

snma.hyper

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Chapter 1

snma.hyper

1.1 Samu Nuojuja's Macro Assembler, SNMA v2.11

```
*****
*
*           S   N   M   A       V2.11           *
*           ~~~~~~
*
*****
```

SNMA is 680x0 conditional macro assembler.

- | | |
|-----------------|------------------------------|
| 1. Introduction | General issues |
| 2. Usage | Startup, commandline. |
| 3. Features | Expressions, directives etc. |
| 4. ARexx | ARexx interface |
| 5. SnmaOpts | SnmaOpts option setter. |
| 6. Author | Address. |

1.2 1. Introduction

Introduction to Samu Nuojuja's Macro Assembler, SNMA

SNMA is a 680x0/6888x macro assembler. SNMA requires OS 2.0+. If you have used another assembler, snma should not throw big surprises in your face. (Look at things to note)

- 1.1 Copyright and disclaimer
- 1.2 What you need
- 1.3 How to Install
- 1.4 Good & Bad things

- 1.5 History
- 1.6 Bug reports
- 1.7 Misc.
- 1.8 Thanks

1.3 1.1 Copyright ©

SNMA stands for Samu Nuojuja's Macro Assembler.

SNMA is © copyright 1993-1995 by Samu Nuojuja
with changes and updates © copyright 2000-2001 by Mikolaj Calusinski

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DISCLAIMER:

~~~~~

SNMA software and documents are provided 'as is'. No guarantee of any kind is given as to what SNMA does or that the information in files is correct in any way. You are using this software at your own risk. The author of SNMA is in NO WAY responsible for any loss or damage caused by SNMA.

## 1.4 1.2 What you need

What you need to use SNMA to produce stand alone programs.

- AmigaOS 2.04 or higher (V37)
- Text editor (to write/edit programs)
- The following libraries:
 

| V.                          | note                   |
|-----------------------------|------------------------|
| ~~                          | ~~~~~                  |
| - dos.library               | 37                     |
| - intuition.library         | 36                     |
| - utility.library           | 36                     |
| - icon.library              | any * WB support       |
| - mathieeedoubbas.library   | any * fp support\$^1\$ |
| - mathieeedoubtrans.library | any * fp support\$^1\$ |
| - rexxsyslib.library        | 36 * ARexx support     |

Libraries marked with a \* are not neccessarily required. The math

libraries are needed for single and double floating point conversions. A 6888x or 680x0 with FPU is needed for the extended floating point conversions. Rexxsyslib is required for the ARexx support and icon.library for the WB support (if snma is started with the icon).

NOTE: In version 2.11 beta all FP support is done directly by FPU routines, even single and double conversions. Thus FPU is now required if you intend to assemble FP code. This shouldn't be a problem nowadays. -MM

Although snma can now produce executables, you may still need a linker to link object modules together (i.e. when your sources consist of several modules). There are many choices for the linker (free ones also) and snma should work with the ones which can deal with standard hunks.

Recommended:

- Hard Disk
- Manuals, manuals ...
- Debugger
- Time (8')
- Development tools (Includes and so on)

```
*****
* Remember, this isn't pascal, this is REAL programming.          *
* - 68000 Assembly language, techniques for building programs      *
*****
```

- Good book (a bit old, however) by D.Krantz and J.Stanley.

## 1.5 1.3 Installing SNMA

There are couple of files to be copied. Installer? Well, as soon as I have some time to spare (it seems that never :)

**SNMA** The main file. Copy it somewhere in your search path if you are using snma from the shell. If you are using snma in its ARexx mode, it needs to be started only once so it is not necessary that this file be in the search path in this case. Also, snma now has an icon so that it can be started directly from the WB.

**SNMA.guide** Documents in AmigaGuide format. Copy this one to anywhere you like.

**examples/** Very simple example files.

**arexx/** ARexx macros. Copy to your Rexx: directory, whichever ones you are going to use.

See also examples/alias.txt file.



(User friendlies at the best 8'| )

## 1.6 1.4 Good & Bad

My personal view on this assembler.  
(Things are not listed in any particular order)

Good:

- It's free (good for You).
- Most common directives are supported.
- Macros are supported.
- All 680x0, 6888x, 68851 and 030/040/060 PMMU instructions are supported.
- Does normal optimizations, including forward branches.
- It's coded in assembler. (See below, Bad things).
- Enforcer was in duty all the time I coded, checked, debugged...
- Supports all data types of 680x0 6888x family (I think).  
(FFP conversions are not supported).
- ARexx interface.
- Global symbol table
- ARexx port
- It's \*FAST\*

Bad:

- All source files must fit into memory at the same time.
- It's coded in assembler. Messy code sometimes - my fault, my problem. (Moral: Assembly language is a two edged sword).
- Some sort of beginner's help would be good (sources...).
- Only output format is Amiga object code or executable.
- No GUI, but I'm not so sure this would even be useful.
- It's driving me crazy, sometimes.

## 1.7 1.5 History of SNMA

History is now contained in a separate text file entitled History .

## 1.8 1.6 Bug reports

Bug reports are WELCOME.

Please, state the following facts:

- 1) Your system configuration (Model, CPU, MEM, OS, ...) and the version of SNMA.
- 2) What you did - Source code which caused the bug - If I can't make the bug reappear, it is an awful task to find out what went wrong. If at all possible try to isolate the bug. Usually, only a tiny

section of source code is required to show it. Or, if the bug is not directly related to the source code, describe it clearly (in any case).

If you find something is implemented badly, missing or could use a little polishing, along with other similar things, suggestions are welcome.

Where to report, see `author` .

```
-----
--* fixed bug better bug *--
-----
```

## 1.9 1.7 Misc., general things

Some words from the inner workings of SNMA  
 ~~~~~

SNMA is not a traditional two pass assembler although its operations can be divided into two stages. Source files are read and parsed only once. SNMA creates its own internal structures in this first pass. In the second pass, snma solves all undefined symbols, optimizes code, recalculates the changed values (like pc-relative stuff) and writes object code (and other requested files).

Listing file creation is sloooow in 2.x systems. It is faster in 3.x systems (where `SetVBuf()` works).

Memory usage by snma isn't the most economical since all source files must fit into memory. (Not to mention the way I implemented all the other stuff). Strip the comments from the include files you use because that will reduce memory usage.

Snma now reports its memory usage (excluding loading the program itself, and all indirect allocations - like opening file).

The way I have implemented macros costs memory since snma needs the produced macro lines to be in memory during the second pass where expressions with relative and undefined symbols are re-calculated and possible errors shown. (SNMA won't read the source twice).

I know the actual snma file is quite large also. Well, I can't help that a lot, without a complete re-design and re-write which is not in my top ten list of how to spend the next years of my life.

The development of SNMA
 ~~~~~

I started the development of snma somewhere in the first half of 1993. I have written SNMA entirely in assembler - first I wrote most of it with a68k and then minor parts with snma itself. Now I'm using snma only - it is good enough for that.

SNMA operates pretty stable on my system (A2000, GVP A3001 28Mhz 68030/882, 4M fast 1Mchip, OS3.1) and now "A1200, Blizzard 030/50Mhz, 8MB/2MB memory".

I'm developing it in my free time and have spent long nights staring at my old 1081 and wondering what the \*\*\*\* is wrong with everything.

\*

Since 2000 Samu was so kind and passed the SNMA sources to me. Eventually, I've found some free time to update his excellent assembler and release the new version.

