

ALTOASM

2 October 1974

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ALTOASM

This assembler, written in BCPL, runs on the Alto and produces BCPL-compatible relocatable binary output files, suitable for input to BLDR, the BCPL loader. The source language of this assembler is patterned after that of the Data General NOVA DOS assembler (see document 093-000017-02). Additions, deletions, and incompatibilities are described below.

1. Symbols

Symbols may be up to 130 characters in length, and every character of a symbol must be used to identify it. By default upper- and lower-case characters are different, and two character strings represent the same symbol only if the same letters and cases are used in both. However, the /U switch causes all lower-case letters in symbols to be changed to upper case (even in external symbols). Thus if you want an assembly-language program to link to symbols containing lower-case letters, you must either default lower-case conversion in ALTOASM or map all symbols to upper case in BLDR using its /U switch.

2. Strings

Strings follow BCPL conventions. They may not extend from one line to the next.

3. Omitted Pseudo-operations

The following have been omitted: .TXTO, .TXTE, .TXTF, .XPNG, .IFE, .IFN, .ENDC, and .EOT. No floating point input format or operators are supported.

4. Assembly Regions

This assembler can assemble into three regions: two static regions (one in page 0) and one code region. The directives .NREL, .SREL, and .ZREL cause the assembler to begin placing code in the code region, the non-page-0 static region, and the page 0 static region, respectively. The BCPL loader causes the restrictions that the code area may not contain pointers into the code area, that the first word of the code area may not point to a static area, and that no static area may contain pointers to a static area. The only external symbols are statics.

Arithmetic is not allowed on symbols denoting statics, and the symbol "." is undefined in .SREL and .ZREL. Any absolute or code-relative
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expression (including such goodies as JMP@ 62) may be placed in .SREL or .ZREL. Any absolute expression, static reference, or instruction reference to .ZREL may appear in .NREL.

5. Text

There are two text modes, .TXTM B and .TXTM L. Mode B causes the generation of standard BCPL strings. Mode L causes the generation of long strings, a full word length followed by the string characters, two per word.

6. .GET

The directive .GET "FOO" causes the file FOO to be shoehorned into the source text at that point. .GET can be used up to two levels deep. Its primary utility is likely to be for lists of externals and for canned entry and exit sequences.

7. .GETNOLIST

Works exactly like .GET, except that the "gotten" file is not included in the listing, nor are any files which it .GET's.

8. .BEXT

In addition to .EXTN and .EXTD and .ENT, I have added two directives .BEXT and .BEXTZ which work exactly as BCPL's External works for non-page-0 and page 0 statics, respectively. This should increase the utility of the .GET feature above.

9. Expressions

Parentheses (but not precedence) have been added. Constructs like "K and \$*N and 5 and 17. and 3B10 are all primaries. Most BCPL and NOVA DOS assembler operators are allowed. The construct 1B10 means 40(octal) , following the NOVA assembler's convention rather than BCPL's. I am willing to be convinced on this point.

10. I/O

This has been left out. DOA, IOP, .DIO, .DIOA, .DIAC, etc., won't
work.
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11. Predefined Symbols

All predefined symbols and directives and opcodes are defined both in all upper-case and all lower-case letters. For example, both LDA and lda are predefined, but Lda is not. The following Alto-specific opcodes are preloaded in the symbol table:

JSRII	JSRIS	CYCLE	CONVERT	DIR	EIR	BRI
RCLK	SIO	BLT	BLKS	SIT	RDRM	WTRM
JMPRM	MUL	DIV				

In addition, the following pile of skips which test various conditions has been added, courtesy of Dan Ingalls. Only the names have been changed to confuse the innocent:

Two operands:

SZE	SZ	SNZ	SP	SGZ	SN	SEQ
SE	SNE	SLT	SLE	SGT	SGE	SGTU
SLEU	SGEU	SLTU	SODD	SKEVEN	SNIL	SNNIL
MKZERO	MKONE	MKNIL	MKMINUSONE			

No Operands:

NOP SKIP

It should be explained that U stands for unsigned, and that Dan thinks of NIL as -1.

12. Operation

If the source file is called F00.SR, type

```
ALTOASM F00.SR
```

If you just type ALTOASM F00 it will first try to use F00 and, failing in that, try F00.SR. The assembler will usually want to construct several files, which it will do by substituting various extensions on F00 unless you specify otherwise. There are a lot of switches which apply to ALTOASM:

```
/L Construct a listing file
/S Include the symbols defined by the user, for what they're worth
/A Include all symbols, even the predefined ones
/R Include a printout of the .BR file
/N Don't make a .BR file
/E Make an .ER file which is a copy of the error messages
  sent to the terminal
/D Print debugging messages (as errors, in fact)
/P Pause after printing each error message (continue with CR)
/U Map all lower-case letters in symbols to upper-case
```

There are also a lot of switches which apply to file names, and which tell the assembler to use this name instead of the one it was about to invent:

```
/L Names the listing file
/E Names the error file
/S Names the source file (also no switches)
/T Names the temporary file
/B Names the relocatable binary file
```

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13. News

ALTOASM of 13 August 1974:

This is the first released version of the assembler. Comments, complaints, etc. to Ed McCreight.

ALTOASM of 3 September 1974:

Three changes were made. The first causes the assembler to pause before scrolling error messages off the screen if no /E file has been specified. The second corrects the length of the .BR file (which, fortunately, BLDR ignores). The third inhibits the appearance of incorrect error messages during pass 1 (which did not affect the correctness of the assembled code).

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Line feeds have been added after carriage returns so that Maxc can print assembler output files correctly. The names assigned to unnamed statics have been changed to SS1, SS2, etc., so that BLDR will handle them correctly because their first characters are alphabetic. An error message prints out the source line in error as well as its line number. Static references in the first word of .NREL are now flagged. Default is now that upper and lower case characters are different; to force all symbols into upper case one must now use the /U switch. The /A switch includes all symbols (even predefined ones) in the listing file. This will be used mostly by EMM for debugging. Speed is slightly faster because display window is not opened until an assembly error is detected, so if there are no errors the window is never opened.

ALTOASM of 7 October 1974

The assembler can now handle an infinite number of nulls. A bug causing lower-case alphabetic characters not to be recognized as alphabetic has been fixed.

ALTOASM of 22 October 1974

Externals which are neither defined nor referenced in an assembly code module are no longer included in the list of statics in the .BR file for that module. This means that one can have huge .GET files with lots of declarations which do not cause modules to incur large .BR space and BLDR time penalties.

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