 and literal-2 shall be alphanumeric literals. The allowable value of literal-1 and literal-2 is defined by the implementer.
- 6) Pseudo-text-1 shall contain one or more text-words, at least one of which shall be neither a

separator comma nor a separator semicolon.

7) Pseudo-text-2 shall contain zero, one, or more text-words.

8) Character-strings within pseudo-text-1 and pseudo-text-2 may be continued in accordance with the rules of reference format.

9) Text-1 and text-2 shall be one of the following formats of identifiers: function-identifier, qualified-data-name with-subscripts, reference-modification, qualified-linage-counter, or qualified-report-counter.

NOTE Text-1 and text-2 are archaic features and their use should be avoided.

If subscripting is specified, it shall not include any arithmetic expressions as subscripts with the exception of a single literal or identifier, or an identifier plus or minus an integer.

The format of any identifier specified in

```

COPY          literal-1
{             text-name-1 }
{ }          [ ] OF/IN
              literal-2
              library-name-1 ]

[ ] [ SUPPRESS PRINTING ]
    REPLACING
              == pseudo-text-1 ==
              text-1
              literal-3
              word-1
              BY
              == pseudo-text-2 ==
              text-2
              literal-4
              word-2

[ ] [ ] LEADING/TRAILING
[ ]
[ ]          == partial-word-1 == BY == partial-word-2 ==
[ ]
```

Subscripts, reference modifiers, or function arguments shall be: a function-identifier, qualified-data-name with- subscripts, reference-modification, qualified-linage-counter, or qualified-report-counter. Function identifiers in text-1 or text-2 shall be intrinsic function references only.

10) Word-1 or word-2 may be any single COBOL word except 'COPY', the compiler directive indicator, or the comment indicator.

11) The length of a text-word within pseudo-text and within library text shall be from 1 through 65,535 character positions.

12) Compiler directive lines shall not be specified within pseudo-text-1, pseudo-text-2, partial-word-1, or partial-word-2.

13) Partial-word-1 shall consist of one text-word.

14) Partial-word-2 shall consist of zero or one text-word.

15) An alphanumeric, boolean, or national literal shall not be specified as partial-word-1 or partial-

word-2.

7.2.2.3 General rules

- 1) Text-name-1 or literal-1 identifies the library text to be processed by the COPY statement.
- 2) Library-name-1 names a resource that shall be available to the compiler and shall provide access to the library text referenced by text name-1.
- 3) The implementer shall define the rules for locating the library text referenced by text-name-1 or literal-1. When neither library-name-1 nor literal-2 is specified, a default COBOL library is used. The implementer defines the mechanism for identifying the default COBOL library.
- 4) If the SUPPRESS phrase is specified, library text incorporated as a result of COPY statement processing is not listed. If a listing is being produced, the COPY statement itself is listed.
- 5) At the completion of copying the library text into the compilation group, the LISTING directive that is in effect for the COPY statement itself is considered to be in effect, regardless of any LISTING directives in the library text.
- 6) The effect of processing a COPY statement is that the library text associated with text-name-1 or the value of literal-1 is copied into the compilation group, logically replacing the entire COPY statement beginning with the reserved word COPY and ending with the separator period, inclusive.
- 7) If the REPLACING phrase is not specified, the library text is included in the resultant text unchanged.
- 8) If the REPLACING phrase is specified, library text is modified during creation of the structured compilation group that is described in 7.2, Text manipulation. Each matched occurrence of pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 in the library text is replaced by the corresponding pseudo-text-2, text-2, word-2, literal-4, or partial-word-2 in accordance with subsequent rules of the COPY statement.
- 9) For purposes of matching, text-1, word-1, and literal-3 are treated as pseudo-text containing only text-1, word-1, or literal-3, respectively.
- 10) The comparison operation to determine text replacement occurs in the following manner:
 - a) The leftmost library text-word that is not a separator comma or a separator semicolon is the first text-word used for comparison. Any text-word or space preceding this text-word is copied into the resultant text.