## 1.10 1.8 Thanks

Thanks  
~~~~~

First, to the following people:

Eric Augustine for helping me with this guide.
Laura Mahony for sending me source code, testing and suggestions.
Jarkko Vatjus-Anttila for lot's of disussion.

and all the other people who have sent in bug reports.

I really must thank all you who have made so much wonderful 'Freely Distributable' software for the Amiga.

Also, thanks to the following people for the software I use(d) while developing SNMA:

- Charlie Gibbs, A68k
- Matt Dillon, DME and DLink
- Aaron Digulla, XDME
- Steffan Becker, ToolManager
- Jorrit Tyberghein, PowerVisor.
- SAS/C for their excellent compiler (SnmaOpts).
- Dietmar Eilert, GoldED

1.11 2. How to use

SNMA can be started from the Shell or from the WorkBench.

- 2.1 Shell startup
- 2.2 Workbench startup
- 2.3 Starting arexx host

1.12 2.1 Startup from shell

SNMA can be started from the shell like a 'traditional' assembler. It parses its arguments using AmigaDOS 2.0 templates. Some of the options can be specified also in the 'old way' , i.e. with '-'. These 'old way' arguments override the template arguments.

Note from MM: I don't recommend using options in the 'old way'. Do yourself a favour and use standard ReadArgs() options.

Command Line template:

NOTE: Some switches has been converted to toggles! -MM

SNMA

SOURCEFILE, O=OBJ/K, I=INCLUDE/K, H=HEADER/K, L=LISTING/K, E=EQUATE/K, J=JOPT/T, F=FOPT/T, Q=QUICKOPT/T, P=PCOPT/T, A=ADDRESSOPT/T, B=BASEFORCE/T, S=SYMBOL/T, LB=LBRA=LONGBRA/T, AREXX/S, PORTNAME/K, QUIET/T, PAGELEN/K/N, LNM=LSTNOMAC/T, LOD=LSTONLYDATA/T, EXE=EXEOBJ/T, SR=SR32=SHORTRELOC32/T, KO=KEEPOBJ/T, MOVEM/T, EC=ERRCOLOR/K/N, LINED=DEBUG/T, OL=OPTLEVEL/K/N, TD=TYPESDIR/T, CS=CASESEN/T, OF=OPTFILE/K, ISC=IMMSIZECHECK/T, CPU/K/N, OCT/T, OLDFLAGS/M:

Where:

SOURCEFILE is the name of the source file. It is a first argument and should always be there except when you start SNMA in AREXX mode

OBJ/K defines the name of the object file.
O alias: -o<name>

INCLUDE/K defines a list of directories where the INCLUDE
I directive searches for include files.
alias: -i<namelist>

HEADER/K defines one file to be included before any lines from
H the source file are assembled. Only one is allowed.
alias: -h<name>

LISTING/K Listing file to be created. Minimal formatting may be
L done by using the PAGELEN option.
alias: -l[<name>]

EQUATE/K defines the equate file name to be created. An empty
E string is allowed in which case SNMA creates the name from the source file name. Currently the equate file is generated at the end of assembly. Symbols are taken from the hash table, so they are in mixed order. You can use the AmigaDOS SORT command if you like some sort of order.
alias: -e[<name>]

JOPT/T jsr/rts -> jmp default: off
J

FOPT/T lea/adda -> addq/subq, default: off

F

QUICKOPT/T Quick optimizing flag, default: on
Q

PCOPT/T pc-relative optimizing, default: off
P

ADDRESSOPT/T effective address optimizing default: on
A

BASEFORCE/T Auto-force (Bd,An)->(displ6,An) default: on
B

SYMBOL/T Write symbol data hunk default: off
S

LONGBRA/T Long branches (wo/size field) default: off
LB

AREXX/S flag to start AREXX command host SNMA. Overrides
other directives.

PORTNAME/K The name of the Arexx port snma will use.
Default: SNMA.

QUIET/T Disables informational output.

PAGELEN/K/N Defines pagelen used in listing file. If null, snma
does not create pages (useful if you want to do your
own formatting).
Default: NULL.

LSTNOMAC/T Include macro expansions in the listing file.
LNM Default: off.

LSTONLYDATA/T Only list the lines which actually define some data.
LOD Default: off.

EXEOBJ/T Produces an executable, instead of an object module.
SNMAOPT e+ causes same effect.
Default: off.

SHORTRELOC32/T write HUNK_RELOC32SHORT instead of HUNK_RELOC32 when-
SR ever possible. Has effect only when EXEOBJ is also
specified. Note that the actual hunk written is NOT
HUNK_RELOC32SHORT (1020) due to a 2.0 bug, but it is
HUNK_DRELOC32 (1015). Since that hunk cannot be in an
executable it doesn't matter. Executables which have
this hunk, work only in OS 2.0 or later.
Default: off.

KEEPOBJ/T Don't delete object file if there are errors in source
KO file.
Default: off.

MOVEM/T Optimize movem (to move or remove) if possible.

Default: off.

ERRCOLOR/K/N ANSI color code for the error highlightning.
EC Default: none.

DEBUG/T Include LINE DEBUG hunks to all sections. See also
 debug directive and snmaopt d.
Default: off.

OPTLEVEL/K/N Number of maximum optimizing passes. One optimization
OL may make more optimization possible. You can define
 the maximum number of levels snma will take. SNMA
 will stop optimizing when there is nothing more to
 optimize.
Default: 1.

YPESDIR/T Toggle some directives which override some types.i macros.
TD Default: off.

CASESEN/T Toggle to use case-sensetine (ON) or -insesensitive (OFF)
CS symbols.
Default: on.

OPTFILE/K Name of the file where to read options.
OF See option file format .

IMMSIZECHECK/T Toggle immediate data size checking on/off.
ISC Default: on.

CPU/K/N Initial CPUID value. See CPU directive.
Default: -1

OCT/T Toggle to allow @ character to be used as octal number
 specifier. This used to be hardcoded, but since SAS/C
 uses it in __regargs function names, this has been changed.
 To allow old behaviour, set this flag on.
Default: Off.

OLDFLAGS/M See old flags

See Options .

SNMA does not check the stack. I haven't had problems with a stack size of 4000 bytes. You can overflow the stack with very nested includes. One level takes about 100 bytes, so "very" means something like 40 levels. Actually, a little less. If you worry about that, use a bigger stack.

Examples

1.13 2.1.1 template: old flags

Please consider this chapter obsolete. SNMA still should support UN*X style ('-') options but don't use them. I don't test them in newer

versions and any new options added to regular template will not be reflected here. The only exceptions are include list ('-l') and header file list ('-h') in SNMAOPTIONS file . -MM

Many applications use the '-' as an option start character (like: a68k file.asm -l -iinclude:). You can specify some options this way in snma, too.

If you wanted to just flag that you needed some file to be generated and wanted snma to create the file name from the source name, you had to pass an empty string (like LISTING ""). I have to admit that this isn't a very elegant method and when trying to pass options to ARexx macros I had many problems with the quotes. So, to allow easier use, a couple of '-' flags are also allowed on the commandline. In template they show as OLDFLAGS/M template. In the template explanation they are referred to as 'alias:'.

To use style old flags, just specify -<flag> in the commandline.

For example:

```
->snma source.asm -l -e
```

Request listing and equate file.

```
->snma source.asm -iinmdir: -hhdr.i
```

Set include directory as "inmdir:" and read hdr.i as header file.

1.14 2.1.2 Command Line Examples

```
prompt> SNMA mycode.asm obj mycode.o include myinc:
```

Mycode.asm is a source file, mycode.o is an object file and include files are searched for in the current directory and then from myinc: directory.

```
prompt> SNMA mycode.asm Q on A off B off S on I work:,work2:inc
```

mycode.asm is a source file. Flags are set on and off. Include files are searched for in the current directory, work: and work2:inc.

```
prompt> SNMA mycode.asm EQUATE myequ
```

produces the equate file named myequ.equ and mycode.o object code.

```
prompt> SNMA mycode.asm E ""
```

produces the equate file named mycode.equ and mycode.o object code.

```
prompt> SNMA arexx
```

Starts SNMA ARexx command host.

```
prompt> SNMA mycode.s -e -l -iinclude:
```

mycode.s is source code, -e and -l flags snma to produce equate and listing file, and -iinclude: tells snma to search include files from the include: directory.

1.15 2.1.3 Option file format

Option files is simple text file where different options are in separate lines. Snma reads this file always when assembly is started, in ARexx mode, too.

If the "OPTFILE <name>" keyword is specified snma tries to handle that file, else snma does the following:

- 1) If ENV:SNMAOPTIONS exists it reads and handles it.
- 2) Then if SNMAOPTIONS file is found from the same directory where the source file is, it is handled.

Option file is intended to be used with snmaopts options setter program which provides simple GUI to create option files.
(Heh, hard to guess where I got the inspiration for this :).

NOTE: For better MUI 'look and feel' as well as support for all new options and enhancements in SNMA, use SNMAOptsMUI written by Przemysław 'Sensei' Gruchała (sensei@box43.gnet.pl). You can find it on Aminet (dev/asm/SNMAOptsMUI.lha) or on author's homepage: <http://www.amiga.pl/redgroup/>, in the FreeWare download page. -MM

Option file format:

<This may very well change in future>

QUICKOPT	= <ON OFF>	opt modes
PCOPT	= <ON OFF>	
ADDRESSOPT	= <ON OFF>	
BASEFORCE	= <ON OFF>	
MOVEM	= <ON OFF>	
LBRA	= <ON OFF>	
FOPT	= <ON OFF>	
JOPT	= <ON OFF>	
OPTLEVEL	= <number>	
SYMBOL	= <ON OFF>	create symbol hunks
LINED	= <ON OFF>	Create LINE DEBUG hunks
EXEOBJ	= <ON OFF>	Create executable
SR32	= <ON OFF>	ShortReloc32
KO	= <ON OFF>	Keep Object
EQUF	= <ON OFF>	create equate file
LISTF	= <ON OFF>	create listing file
LMN	= <ON OFF>	no macros to listing file
LOD	= <ON OFF>	Only lines which define data
CS	= <ON OFF>	Case-sensitive symbols
TD	= <ON OFF>	TypesDirectives

QUIET	= <ON OFF>	Be quiet
IMMSC	= <ON OFF>	Immediate data size checking
OCT	= <ON OFF>	Allow @ char as octal specifier
EC	= <number>	Error Color
CPU	= <number>	Initial CPU value
-h	= <filename>	Header file
-i	= <directory>	Incdir

1.16 2.2 Workbench support

SNMA may be started from the Workbench, too. Its behaviour is controlled with ToolTypes. SNMA can assemble file(s) or start ARExx SNMA. You can disable a ToolType by removing it or setting it to parenthesis "()".

Tooltypes:
~~~~~

AREXX flag to start snma in ARExx mode.

PORTNAME=<name> AREXX port name. If omitted, snma uses the default name (SNMA).

WINDOW=<file> Specify output file. If omitted, snma will use its default output (CON:...). If the AREXX flag is set too, no default output is created, if omitted. See ARExx/SET

The default tooltypes are set so that AREXX snma will be started. Trying to run snma twice with the same ARExx port name will now ask if you want to quit snma (ARExx host). If not, nothing happens. If you want to start multiple SNMAs, define different port name to each instance. This is easiest to do with creating project icons (do not create actual file - only the .info file) and specifying necessary tooltypes in them (in this case AREXX and PORTNAME=<>). Set default tool to snma.

See also 4. ARExx

To stop SNMA you have to send a QUIT command to it. Here's how you do that from the shell:

```
->rx "address SNMA QUIT"
```

where "SNMA" is the name of the ARExx port.

How do you stop snma from the WB?

Simple, click the icon you started snma from and ask "Quit" to the requester which appears.

If you want to assemble files using the icons, I suggest you use something like ToolManager, which makes your life a lot easier.

I added the WB support mainly because it may be helpful to start SNMA in ARexx mode from an icon.

If you start SNMA from the WB and pass it arguments (ie: you have selected other icons as well), SNMA will try to open WINDOW=<file>, if omitted it will open its default output window. Then the passed file(s) is(are) assembled just like in shell mode, including snmaoptions file handling.

## 1.17 2.3 Starting the ARexx SNMA host

SNMA can be started as an ARexx host and I suggest it be used that way. Of course, lots of people are not used that and stick in more traditional way - no problem.

Startup from:

- Shell        use AREXX template
- WB           use AREXX tooltype

See ARexx section (4.).

## 1.18 3. Features of SNMA

This section covers all features of SNMA, relating to the actual assembly process.

3.1 Source code format

3.2 Symbols

3.3 Expressions

3.4 Addressing modes

3.5 Directives

3.6 Data types

3.7 Things to note

3.8 Errors

3.9 Bugs

## 1.19 3.1 Source code format

---

The format of the source code is 'standard'.

One line can be 256 bytes long (after macro expansion, too).

One source code line may have the following components:

```
<Label>    <opcode>  <operands>  <comment>
```

<Label>      Labels must start from the first column.  
It may end with a colon (':').

Legal label characters are 'A-Z', 'a-z', '0-9', '\_', '.', or codes 127-255 (like äöåÐ). I decided to handle all the characters in the range 127 to 255 as symbol characters.

First character must be: 'A-Z', 'a-z', codes 127-255, '\_', '.' After that digits (0-9) are legal too.

Local labels are supported. You have three alternatives to define a local label:

- 1) add a '.' in front of it. For example: .local
- 2) add a backslash in front of it. \local
- 3) add a '\$' to the end of it. For example: local\$

Local labels may also start with a digit (actual label portion). (1\$, .1, ...)

<opcode>      Opcode field is separated from the label field by at least one space. An Opcode can be:

- 1) MC680x0 operation code (instruction).
- 2) Assembler directive .
- 3) Macro invocation.

<operands>    Operand field is separated from the opcode field by at least one space. The Operand field may contain 0 to 9 operands depending on what is in the opcode field. Operands are separated by a comma (,). There can now be 99 macro operands.

<comment>    Anything after the operand field is ignored and treated as a comment. Those MC680x0 instructions which don't have operands ignore anything after the opcode field. Anything after a ";" character is treated as a comment. If the character in the first column is a "\*", the entire line is considered a comment or if the opcode is a "\*" it is ignored.

## 1.20 3.2 Symbols in SNMA

Symbols in SNMA have different meaning, depending on where they are used.

Absolute, relative, register and register list symbols are case-sensitive by default, but you can change this behaviour with "snmaopt c-" or with CASESEN=OFF commandline toggle.

#### Absolute symbols ~~~~~

Absolute symbols are defined with the EQU or SET directive. Symbols may be local symbols in the same way as labels. See the label definition. Absolute symbols refer to numerical values.

Local symbol example

SNMA pre-defines some symbols with the SET directive.

#### Relative Symbols ~~~~~

Relative symbols are labels, or equates which have relative symbols in the expression which defines it. The only exception to this is expression Relative-Relative which results in an absolute type. See expressions for restrictions on relative symbols.

"\*" is a special symbol and is the value of the program counter (PC).

For example:

```
data    ds.b    100           ; define space 100 bytes
size    equ     *-data       ; size gets value of 100 (abs type)
```

#### Register Equates ~~~~~

Register equates are defined with the equr directive. "Register symbol" refers to the register (Dn or An).

#### Register lists ~~~~~

Register lists are only allowed in movem and fmovem instructions. They are defined with reg directive. "Register list" refers to the list of registers.

#### Macro symbols ~~~~~

Macros are defined with the macro and endm directives. "Macro symbol" refers to the defined macro. Names of macros are always case-insensitive.

---

## 1.21 Pre-defined symbols

SNMA pre-defines the following symbols with SET.

| symbol name | value |                                         |
|-------------|-------|-----------------------------------------|
| ~~~~~       | ~~~~~ |                                         |
| SNMA        | 0     |                                         |
| snma        | 0     |                                         |
| NARG        | 0     | (actually number of args in macro call) |
| M68000      | 1     |                                         |
| M68010      | 2     |                                         |
| M68020      | 4     |                                         |
| M68030      | 8     |                                         |
| M68040      | 16    |                                         |
| M68060      | 32    |                                         |
| M68881      | 256   |                                         |
| M68882      | 256   |                                         |
| F040        | 512   |                                         |
| M68851      | 1024  |                                         |

M68xxx symbols are meant to be used with the `cpu` directive.

See also `register names` .

## 1.22 Register names

SNMA uses the following register names:

D0-D7 A0-A7 SP CCR SR SFC DFC CACR USP VBR CAAR MSP ISP FP0-FP7  
 FPCR FPSR FPIAR TT0 TT1 TC DRP SRP CRP CAL VAL SCC AC MMUSR PSR  
 PCSR BAD0-BAD7 BAC0-BAC7 DTT0 DTT1 ITT0 ITT1 URP IC DC IC/DC DC/IC  
 BC BUSCR PCR

Registers from the CCR in the above list are special registers. If the name of special register is the only component of an address mode (like `'lea CAL,a0'`) snma considers it to be a special register. If the name of a special register is one of the components of an address more (like `'lea (CAL,pc),a0'`) it is treated as a normal symbol. However, to avoid any confusion, I strongly suggest that you use these names only when referring to the special registers.

xxxx

The future versions of snma can handle this situation differently.

## 1.23 3.3 Expressions in SNMA

Expressions can be used almost anywhere where numerical components are needed. The only exception being floating point numbers which don't allow expressions. Expressions use 32 bit integer math.

Expressions may have: 1) symbols, 2) constants, 3) operators, 4) parenthesis.

1) Symbols must be absolute or relative symbols.

2) Constants are numbers. They can be decimal, hexadecimal (\$), octal (@) or in binary (%) form. First character tells which type to use. To use octal numbers, OCT flag must be set on in commandline options.

3) operators (in the order of precedence) precedence

NOTE: I've changed power operator from '^' to usual '^'. -MM

|      |                                |   |
|------|--------------------------------|---|
| -    | Unary minus                    | 9 |
| ~    | bitwise NOT (one's complement) | 9 |
| <<   | left shift                     | 6 |
| >>   | right shift                    | 6 |
| ^    | power                          | 6 |
| &    | bitwise AND                    | 5 |
| ! or | bitwise OR                     | 5 |
| *    | multiply                       | 4 |
| /    | divide                         | 4 |
| //   | modulo                         | 4 |
| +    | add                            | 3 |
| -    | subtract                       | 3 |

|                                          |                          |
|------------------------------------------|--------------------------|
| boolean operators (TRUE <> 0, false = 0) | 2                        |
| =, ==                                    | equal to                 |
| !=, <>                                   | not equal to             |
| <                                        | less than                |
| <=, =<                                   | less than or equal to    |
| >                                        | greater than             |
| >=, =>                                   | greater than or equal to |

4) Parenthesis are (). They may be nested.  
For example:  $3 * ((12 - 6) / (2 + 2))$

Expressions are either absolute or relative, depending on the types of symbols and operators. Relative symbols are allowed only to add and sub(tract) operands. When an expression is evaluated, it is divided into the sub-expressions to the stage

<number operand number>

where number can be a symbol. This sub-expression gets its own sub-type. Confused? See below.

For example:  $(Rel2 - Rel1) / 4$  is a legal expression, because the type of Rel2-Rel1 is absolute although they are both relative symbols. See the table below.

Following table shows types of expressions.  
 A = Absolute , R = Relative, - = not allowed

| Operator               | operands |        |        |        |   |
|------------------------|----------|--------|--------|--------|---|
| ~~~~~                  | ~~~~~    |        |        |        |   |
|                        | A op A   | A op R | R op A | R op R |   |
| +                      |          |        | A      | R      | R |
| -                      |          |        | A      | -      | R |
| *, /, //, &, !, <<, >> |          |        | A      | -      | - |

## 1.24 Local symbol example

The following example demonstrates local and global symbols.  
 (Global means global to one source file here).

```
; start-----
num    equ    123                ; define global symbol
start:
.num    equ    10                ; define local symbol
    move.l    #.num,d0           ; move 10 to d0
    move.l    #num,d1            ; move 123 to d1
new:
.num    equ    23                ; define local symbol
    move.l    #.num,d0           ; move 23 to d0
    move.l    #num,d1            ; move 123 to d1
    rts
    end
; end-----
```

## 1.25 3.4 Address modes

SNMA supports all the addressing modes of the 680x0.

xxxx

SNMA supports Motorola's new addressing mode format as well as the old format. (The different being the placing of first component. Ie. Should it be outside the parentheses or inside).

Forcing the size

~~~~~

In some places, you can force a value to be either word or long word. This is generally used to force something to word size, but it can be used to force something to long as well. Forcing is implemented by adding the .w (for word) suffix or the .l (for long word) suffix to the symbol. For example, 'move.l (4.w),a0'.

Note1: The above addressing mode is optimized when using simple 'move.l (4),a0'. 'move.l (4.l),a0' will not allow optimizing due to the forcing suffix.

Note2: SNMA won't complain about the mode (4).w, but it does ignore the forcing suffix. (Mode is probably optimized to word size later). In some other addressing mode, like (Aku.w,An,Xn) the .w suffix is inside the parenthesis. The mode (Aku.w) is just stripped down version from that mode and I think it is better to use consistent system to refer things.

xxxx

Currently you can't force to byte like "num.b(a0,d0.w)" but you can do it by disabling 020+ code generation by using mc68000 directive. This is a little ugly, I know. Maybe I'll add a ".b" suffix in some day.

Base displacement modes (including Memory Indirect)

~~~~~

You can force Base Displacement and Outer Displacement to be a long word or word with the .l (long) or .w (word) suffix.

For example: ([BD.w,A0,d1.w],OD.l) where BD and OD are symbols.

SNMA will optimize addressing modes to the best possible. If certain components are omitted a change to a quicker mode can be made. When you force some value with a .l or .w, the value must be within range and even if the actual value could be optimized it is not because it is forced.

Example:

```
jsr      (BD.w,a6)
BD equ   0
```

```
; Although BD is null, generated addressing mode will be disp16(An)
; because we forced BD to be word.
```

```
tst.l (BD,a0)
BD equ 0
```

```
; This will generate addressing mode (An)
; end of example
```

The same applies to Outer Displacement, except that addressing mode is always Memory Indirect if there is OD.

Don't worry if the above is confusing. You don't usually have to force anything since SNMA optimizes to the best mode for you. If you want some value to be an exactly specified size (when importing a value, for example) forcing can be a handy feature.

No Address Register in addressing mode

~~~~~

When an address register is not part of address generation you have two ways to exclude it. First, just don't set it (like (d2.l)).

Then you can always use a Zero Suppressed address register using the name ZAn (n does not matter) instead of An. For example,

```
(10,d3.l)      =      (10,za0,d3.l)
(d1.l)         =      (za0,d1.l)
(10,a2.w)      =      (10,za0,a2.w)    index register is An
```

You may wonder what the <---> is this Zero suppress stuff. The book I used as a reference manual mentioned it and I being a fool, didn't realize until now (a long time passed) that the index register has (err.. may have - that .l or .w - it is good practise to use them) suffix information which says, "HEY ! I'm the index register".

Oh well...

Immediate values

~~~~~

SNMA checks immediate values so that they are in range, depending on the size of the instruction. Immediate values can also be longer than 32 bits if the instruction is some fpu/mmu instruction. FPU instructions allow real mode definition of a number like -11.13232e-2. The sizes of FP values are not checked.