Starting with the first text-word for comparison and first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 that was specified in the REPLACING phrase, the entire REPLACING phrase operand that precedes the reserved word BY is compared to an equivalent number of contiguous library text-words.
 - b) Pseudo-text-1, text-1, word-1, or literal-3 match the library text only if the ordered sequence of text-words that forms pseudo-text-1, text-1, word-1, or literal-3 is equal, character for character, to the ordered sequence of library text-words. When the LEADING phrase is specified, partial-word-1 matches the library text only if the contiguous sequence of characters that forms partial-word-1 is equal, character for character, to an equal number of contiguous characters starting with the leftmost character position of a library text-word. When the TRAILING phrase is specified, partial-word-1 matches the library text only if the contiguous sequence of characters that forms partial-word-1 is equal, character for character, to an equal number of contiguous characters ending with the rightmost character position of a library text-word.
 - c) The following rules apply for the purpose of matching:
 1. Each occurrence of a separator comma, semicolon, or space in pseudo-text-1 or in the library text is considered to be a single space. Each sequence of one or more space separators is considered to

be a single space.

2. Each operand and operator of a concatenation expression is a separate text-word.

3. Except when used in the non-hexadecimal formats of alphanumeric and national literals, each alphanumeric character is equivalent to its corresponding national character and each lower case letter

is equivalent to its corresponding upper case letter, as specified for the COBOL character repertoire in the COBOL character repertoire.

4. For alphanumeric, boolean and national literals:

a. The two representations of the quotation symbol match when specified in the opening and closing delimiters of the literal.

NOTE The opening and closing delimiters are required to be in the same representation.

b. In the content of the literal, two contiguous occurrences of the character used as the quotation symbol in the opening delimiter are treated as a single occurrence of that character.

5. Each occurrence of a compiler directive line is treated as a single space.

6. Comments, if any, are treated as a single space.

NOTE Because comments are removed during logical conversion, none are expected.

d) If no match occurs, the comparison is repeated with each next successive pseudo-text-1, text-1, word-1, literal-3, or partial-word-1, if any, in the REPLACING phrase until either a match is found or there is no next successive REPLACING operand.

e) When all the REPLACING phrase operands have been compared and no match has occurred, the leftmost library text-word is copied into the resultant text. The next successive library text-word is then considered as the leftmost library text-word, and the comparison cycle starts again with the first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 specified in the REPLACING phrase.

f) When a match occurs between pseudo-text-1, text-1, word-1, or literal-3 and the library text, the corresponding pseudo-text-2, text-2, word-2, or literal-4 is placed into the resultant text. When a match occurs between partial-word-1 and the library text-word, the library text-word is placed into the resultant text with the matched characters either replaced by partial-word-2 or deleted when partial-word-2 consists of zero text-words. The library text-word immediately following the rightmost text-word that participated in the match is then considered as the leftmost text-word. The comparison cycle starts again with the first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 specified in the REPLACING phrase.

g) The comparison operation continues until the rightmost text-word in the library text has either participated in a match or been considered as a leftmost library text-word and participated in a complete comparison cycle.

11) If the REPLACING phrase is specified, the library text shall not contain a COPY statement.

12) The resultant text after replacement shall be in logical free-form reference format. When copying text-words into the resultant text, additional spaces may be introduced only between text-words where there already exists a space or where a space is assumed.

NOTE A space is assumed at the end of a source line.

13) If the REPLACING phrase is not specified, the library text may contain a COPY statement that does not include a REPLACING phrase. The implementation shall support nesting of at least 5 levels, including the first COPY statement in the sequence. The library text being copied shall not cause the processing of a COPY statement that directly or indirectly copies itself.

14) The replacing action of a COPY statement shall not introduce a COPY statement, a SOURCE FORMAT directive, a comment, or a blank line.

Well, that was well explained. You might want to read it again.

WARNING: Regardless of the above text, it does ***not*** mean that these procedures have been implemented into this program, or for that matter the GnuCOBOL compiler.

What it does show is that when processing literals or text that goes over one line that this program may well adopt the free source format for the COPY libraries that are called for inclusion in order to expand said literals correctly and this format may well be used in the listings in a similar manner to GnuCOBOL (see the .i file when produced by various GC parameters including '--save-temps' , -E etc).

See the other parts of this manual for what exactly, ***is*** implemented for any specific version of the program.

The REPLACE clause HAS now been implemented.

And now, the Copyright notices that apply to the documentation and the software.

Appendix C - GNU Free Documentation License

Version 1.3, 3 November 2008

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