Optimizing Address modes

~~~~~

Address modes are optimized very well in SNMA. Forward optimizing is also included. See the SNMAOPT directive and above for more information. I suggest that you keep addressing mode optimizing on, especially when the 68020+ mode is on because of the way SNMA works. You will definately get the worst addressing mode if the symbols are not defined when the line is assembled first time.

1.26 3.5 Directives

The following directives are supported:

CLRFO	Reset _FO
CNOP	Conditional NOP
CNUL	Conditional NULL
CPU	Define CPU ID type
DC	Define Constant
DCB	Define Constant Block
DEBUG	Write line debug hunk
DS	Define Space
DX	Define BSS space
ELSEIF	Conditional assembly toggle
END	End of source file
ENDC	End conditional assembly
ENDIF	Alias for endc
ENDM	End macro definition
ENDR	End repeat block
EQU	Define symbol value

EQR	Define register equate
EVEN	Ensure PC is even
FAIL	User error
FO	Frame offset
GET	Get an internal variable
IDNT	Set program unit name
IFC	Assemble if strings equal
IFcc	Assemble if condition true
IFD	Assemble if symbol defined
IFNC	Assemble if strings not equal
IFND	Assemble if symbol undefined
INCBIN	Include Binary
INCDIR	Include directory list
INCLUDE	Include source file
LIST	Turn on listing file generation
MACRO	Start macro definition
MC680x0	CPU mode
MEXIT	Exit from macro
NOLIST	Turn off listing file generation
OPT	Changed to SNMAOPT
OPTS	Set internal options variable
REG	Define register list
REPT	Start repeat block
RS	Define structure offset
RSRESET	Reset _RS
RSSET	Set _RS
SECTION	Start new section
SET	Define SET value
SETFO	Set _FO
SNMAOPT	Define options
SMALLDATA	Enable small data for section
XDEF	Export symbol
XREF	Import symbol
types.i	types.i macros as directives

1.27 3.5.1 types.i directives

SNMA has most of the exec/types.i macros defined as directives. Although this doesn't save very much assembling time it reduces memory usage because snma doesn't need to create macro lines.

You can enable/disable this feature with 'snmaopt T' flag or with a 'typesdir' toggle in a startup template. By default this feature is disabled.

As you can see, you probably need to include types.i because there is only structure definition stuff at the moment. (This does not take into consideration what kind of modifications people have made to the their types.i file)

Currently , the following exec/types.i macros are supported:

aptr	<name>[,how many]	(32 bits)
byte	<name>[,how many]	(8 bits)
bool	<name>[,how many]	(16 bits)

cptr	<name>[,how many]	(32 bits)
double	<name>[,how many]	(64 bits)
float	<name>[,how many]	(32 bits)
fptr	<name>[,how many]	(32 bits)
label	<name>	
long	<name>[,how many]	(32 bits)
rprr	<name>[,how many]	(16 bits)
struct	<name>,<how many>	
structure	<name>[,offset]	(offset=0 if omitted)
short	<name>[,how many]	(16 bits)
uword	<name>[,how many]	(16 bits)
ubyte	<name>[,how many]	(8 bits)
ulong	<name>[,how many]	(32 bits)
ushort	<name>[,how many]	(16 bits)
word	<name>[,how many]	(16 bits)

[,how many] field is extension to the exec/types.i macros.
 'Structure' doesn't require initial offset (basic macro does).

Notice that there are no data type checks so most of these directives do same thing (the ones which have same size).

Example:

```

    structure    MyDataStruct
    aptr         ptr           ;ptr    = 0
    byte         coll         ;coll    = 4
    byte         col2         ;col2    = 5
    word         mask         ;mask    = 6
    aptr         planes,8     ;planes= 8
    long         count        ;count   = 8+8*4 = 40
    label        sizeof      ;sizeof= 44
  
```

1.28 CLRFO directive

CLRFO

Resets the _FO variable to 0.
 See also FO and SETFO .

1.29 CNOP directive

Conditional NOP. This directive is used to align data arbitrarily.

CNOP offset,alignment

Offset is a value which is added to the alignment.
 Alignment is an alignment boundary value.

`cnop 0,4` aligns pc to the long word boundary.

`cnop 2,8` align pc to the 8 byte boundary plus two bytes.

1.30 CNUL directive

`CNUL` offset,alignment

Conditional NULL. Same as `CNOP` but, unlike the `NOP` directive, it pads with null word.

1.31 CPU directive

`CPU` <expression>

Defines what kind of instructions are legal. This is also used for FPU and MMU instructions.

Expressions are simple numerical values which are set to the internal SNMA variable (CPU command is only way to set it, it is not a symbol). See Pre-defined symbols .

You can store the old value of CPU using new `GET` directive. `-MM`

```
M68000
M68010
M68020
M68040
M68060
M68851      MMU
M68881      FPU
M68882      FPU    same as M68881
F040        MC68040-type floating point only$^1$
M030        68030 MMU
M040        68040 MMU$^1$
```

`1`denotes 060 FPU/MMU if used with M68060

If you want to use `CPU` keyword, the value for it must be calculated 'by-hand'. See the values from Pre-defined symbols and bitwise OR them together, or use `SnmaOpts` and option file (a lot easier).

The documentation for `CPU` command may have been little mis-leading. When one cpu type is allowed, instructions and address modes for that type are enabled. It does not mean that other instructions are disabled. So if you have both M68000 and M68020 set, snma can generate 020 opcodes and address modes as well as M68000 ones. Snma starts in 'swallow all' mode, allowing all instructions and address modes to be generated (if you don't specify cpu in options).

Pay attention to the '040s MMU commands. There are some overlaps with '030: same instruction name must produce different code for '030 and '040. For example "PFLUSHA" is different in '030 and in '040. If M040 is set, '040 MMU opcodes are produced, no matter of M030 flag. So, by default, snma generates 040 MMU commands.

See also GET directive.

Examples:

```
CPU M68000                enables 68000 instructions
CPU M68000!M68010!M68020  enables instructions of those cpu's.
```

```
CPU M68020!M68030!M68881  enables FPU instructions also.
```

```
CPU M68040!F040           '040 without floating point supporting
                           routines, ie. only those fpu instructions
                           which are in silicon.
```

```
CPU M68060!F040           the same as above but for 68060
```

```
CPU M68040!F040!M68882    '040 floating point software installed.
                           (which emulates missing silicon)
```

This directive can be used so that if code is desired to be run on M68000 machines you can check that there are no other instructions than those which the MC68000 recognizes. All combinations are possible. CPU -1 enables all instructions to be assembled. SNMA performs "CPU -1" in the beginning of the assembly.

See also MC680x0 directives.

1.32 DC directive

Define Constant

```
DC.n    <expression> or <single value>
```

n is size of data.

See Data types .

```
dc.b    2+1              reserves one byte and sets 3 to its value.
dc.l    12                reserves long word and sets 12 to its value
dc.s    $FEEBD00D         reserves long word and sets it to $FEEBD00D
dc.d    +12.9292e-2       reserves two long words and sets its value what
                           that number is in double format (binary).
```

Expressions are only valid as integers. Expressions that are floating point numbers are not allowed.

If `n` is not defined the default size is `word`.

1.33 DCB directive

Define Constant Block

```
dcb.n <abs expression>[,<value>]
```

Reserves space for the given data type (`n`). All entries are set to a single value which is given as the second argument. See Data types .
If value is omitted, snma fills area with nulls.

1.34 DEBUG directive

DEBUG

Writes `LINE` debug hunk(s) to to the output file. Only affects the section where this directive is specified. If `DEBUG` commandline switch is used, `LINE` debug hunk is written to the all sections. "`SNMAOPT D`" can be used to switch snma to write the full path of the source name, which may be required with some debuggers.

This feature allows source level debugging to be used with debuggers which support that.

1.35 DS directive

Define Space

```
DS.n <abs expression>
```

Defines storage for the given data type (`n`).

<code>ds.b</code>	<code>12</code>	reserves space for 12 bytes
<code>ds.l</code>	<code>3</code>	reserves space for 3 longs (12 bytes)
<code>ds.x</code>	<code>4*4</code>	reserves space for 16 extended type fp number.
	<code>(192 bytes)</code>	

`<abs expression>` must be evaluated and it cannot contain relative symbols (or undefined by far).

All reserved space is set to null.
See Data types .

1.36 DX directive

`DX.<size>` defines BSS space to be allocated after code or data hunk. This directive only takes affect when producing an executable with snma. DX is like DS except that the size is reserved only from the hunk header. When the AmigaOS loads the executable it allocates memory as is specified in the size field of the hunk header. This size can be larger than the actual hunk size. Before 2.0 this memory range was not cleared and it must be done (if desired) by startup code. After 2.0 AmigaOS clears this area.

By using this method you can reduce the size of the executable and make more effecient BSS data references using combined DATA/BSS base register.

1.37 ELSEIF directive

ELSEIF toggles conditional assembly. If assembly was off it toggles it on and vice versa.

1.38 End Directive

End directive ends assembly. It is not required to be at the end of the source file. When the source file ends it also ends assembly. Anything after the END directive is not assembled.

1.39 ENDC directive

ENDC (alias ENDIF)

Toggles off conditional assembly if nest counts match.

1.40 ENDM directive

ENDM

Ends current macro definition.

1.41 ENDR directive

ENDR

Ends current repeat block.
See REPT .

1.42 EQU directive

EQUate.

symbol EQU <expression>

Sets the value of the symbol to <expression>. Symbol and <expression> are both required. = is equivalent to equ.

See Expressions .

Floating point numbers are supported by specifying a size field to the EQU.

See Data types .

Only floating point data types are supported in equ if the n suffix is present. (You can't 'equ.b 5').

When a symbol is used as part of an fpu instruction simple type checking is done, but only between floating point types. The following code will cause an ERROR:

```
NUM    equ.d    +11.234343
    fmove.s #NUM,fp0
```

To fix this, change NUM to single or fmove to double.

```
NUM    equ.d    +11.234343
    fmove.d #NUM,fp0           declared type same as used type !
```

The following code will not cause an error, because fmove uses the long type which is not floating point type (okay, it would be good to check anyway).

```
NUM    equ.d    12.23232
    fmove.l #NUM,fp0
```

1.43 EQUR directive

EQUR means register equate.
It allows registers to be addressed as symbols.
Register equates must be defined before use.

Example:


```
count    equr    d0
move.l   #0,count    ; means move.l #0,d0
```

1.44 EVEN directive

EVEN aligns PC to be divisible by two if it is not already. It does the same thing as `cnop 0,2` See `CNOP`.

1.45 FAIL directive

FAIL flags the assembler to stop assembling. It is used to flag user errors. It may be used if a macro call won't get enough parameters for example.

1.46 FO directive

Label FO.<size> <absexpression>

Define frame offset. Useful with the `link` instruction. This is something like `RS` but decreases the counter `_FO` and then assigns the value to the symbol (label).

Sizes other than byte are aligned to the word boundary.
See also `CLRFO` and `SETFO`.

It's good practise to keep your stack long word aligned. `FO` doesn't ensure it (how about some `FOLONG` directive?).

Little example:

```
clrFO      ; reset _FO (0)
longl   fo.l   1   ;--4
bytel   fo.b   1   ;--5
wordl   fo.w   1   ;--8

link     #_FO,a5      ; _FO = -8

;-- set all local variables to 0.

clr.l    longl(a5)
clr.b    bytel(a5)
clr.w    wordl(a5)

unlk     a5
rts
```

The stack looks something like the following after `link`:

```

a5
  offset
  ~~~~~~
SP->  -8      [  ]    word      word1
      -6      [  ]    byte      pad byte
      -5      [  ]    byte      byte1
      -4      [  ]    long      long1
a5 ->  0      [  ]    long      old a5

```

1.47 IDNT directive

```
IDNT    <name>
```

Sets the name of the program unit to <name>.

1.48 IFC directive

```
IFC      'string1','string2'
```

If string1 = string2 DO assemble.

See also IFNC .

1.49 IFcc directives

```
IFcc    <expression>
```

IFcc is a conditional assembly control directive. cc is the condition. The expression is tested against the value of zero.

directive (condition)		means
~~~~~	~~~~~	~~~~~
IFEQ	<expression>	Equal
IFNE	<expression>	NEqual
IFGT	<expression>	Greater Than
IFGE	<expression>	Greater or Equal
IFLT	<expression>	Lower Than
IFLE	<expression>	Lower or Equal
IF	<expression>	If true (not equal)
IFT	<expression>	If true (not equal)
IFF	<expression>	if false (equal)
IFNT	<expression>	if not true - false (equal)

If the condition is true, assembly is continued. If the condition is false assembly is turned off. The ENDC directive ends conditional assembly.

## 1.50 IFD directive

IFD <symbol>

Conditional assembly trigger.

If symbol is defined, do assembly, else don't.

See also IFND .

## 1.51 IFNC directive

IFNC 'string1','string2'

If string1 <> string2 DO assembly.

See also IFC .

## 1.52 IFND directive

IFND <symbol>

Conditional assembly trigger.

If symbol is not defined, do assembly, else don't.

See also IFD .

## 1.53 INCBIN directive

INCBIN <file>

Incbin directive includes the named file into the code in its binary form. No assembling is done on the file. If you had a file named bin and it contained following data in hex form (4 bytes long file):

0BAD BEEF

Now..

IncBin bin

would do same as

dc.l \$0BADBEEF.

If the length of the file is not even, an extra null byte is added to the end of the data when it is set to the produced code. This makes sure that the program counter stays aligned. This is just the same as the Incbin without this feature (in SNMA this feature is always on):

```
incbin <file>
even
```

Thus, above 'even' is done automatically (always) by 'incbin' and is unnecessary in SNMA.

## 1.54 INCDIR directive

```
INCDIR <mydir1>[,mydir2,mydir3...]
```

INCDIR adds directories to the directory list where the INCLUDE files are retrieved from.

INCBIN uses this list, too.

## 1.55 INCLUDE directive

```
INCLUDE <file>
```

Starts to assemble <file>. After it has been assembled, snma continues assembling after the INCLUDE directive.

Include files are looked for first in the current directory, and then in the directory list which can be defined in command line or with the INCDIR directive. If an include file is not found during assembly the assembly is terminated immediately (fatal error).

When snma is in ARexx mode it can have global include tables. If <file> is already in the global table it is skipped (not even loaded into memory). See ADDGB .

xxxx

Addition to include file handling

~~~~~

Snma can now handle includes which I have decided to call "symbol tables" shortly STab files. STab files are include files which store the information organized so that snma can handle them faster than normal include files.

Important !

STab files are just symbol and macro tables, there are no assembly controlling information (directives) nor any instructions, like normal include files can have. Usually, include files just define things so there is no problem here, but this is good thing to keep in mind.

Where to get these STab files ?

You have to use snma to create them. It is pretty easy if you follow the next example.

1) Start snma in ARexx mode (if not already running).

```
->run snma arexx
```

2) Create file which includes all the files you want to include to the STab file.

```
->list <incdir> files all lformat=" include %p%n" > <include file>
```

where <incdir> is the directory you want to include the files.

<include file> is the produced include file.

3) Add the include files which the file produced in step 1 will include to the snma's global symbol table. I assume that you have copied "addgb.rexx" ARexx macro to your rexx: directory.

```
->rx addgb <include file>
```

4) Produce the STab file.

```
->rx "address snma makest <stabfile.st>"
```

where <stabfile.st> is the name of the STab file you can include much faster later on.

Quick repeat:

Assume that you have system includes in the directory called "incdir:" and you want to create file named "systab.st", which contains all the stuff include files contains in this directory. "->" represents shell prompt.

```
1) ->run snma arexx
```

```
2) ->list incdir: files all lformat=" include %p%n" > ia.asm
```

```
3) ->rx addgb ia.asm -iincdir:
```

```
4) ->rx "address snma makest systab.st"
```

3.1 Include files - without comments - take about 441 kB of space, while the systab.st file - produced from the above - takes 219kB.

Shortly, add the include files to the snma's global symbol table and then execute snma's ARexx command MAKEST which will write the STab file taking the symbol and macro definitions from the snma's global symbol table.

You can, of course, call these files whatever you want and set the file extension to whatever pleases you.

1.56 LIST directive

LIST turns on listing file generation. You can disable portions (like includes) of a listing file to be generated with the LIST and NOLIST directives. These do not nest.

1.57 MACRO directive

<Symbol> MACRO

Starts macro definition. Code inside a macro definition is not assembled until the macro is called. The NARG symbol is set to the number of arguments passed to the macro, when the macro is called. Macro names are case-insensitive.

The Macro call may have up to 99 parameters. A produced macro line must fit into 256 bytes, however. If a parameter is enclosed between "<" and ">", it can contain any characters (including commas, spaces, tabs) except the ">" (which always ends the parameter started with "<") and LF (\$a).

Backslash ("\") has special meaning in macro definition. If character after it is:

- 1) 01-99 insert argument number <number>
- 2) 0[0] insert size field of macro call
- 3) @<label> produces unique label (like local labels).
- 4) \*<function()> executes special function

Argument number (1) may be defined with one or two digits. If you want to produce something like <argument><number> with arguments below 10 you must set the leading 0, otherwise it is not required.

```
;-----
simple examples:

BURGER macro
dc.b    "\011"
endm

BURGER HAM          ; produces dc.b "HAM1"

Do      macro
move.\0 \1,\2
endm

Do.b    d0,d1        ; produces move.b d0,d1
;-----
```

Special functions (4) insert the resulting string into the macro. If there is an error the actual function call is inserted. These 'functions'

do not nest, BUT you can define macro arguments in the argument of a function (like `\*valof(\1)`).

The parenthesis are always required because there must be some way to tell when the 'function' ends.

`\*VALOF(expression)` inserts the numerical value of expression. This expression is only solved during pass1. If expression has relative components, optimization may change it but the change is NOT reflected here. Also, symbols in the expression must already be defined.

| | | |
|-----------------------------|--|-------------|
| <code>\*DATE(format)</code> | inserts the current date string of the system. | |
| Format char | format type | |
| ~~~~~ | ~~~~~ | |
| d | DOS | (dd-mmm-yy) |
| i | INT | (yy-mmm-dd) |
| u | USA | (mm-dd-yy) |
| c | CND | (dd-mm-yy) |
| v | \$VER | (dd.mm.yy) |

`DATE()` uses dos/datestamp.

v format uses CND format, and replaces "-" with ".".

Adding "l" after format char will produce full 4-digit year notation, so:

`\*DATE(vl)` will yield "dd.mm.yyyy"

`\*TIME()` inserts current system time
`TIME()` uses dos/datestamp.

`\*VAR(name)` inserts local or global (ENV:) dos variable
 using `dos/GetVar()`.

`\*STRLEN(string)` inserts length of string
`\*UPPER(string)` converts string to uppercase
`\*LOWER(string)` converts string to lowercase

```
DATE      macro
dc.b      'Assembling Date: \*DATE(d)',0
endm
```

1.58 mc680x0 directives

The following directives are shortcuts to the cpu directive.

```
mc68000
mc68010
mc68020
mc68030
mc68040
mc68060
mc68881
mc68882
mc68851
```

These do the same as CPU with a single argument, which is one of the types of cpu. MC68881 (mc68882) enables also 68020 (68030). Using the CPU directive, you can control arbitrarily the value of CPUID.

1.59 MEXIT directive

MEXIT

Exit from macro definition.

When macro is called it may be useful to exit from macro expansion before actual macro ends.

Used usually in conditional macros.

1.60 NOLIST directive

NOLIST directive turns off listing file generation.

See also LIST directive.

1.61 SNMAOPT directive

SNMAOPT flag[,flag,flag...]

where flags are:

Q Quick optimizing. Move->moveq, add->addq, sub->subq whenever possible.
Default: On

P Absolute long addressing -> program counter relative whenever possible.
Default: Off

A Effective address optimizing. 0(An)->(An), BD and OD optimizing if 0 or word. (BD,An)->dipl6(An) if possible. Optimizes address modes as quick as they can be.

Default: On

B Auto-force (BD,An) -> displ6(An). You can override by disabling this flag or using .l suffix in the symbol. (BD.l,An) makes the addressing mode always long irrespective of the B flag. This feature is present because routines in the run-time libraries can all be called by the (displ6,An) mode. Displacement can be an xref'd symbol which is solved during link time. Because symbol is xref'd it must be treated as 32 bit because in theory it can be this way. All library calls however can use (displ6,An) mode. In using this option you needn't add the .w suffix to all calls.
Default: On

S With this flag symbol hunks are written to the object file. This is handy when using symbolic debuggers.
Default: Off

L Long branches. Enable long branches if there is no size field in Bcc instructions.
Default: Off

E Produce executable (instead of producing object code). Source file cannot have xref statements. Sorry, no DATA+BSS coagulation yet.
Default: Off

R RELOC32SHORT to executables, implemented as 1015.
Default: Off

J 'jsr <ea>, rts' pair to the jmp <ea> if rts is not referenced. See Opt j example.
Default: Off

M Movem to move if only one reg. Warning: can affect CCR!
Default: Off

D Write the full path of the source file to the line debug hunks. See also DEBUG.
Default: Off.

T SNMA has some exec/types.i macros defined as directives.
Default: Off

I Immediate data field siz checks. Checks if data fits to given field.
Default: On

F Some more optimizations which will change the CCR.
lea -> addq/subq
adda -> subq/addq
Default: Off

Flags are case-insensitive.

Example:

SNMAOPT S,P+,b-

Write symbol hunks, Optimize Absolute long -> pc-relative,
Disable Auto-forcing of (BD,An).

1.62 OPT J example

Little example:
...
jsr SubRoutine
rts
 Can be converted to
...
jmp SubRoutine
 because SubRoutine (usually) ends to rts.

Be careful with this one - if you pass parameters via stack or do something else that depends on a return address being in stack, DO NOT USE this.

If you have enabled this optimizing, you can locally disable it by setting a label to the rts or by using snmaopt directive.

1.63 REG directive

Symbol REG <reg-list>

REG directive specifies the register list used by the movem instruction. List may contain a symbolic register name defined by equr. Symbolic register lists must be defined before use. Symbols defined by the REG directive can be used only with the movem instruction. <reg-list> may be omitted. If <reg-list> is empty, the movem instruction, which uses empty list, is not generated.

example:

```
list    reg      d0-d3/a0-a2/a5
movem.l list,-(sp)            push registers onto stack
nop
movem.l (sp)+,list            pop  registers from stack
```

1.64 REPT directive

REPT <num>

Starts repeat block. <num> specifies how many times repeat block is repeated.

Example

```
rept    100                ; clear 400 bytes
clr.l   (a0)+
endr
```

See ENDR .

Don't define things inside a repeat block, use include or something similar.

1.65 RS directive

Label RS.<size> <absexpression>

RS directive can be used to define structure offsets. Label is always required (for obvious reasons). Size field is one of the allowed. See data types . Expression must be absolute and defined before use.

Simple example:

```
rsreset    ; reset _RS

num1    rs.l    1    ; num1 = 0
double  rs.d    1    ; double = 4
byte     rs.b    3    ; byte = 12 (3 bytes)
word     rs.w    1    ; word = 16 (auto-align to word boundary)
```

1.66 RSRESET directive

RSRESET

Reset the value of \_RS symbol to 0. Equivalent to RSSET 0.
See also RS .

1.67 RSSET directive

RSSET <absexpression>

Set \_RS value. \_RS can be set also with the SET directive, but DO NOT 'equ' it. See also RS .

1.68 SECTION directive

```
SECTION <name>[,<type>[,<mem type>]]
```

Start a new section. Name of the section is set to <name>.

The Type of section is one of the following:

```
CODE      CODE_C  CODE_F
DATA      DATA_C DATA_F
BSS       BSS_C   BSS_F
```

\_C extension specifies mem type (C=CHIP, F=FAST).

<mem type> specifies the type of the memory where the hunk should be loaded. It can be specified with <type> field by extension or with separate third argument which is CHIP or FAST.

1.69 SET directive

```
<Symbol>    SET <number>
```

With SET you can define a symbol whose value can be changed arbitrarily later on. You can 'equ' set symbols but then they become absolute symbols which cannot be changed again.

1.70 GET directive

```
<Symbol>    GET <internal variable>
```

GET has been introduced mainly for use in macros. It is the only way of access to some internal SNMA variables, which can be useful if you want to restore them later to the original value. Currently only two internal variables are supported:

CPU - gets internal state of CPU variable

OPTS - gets internal state of OPTIONS variable

Let's demonstrate the usage. As you probably know the same 'pflusha' instruction can produce two different opcodes: one for MC68030/68851 CPUs and one for MC68040/68060 CPUs. By default SNMA sets CPU variable to its maximum -1 value which enables all available CPUs. Because 'pflusha' overlaps, 040/060 opcode takes precedence. If your code is to be run on 68030 or 68851 CPUs only there's no problem: all you need to do is to write 'mc68030' at start of your source. But if you intend to use code usable with various CPUs, you can define special macro, which will locally set CPU to required value, restoring it to original on exit. Here it comes:

```
pflusha2 macro
\@cpu get cpu ;get current internal CPU variable value and bound it
;to the local \@cpu label
```

```
mc68851    ;set 68851 'pflusha' opcode generation
pflusha
cpu \@cpu ;restore CPU variable to original state
endm
```

The same goes with the second supported variable, OPTS. Here you can get the copy of internal optflags field. The exact meaning of individual bits is intentionally not documented here and please do not make any assumptions! Things may change! If you need to change any of the options, use SNMAOPT directive. Example:

```
\opts get opts ;get current internal optflags variable value and
;bound it to the local \opts label
snmaopt m- ;turn off single argument movem->move optimization
movem.l (sp)+,d0 ;so this movem will not be optimized
opts \opts ;restore options to original state
```

See also OPTS directive.

1.71 OPTS directive

OPTS <number>

Sets internal optflags variable. Use only with values obtained via GET directive.

1.72 SETFO directive

SETFO <absexpression>

Sets \_FO variable to the <absexpression>.
See also FO .

1.73 SMALLDATA directive

SMALLDATA [<An>]

Enables small data model for the current section. If the section has any base relative address modes which have An as a base register, snma handles them as being references to data area - ie. using HUNK\_DREL or EXT\_DREF hunks.

If register An is omitted , the default is a4.

To use small data model, you need linker a which can deal with HUNK\_DREL and EXT\_DREF hunks. Please refer to your linker documentation for more information on how to use the small data model. There are certain rules as to how to name sections which define data and so on.

1.74 XDEF directive

```
XDEF      <symbol>[,<symbol>[,<symbol>...]]
```

Define external symbol. Defines a symbol value to be visible to other modules. (Export)

1.75 XREF directive

```
XREF      <symbol>[,<symbol>[,<symbol>...]]
```

External reference to symbol. Defines a label to be imported from other modules.

1.76 3.6 Data types

Supported data types.

All data types are NOT supported by ALL instructions.

Directives which support:

DC.n

DCB.n

DS.n

EQU.n (all integers are 32 bit values and they are defined without a suffix).

RS.n

n is one of these.

~~~~~

b = byte

w = word

l = long word

s = single precision floating point number

d = double precision floating point number

x = extended precision floating point number

p = packed floating point number

Used K-factor is 17 with packed type.

size

~~~~

(1 byte)

(2 bytes)

(4 bytes)

(4 bytes)

(8 bytes)

(12 bytes)

(12 bytes)

1.77 3.7 Things to Note

Things to note when using SNMA.

3.7.1 Instructions

3.7.2 Expressions

3.7.3 Include files

3.7.4 Directives

3.7.5 Misc.

1.78 3.7.1 Notes about instructions

Bcc (bsr, bra, beq,...) instructions
 ~~~~~

- If there is no size field (like bra or bsr) SNMA attempts to optimize the branch to the shortest possible. If the size field is given (like bsr.w) SNMA does not try to optimize the instruction. When generating jump tables, I wanted branches to be 'forced' to word size without altering the snmaopt directive (I don't remember those option chars even myself 8).

If the size field is omitted:

- LONGRA flag tells SNMA whether to use long or word size. LONGBRA=on enables long branches in these cases and LONGBRA=off disables longs, forcing SNMA to use word size branches.
- If the value is an external reference, SNMA won't optimize it. Instead, depending the on LONGBRA flag (and the CPU mode) it may be set to long or word.
- Currently, if you Bcc to another module and SNMA ends up at a long branch, things go wrong. I have to dig out what is in those new hunks - about which my old Bantam book knows nothing at all. Until then be warned... (a change to jsr could be made but I'm searching for a more elegant method, like RELRELOC32) SNMA should really warn if this happens.

## 1.79 Bcc instruction

Bcc instruction. (Also bsr).

bhs = bcc  
 blo = bcs

Sizes: .s .b (byte)  
 .w (word)  
 .l (long)

## 1.80 3.7.2 Notes about the expressions

The Check of the data sizes

~~~~~

SNMA checks that specified data fits where it is set. For example if you have the instruction "move.w #100000,d0" SNMA tells you that value won't fit as word. Positive number range is unsigned and negative signed (All internal math is 32 bit).

Remember that when using the NOT (~) operation all 32 bits are affected, not just parts of it.

Range checking can be annoying if you are using NOTs with bit masks and sizes other than long word. (Hint: you can mask values with AND) Checking of the ranges by SNMA reveals some bugs (value too big to fit in a byte) which were not noticed when using a68k, so I think it is a useful feature, which can be turned off, if desired.

1.81 3.7.3 Notes about the include files

SNMA assembles V37 includes just fine.

The V40 includes which I got from NativeDeveloperKit3.1 have very few problems with SNMA.

Ooops... about devices/conunit... <> is a macro argument enclosure (or something like that) and is now supported by snma.

NOTE: I haven't tried all the possible macros, so I don't claim all macros will work as intended. If you have some problems, a bug report is welcome.

StripC tool which is in the NDK3.1 won't handle the file exec/macros.i, BTW.

1.82 3.7.4 Notes about the directives

The OPT directive is changed to "SNMAOPT" to avoid any confusion with other assemblers which may have implemented the OPT directive differently.

The CPU directive works a little differently than the MACHINE directive found in some assemblers. So, to avoid any confusion I implemented a CPU directive.

1.83 3.7.5 Misc. notes

Alignement problems

~~~~~

SNMA does not produce mis-aligned code. One thing to mention:

```
;-----
s dc.b 'arg'      line 1
sl = *-s          line 2
    dc.w  0        line 3
;-----
```

The value of 'sl' will be 4 instead of the intended 3. SNMA 'adjusts' dc.b in this case with one null byte. To prevent this (so that 'sl' will get the right value), add EVEN or CNOP between line2 and line3. (It's good practice to have EVEN or CNOP 0,4 after 'DC.B's anyway).

One pass assembler

~~~~~

SNMA does not read and parse the source twice. So things like conditional assembly relating to the value of PC are probably going to break under snma. You don't have to declare normal symbols before you use them (with the exception of register equates and lists), snma is smart enough to create its private structures for them, and then solves them in pass2.

1.84 3.8 Error messages of SNMA

Error messages in SNMA are quite self explanatory. An error may be a "DEAD END" error which means that assembly cannot continue. An object file is NOT produced if there is even one error. If there is an old object file it is deleted so you don't link it by accident. There are a couple of warnings too. Grammar of the error messages is quite awful, by the way, but I hope you get an idea of what caused the error (I hope you understand this guide, too).

The first character of the possible cause of the error is under-scored. This might sometimes be in the wrong spot, so don't wonder if you think the error is somewhere else (it can be). I added this feature later on and there are quite a lot of places I should adjust it so that the error column will be in the right spot always. When I find it is in the wrong place I usually (or sometimes) try to fix the problem, which is not quite a big one.

When the error is in a macro you get two messages in the SHELL interface. The first one tells you where the error is in the macro and the second, where the macro call is which caused the error. The error count is incremented by one, because there is only one error, except in AREXX mode where both are counted.

When an error is found in pass 2 (solving undefined symbols...) you get only one error message when it's in a macro. This needs some work but, you can see where the error is quite easily even

now (well, not always...8-()

If you get an error which says its an internal bug or something similar, a bug report is welcome and appreciated.

You can control the error message mechanism with AREXX/SET command.

1.85 3.9 Known bugs

Yes, there are known bugs.

- Power operator associates from left to right.
- Branch optimizing will sometimes optimize branch (Bcc) although it shouldn't. This will happen when you have right combination of cnops and/or byte strings between branch. I'm not sure what this right combination is and therefore unable (at the moment) to fix the bug. So if snma complains something like "Must be 8-bit signed value" you have to add the .w extension (Bcc.w) to the branch instruction.

Although the cases when this happens are rare it is still annoying bug. Sorry about that.

Hmm, I couldn't reproduce above. If you can, please contact me. -MM

- Hmmm... probably something else, too. Contact me if you find any bugs!

1.86 4. SNMA, ARexx

The ARexx interface is implemented as a command host. The PORTNAME keyword in the template can be used to change the basename of the ARexx port. Default basename is SNMA.

RexxMaster must be running when using snma in ARexx mode.

SNMA itself cannot execute any ARexx macros, it is a simple command host.

4.1 General

4.2 Commands

4.3 Examples

SNMA's ARexx port is the first one I wrote so it may need little more polishing, but it works the way I want. Totally different question: is that way the right one?... 8^)

1.87 4.1 general ARExx stuff

GENERAL AREXX THINGS

~~~~~

I recommend you use snma as an ARExx host. Calling snma direct from the text editor and using a global symbol table cuts down assembly time. If you have difficulties in writing interface macros for the text editor you use, you can always utilize the ShellAsm.rexx macro. The interface is basically the same as in snma's shell mode. That way you can still use global tables. Also, snma is always in memory so, no load time in this method either.

It is possible to display error messages as in shell mode when snma is in ARExx mode. SNMA writes the messages to the default output if you want (you can always redirect the default output wherever you want, for example to con:). See AREXX/SET

There are lots of possibilities in using snma, be creative! (As always).

## 1.88 4.2 ARExx commands of SNMA

Many commands use RexxVariableInterface to pass information back.

4.2.1	ASM	Assemble file
4.2.2	CHDIR	Change working directory
4.2.3	FREE	Free resources of last assembly
4.2.4	GETERR	Get the errors
4.2.5	INFO	Get info about the last assembly
4.2.6	QUIT	Quit SNMA (ARExx)
4.2.7	SET	SET attributes
4.2.8	ADDGB	Add global include
4.2.9	REMG	Remove global include
4.2.10	SEEG	See global includes
4.2.11	SELFCHK	Check snma's code
4.2.12	MAKEST	Make symbol table file
4.2.13	INFO2	Return INFO in string

## 1.89 4.2.1 SNMA,ARExx: ASM command

### Command:

~~~~~ ASM SOURCEFILE/A,OBJ=O/K, INCLUDE=I/K, HEADER=H/K,  
LISTING=L/K,EQUATE=E/K

Template:

~~~~~

All the keywords are the same as in SNMA commandline.  
SNMA ARExx commandline does not have PORTNAME, AREXX

or SNMAOPT flags. You can set SNMAOPT flags with the SET command.

Results:

~~~~~

ASM command triggers SNMA to assemble SOURCEFILE. To find out how assembly went, see/use the INFO command.

1.90 4.2.2 SNMA, ARexx: CHDIR command

Command: CHDIR DIRNAME/A

~~~~~

Template: DIRNAME is the name of the directory

~~~~~

Function:

~~~~~

Changes the working directory of SNMA. You can set the working directory to be the same directory where your source file is with this command. If you have the include files in the same directory as the program source this becomes quite a helpful command. If DIRNAME does not exist or is a file, SNMA opens a Requester to tell you.

Why is this named CHDIR instead of CD ? To avoid any confusion between this and AmigaDOS CD.

## 1.91 4.2.3 SNMA, ARexx: FREE command

Command: FREE

~~~~~

Template: none

~~~~~

Function:

~~~~~

Frees all resources opened by the ASM command. After you execute this command you will lose all information about the previous assembly, including errors.

"Resources" here means memory. All file handling (opening/closing) is internal to the ASM command.

1.92 4.2.4 SNMA, ARexx: GETERR command

Command: GETERR NUMBER/N REMOVE/S WARN/S STEM/K

~~~~~

LINENUM/S LINETEXT/S FILENAME/S ERRTXT/S COLUMN/S

Template:

~~~~~

NUMBER error/warning number. SNMA keeps track of which error was requested last. If the number is omitted the next error is returned. If GETERR tries to fetch an error which does not exist it returns special values (see below).

REMOVE Toggling removes error from the list. Errors are numbered such that the first one is always number one and if you remove number one, the second one becomes number one and so on.

WARN Toggling causes GETERR to return WARNINGS instead of the ERRORS.

STEM variable specifies variable base name.

Results:

~~~~~

If STEM keyword is defined :

<STEM>.LINENUM  
<STEM>.LINETXT  
<STEM>.FILENAME  
<STEM>.ERRTXT  
<STEM>.COLUMN

<STEM>.LINENUM

The line number of the error. If this is NULL there is no such error as the one requested.

<STEM>.LINETXT

String which holds the source code line where the error is.

<STEM>.FILENAME

Name of the source code file.

<STEM>.ERRTXT

Error description text.

<STEM>.COLUMN

Column number where SNMA thinks the error is. If your source code has TABS in it you may need to change the TAB value with SET command to get the right column.

Default TAB is 8 (as AmigaDOS uses).

<STEM>.ERRNUM

Which error this was. Handy if you want to know when using GETERR to fetch next error. Number 1 is first.

GETERR returns RESULT string if one of the following switches is defined and STEM keyword is not:

```

LINENUM
LINETEXT
FILENAME
ERRTXT
COLUMN

```

As you can see they are same as STEM variables fields.  
Only one can be returned at time.

Function:

```
~~~~~
GetErr is used to fetch errors SNMA found in the
source code. Warnings are fetched with GetErr, too.
```

Errors are stored in a list. The first error is first in the list, second is second and so on. The Warnings are in a separate list.

Exactly how many errors is in the list can be found with the INFO command from the <STEM>.ERRORS field. Warnings are in the <STEM>.WARNINGS field.

GETERR REMOVE changes these values if you call INFO after GETERR REMOVE, but does not change them when you call GETERR.

If you call GETERR with an illegal error number (an error which does not exist) you will get the following results:

```

LINENUM=0
LINETEXT=' '
FILENAME=' '
ERRTXT='No more errors'
ERRIND=0

```

LINENUM=0 is not generated anywhere else because line numbers start at one(1), so it is safe to check this field in an ARexx macro if the error fetching was successful.

If you call GETERR to get the next error and there is no text error (all errors are handled) the situation is same as above.

## 1.93 4.2.5 SNMA, ARexx: INFO command

```

Command: INFO <STEM>
~~~~~

```

Template:

```
~~~~~
```

<STEM> is the stem variable where values are put.  
Look at INFO2 to get RESULT string.

```

Results:
~~~~~
<STEM>.STATUS      ok, warn, error, fail
<STEM>.LINES       How many lines we assembled
<STEM>.ERRORS      number of errors
<STEM>.WARNINGS    number of warnings
<STEM>.CODE        number of code sections
<STEM>.DATA        number of data sections
<STEM>.BSS         number of bss sections
<STEM>.CODESIZE    number of bytes in code sections
<STEM>.DATASIZE    number of bytes in data sections
<STEM>.BSSSIZE     number of bytes in bss sections
<STEM>.FAILSTR     possible failure string
                    (if STATUS="FAIL")

.STATUS           is one of the following strings:

    OK           = assembly went just fine / nothing
                  assembled yet
    WARN         = last assembly resulted warn
    ERROR        = last assembly resulted error
    FAIL         = last assembly resulted failure

    if .STATUS is "FAIL" .FAILSTR has the failure
    description.

.LINES           tells how many lines SNMA assembled. (Include
                  files are also counted for this).

.ERRORS          How many errors, if any. Failures don't count
                  here.

.WARNINGS        How many warnings there were, if any.

.CODE            Number of CODE sections.

.DATA and .BSS   are equivalent with .CODE

.CODESIZE        The number of bytes section(s) take. This is the
                  sum of all CODE sections.

.DATASIZE and .BSSSIZE are equivalent with .CODESIZE.

.FAILSTR         Possible failure description. See .STATUS.

```

## 1.94 4.2.6 SNMA, ARexx: QUIT command

```

Command:         QUIT
~~~~~
Template: none
~~~~~
Function:         Quits SNMA

```

~~~~~

1.95 4.2.7 SNMA, ARexx: SET command

Command: SET J=JOPT/T F=FOPT/T Q=QUICKOPT/T P=PCOPT/T A=ADDRESSOPT/T
 ~~~~~ B=BASEFORCE/T S=SYMBOL/T LB=LongBRA/T TABS/K/N  
 KS=KEEPSOURCE/T OF=OUTFILE/T RE=RXERR/T LNM=LSTNOMAC/T  
 LOD=LSTONLYDATA/T SR=SHORTRELOC32/T KO=KEEPOBJ/T MOVEM/T  
 EC=ERRCOLOR/K/N DEBUG/T OL=OPTLEVEL/K/N TD=TYPESDIR/T  
 CS=CASESEN/T CPU/K/N EXE/T

Template:

~~~~~ JOPT J flag bsr/jsr to bra/jmp  
 FOPT F flag lea/adda to addq/subq
 QUICKOPT Q flag move-moveq and so on
 PCOPT P flag absolute long ->pc-relative
 ADDRESSOPT A flag address mode optimizing
 BASEFORCE B flag ensure displ6(an) mode
 SYMBOL S flag write symbol hunk
 LongBRA L flag enable long branches (w/o .l
 suffix)

TABS

Number which specifies your current TAB setting. SNMA needs this value for the GETERR.COLUMN field. If the value is NULL or negative SNMA simply ignores it.
 Default: 8.

KEEPSOURCE

KS If off snma frees all the source code it allocated in the last assembly and you cannot print the line of the error, but when working from a text editor that is not necessary. When this flag is on, snma frees the source when the next assembly is started (or via FREE command), keeping the source code in memory between the previous assembly and the next one.
 one.
 Default: ON.

OUTFILE

OF Toggle to enable/disable normal snma output. With this is OFF snma will not write assembly messages to the default output. When ON snma writes to the default output.
 Default: OFF.

RXERR

RE Enable/disable ARexx errors. Normally, in ARexx mode this flag is kept on. If it is off snma will NOT generate ARexx error structures. INFO and GETERR commands think that there were no errors if this flag is off, even if there are errors.

Default: ON.

LSTNOMAC no macro expansions to the listing file
LNM Default: OFF.

LSTONLYDATA only those lines which define data.
LOD Default: OFF.

SHORTRELOC32 Use short reloc32 whenever possible.
SR Default: OFF.

KEEPOBJ Do not delete object file when there are
 errors in the source file.
Default: OFF.

MOVEM movem optimizing.
Default: ON.

ERRCOLOR Error highlighting.
EC Default: none.

DEBUG Toggle to enable debug line hunks
Default: OFF.

OPTLEVEL How many times to run optimizer.
OL Default: 1.

TYPESDIR Some macros implemented as directives.
TS Default: OFF.

CASESEN Case-sensitive symbols.
CS Default: ON.

CPU Initial CPUID value.
Default: -1.

EXE Produces an executable, instead of an object
 module.
Default: OFF

Function:

~~~~~

To change default settings of SNMA. The SNMAOPT  
directive overrides those flags which can be set with  
SNMAOPT. Some flags are the same as in the shell  
template .

Options set by this command override the ones parsed from  
SNMAOPTIONS file (if found). This is different from previous  
versions of SNMA, so be warned. The options are cached between  
successive assemblings until FREE command is used.

Option file doesn't have all options which "SET" ARexx  
command has.

The ARexx SET command has nothing to do with the SET  
directive.

---

## 1.96 4.2.8 SNMA, ARexx: ADDGB command

Command:       ADDGB  
 ~~~~~  
 SOURCEFILE/A, OBJ=O/K, INCLUDE=I/K, HEADER=H/K,
 LISTING=L/K, EQUATE=E/K

Template:
 ~~~~~  
               Template is same as in the   ASM   command.

Function:  
 ~~~~~  
 To add symbols and macros to the global table. A single
 ADDGB can add any number of include files to the global
 table.

ADDGB works like ASM with the following exceptions:

- 1) No code is generated
- 2) Second pass is not executed
- 3) Absolute symbols and macros are transferred to the global table at the end of assembly.
- 4) Include files are added to the internal include file list to prevent them from being included again.

Equates, sets, floating point equates and macros are transferred to the global table.

The idea of the global table is to lower include file loading and processing time. You need do this process only once after which SNMA will find the symbol (or macro) from the global symbol table if it is there. If you try to INCLUDE a file which has been ADDGB'd the include file will be skipped. If you have includes in your source the include files which are ADDGB'd are not processed.

SNMA locks the files you add to the global table. This prevents you from modifying the (still readable) files, as the change doesn't modify the global table anyway. The REMGB command can be used to remove a file from the global table.

Important! The main sourcefile symbols and macros are NOT transferred to the global table. A file you handle with this command usually contains some INCLUDE directives which SNMA processes. This enables you to process your current sourcefiles with ADDGB.

Errors are reported just like in the ASM command.

If you have includes which produce code and you want that code to be included DO NOT use the ADDGB command to include that file.

The Global table can be used only in ARexx mode.

So, what does all that mean in practice? There is a

little example in snma/examples. Look at it.

The current implementation of include file skipping tries to lock the file, even if it is in the global table and if it doesn't succeed it fails. For the hard disk users there is nothing to worry about, but the floppy users may find this frustrating. In theory, you should be able to add the include file to the global table from the floppy and then remove the actual disk where they were loaded, but as snma tries to lock these files it can't find them. Any floppy users out there? It is not a big task to change the include handling to allow the above situation. It is big enough to avoid if nobody really needs it though. (Hint: Invest in a hard disk. Yeah, I know, THAT requires money 8)

1.97 4.2.9 SNMA, ARexx: REMGB command

Command: REMGB FILENAME
~~~~~

Template:  
~~~~~ FILENAME Name of include file you want to remove.  
This removes only symbols added in the main include file. If this include has included other include files they will not be removed. If the FILENAME has been omitted, the global table is cleared and the symbols freed.

Function:
~~~~~ To remove symbols and macros for one file (or all) that have been included in the global tables. You can see what files are in the global tables with the SEEGB command.

I have the following alias defined in my shell-startup:

```
alias remgb "rx 'address SNMA remgb "[ ]'"
```

Then just typing remgb <name> will remove the file from the global table if present there.

Symbols which have been declared by using the SET directive belong to the first file which defined them. When you remove that file, the symbol is removed from the global table even if some other include file has changed it (i.e. declared by using SET).

## 1.98 4.2.10 SNMA, ARexx: SEEGB command

Command:     SEEGB     STEM

Template:

```
~~~~~
 STEM stem variable name.
 STEM.COUNT will hold the number of filenames
 STEM.0 filename 0
 STEM.1 filename 1
 STEM.n filename n
```

Function:

```
~~~~~
      To get information as to what files are in the global
      symbol table. If you don't specify a STEM variable this
      command is a no-op.
```

## 1.99 4.2.11 SNMA, ARexx: SELFCHK command

Command:     SELFCHK

~~~~~

Function:

```
~~~~~
      Calculates a new checksum from the snma's own code and
      compares it with that calculated in startup. If there's
      a difference snma will report it. Programs tend to run
      away every now and then when developing. Using this
      command you can make sure snma is still in good health.
      (Yes, sometimes memory protection would be nice).
```

1.100 4.2.12 SNMA, ARexx: MAKEST command

Command: MAKEST

~~~~~

Function:

```
~~~~~
 Produces symbol table file from the symbols and macros
 which are in the snma's global symbol table. This is the
 other way (another is to use global symbol tables) - but
 not mutually exclusive - to reduce include file handling
 time.
```

The include file produced is in a format which is much quicker to handle, but it lacks all the assembly directives and possible instructions.

You can, for example, create one file which will contain all the symbols and macros from the system include files, which can be loaded faster.

See INCLUDE directive documentation.

I added this command because I realised that not at all people are using ARexx interface and I found even by myself that loading symbol tables to memory in every assembly time have its strong points, especially when developing software which is full of bugs. So, now it can be done much quicker.

## 1.101 4.2.13 INFO2

Command: INFO2

Template:

```
STATUS/S ok, warn, error, fail
LINES/S How many lines we assembled
ERRORS/S number of errors
WARNINGS/S number of warnings
CODE/S number of code sections
DATA/S number of data sections
BSS/S number of bss sections
CODESIZE/S number of bytes in code sections
DATASIZE/S number of bytes in data sections
BSSSIZE/S number of bytes in bss sections
FAILSTR/S possible failure string
 (if STATUS="FAIL")
```

Function:

This command is almost same as INFO , but instead of returning results in STEM variable INFO2 returns result string. You can specify only one item at time. See INFO for more information about results.

## 1.102 4.3 ARexx examples

The ARexx directory of the snma package has many ARexx macros (programs). You may use them as they are or modify them anyway you like.

SNMA.ced            I use this script with own developments. It allows comfortable SNMA with CED integration. The best assembler with best editor. :-) Just set the paths to match your system environment. -MM

ShellAsm.rexx      is a simple macro to call from the shell and it does basically the same as SNMA in shell mode. This one looks a little better than that found in the V1.70 release.

addgb.rexx          adds symbols to the global table. Basically the same as ShellAsm.rexx.

seegb.rexx          displays what include files are in the snma global symbol table.

Other macros are for the XDME text editor. Those who have some other text editor (which supports ARExx) may find them helpful as an example in writing their own interface macros.

```
asm.xdme assembles file
GetErr.xdme fetches error information
snmainfo.xdme displays information about last assembly
```

These macros need a little more work but they do well for now. The GetErr macro also needs some work with 'user macro' errors.

Feel free to modify these macros anyway you please or write completely new ones. My taste is not necessarily yours.

If you modify these files and distribute them, please change the names and state what they are supposed to do clearly enough.

## 1.103 5. SnmaOpts

SnmaOpts is a program for setting snma's option files.

5.1 Shell startup

5.2 Workbench startup

5.3 Menus

5.4 Gadgets

## 1.104 5.1 SnmaOpts - Shell startup

```
FORMAT snmaopts [OPTFILE=<file>]
 [PUBSCREEN=<screen>]
 [WINX=<x>] [WINY=<y>]
 [FONT=] [FONTY=<fontsize>]
 [QUIET]
```

<file> Name of option file. Specifying this, SnmaOpts reads only this file.

<screen> Name of public screen to open window.  
Default: default public screen.

<x> <y> Window's place in screen.  
Default: Visible portion of screen.

<font> Name of the font to use in window. Use .font extension.  
Default: Screen's font, fallback to system's monospaced font or topaz 8, if window doesn't

fit to visible portion of screen.

<fontsize> Y size of the <font>.  
Default: 8.

QUIET Don't give error messages.

TEMPLATE OF=OPTFILE/K,PUBSCREEN/K,WINX/K/N,WINY/K/N,  
FONT/K,FONTY/K/N,QUIET/K

#### FUNCTION

SnmaOpts reads option file in. If you give <file> options are read from that file. Without file <file>, options are read first from ENV: and then from the current directory, from the file SNMAOPTIONS.

## 1.105 5.2 SnmaOpts - Workbench startup

SnmaOpts can be started from the Workbech. You can pass it argument by the extended selection (click SnmaOpts icon once, then hold down shift key, and double click icon you want to pass as an argument). SnmaOpts ignores all but first argument, because there is no point to pass many arguments.

TOOLTYPES:

PUBSCREEN=<screen>  
WINX=<x>  
WINY=<y>  
FONT=<font>  
FONTY=<fontsize>  
QUIET

The function of tooltypes is exactly same as the shell commandline options.

## 1.106 5.3 SnmaOpts - Menus

| Project<br>===== | shortcut<br>===== | function<br>=====                       |
|------------------|-------------------|-----------------------------------------|
| Save             | S                 | Save SNMAOPTIONS to current directory   |
| Save Def         | D                 | Save SNMAOPTIONS to ENV: and ENVARC:    |
| Save As...       | A                 | Save asking filename                    |
| Load             | L                 | Load SNMAOPTIONS from current directory |
| Load Def         | E                 | Load SNMAOPTIONS from ENV:              |
| Load As...       | O                 | Load asking filename                    |
| Restore Defs     |                   | Restore defaults                        |
| About            |                   | Display version                         |

|      |   |               |
|------|---|---------------|
| Quit | Q | Quit SnmaOpts |
|------|---|---------------|

## Settings

=====

This menu is currently disabled. Settings are read from the .info file of SnmaOpts or from the .info file of argument file (if started from WB). You can alter the settings by using Workbench's Information menu item, and manually set TOOLTYPES.

## 1.107 5.4 SnmaOpts- Gadgets

On the right side, there are always three gadgets:

Save                      Saves SNMAOPTIONS to current directory and quits.

|              |                                                  |
|--------------|--------------------------------------------------|
| Save default | Saves SNMAOPTIOS to ENV: and ENVARC: , and quits |
|--------------|--------------------------------------------------|

Cancel                      Quits

On the left side, there are group of gadgets (page) which can be cycled with the top gadget "Page". These gadgets display the state of option file and they can be used to alter options.

There are five pages: Optimizing, Result files, Debug & cpu, Misc and Include. Please refer to other sections of this manual to find out the meaning of the options to snma. Good starting point is section 2.1 startup from shell or 2.1.3 option file format.

## 1.108 6. Author

\*\*\*IMPORTANT\*\*\*

\*\*\*\*\*  
Please note that original author, Samu Nuojuu, no longer develops SNMA,  
so please do not disturb him with bug-reports/requests. Instead, write  
to me .  
\*\*\*\*\*

The author lives in Helsinki, Finland.

If you are using snma, by sending mail or a postcard you will motivate him to work with snma.

Send your comments, flames or whatever to

E-mail: [snuojua@cc.helsinki.fi](mailto:snuojua@cc.helsinki.fi)

or

email: Samu Nuoɔɔua



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Although snma is freeware, donations are always welcome.  
If you use snma to create something nice, how about sending me a copy ?  
(If it is not freely available).

Finally, thanks to Satu for the patience.

## **1.109 7. Current developer**

Please send all bug-reports or comments regarding SNMA to:

Mikolaj Calusinski <bloelle@.priv.gold.pl> or <bloelle@polbox.com>

Thank you.

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