MAC User's Guide

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MAC is based on an idea of Greg C. Warwar. The program was developed to add flexibility and interactivity to a language for manipulating data.

Language Purpose

MAC is a ***MAC***ro preprocessor dedicated to the preparation of ASCII data files. The program was developed to add flexibility and interactivity to a language for manipulating data.

MAC understands fairly simple directives: assignments, conditions, file inclusions, and exits. It is interpreted. ***MAC*** is fully integrated into the UNIX world as it understands the UNIX data pipe.

Unlike C preprocessors, the process is strictly sequential. Input files are scanned line by line. A line beginning with the symbol '**#**' is considered as a macro directive. Macro directives modify the behavior of ***MAC***. Other lines are considered as data lines. MAC processes data lines according to the previously defined macro directives. To avoid loops, a recognized macro is replaced by its direct definition; ***MAC*** does not attempt to go further by evaluating the definition itself.

Whenever possible, the syntax of ***MAC*** was kept identical to C preprocessors. Some features are omitted (macro functions, pragma directives...). ***MAC*** does understand features not handled by C preprocessors (default value, indirection, messages, interactive mode, prefixes, arithmetic computation including usual mathematical functions, ...).

MAC can analyze inputs and send warnings and error messages. Debugging is made easier by various integrated trace capabilities including 'verbose' mode and several levels of comments.

MAC supports two types of input: standard input "*stdin*" and ASCII files. The output is directed to standard output "*stdout*". Warnings, error messages and trace are directed to standard error output "*stderr*".

MAC is fast and can be made faster and more secure through the use of macro prefixes.

MAC is written in ANSI-C and is currently built and tested by the author with the MinGW GNU-C compiler on 64-bit Windows.

Glossary

MACRO: Identifier which will be replaced by its definition. All definitions are stored internally as strings.

name: left value

definition: right value

DIRECTIVE: ***MAC*** command. Directives begin with symbol **#**. They modify the behavior of ***MAC***.

TOKEN: A token is any printable ASCII text taken as a whole by ***MAC***. If punctuation marks, weird symbols or spaces have to be included in a single token, use single quotes to delimit the token.

These symbols are not considered as delimiters: **a...z A...Z 0...9 $ _ ! = < > | & [ ] % @**

OPERATION: Usual monadic and dyadic functions as defined in C language. Operations are applied only to numbers (internal type for operations: double precision).

SEQUENCE: Set of tokens delimited by one or more delimiters.

DATA: Input line that is not recognized as a macro directive. MAC processes data according to the previous ***MAC*** directives.

BLOCK: Set of contiguous input lines delimited by **#if**, **#ifdef**, **#ifndef**, **#else** or **#endif**.

LIST: Set of tokens delimited by commas, and declared as a list by dedicated directives (this is an advanced feature).

Convention Used in this Guide

NAM:	macro identifier (must be a token beginning with a letter, $ or _).
DIG:	one digit (0..9).
VAL:	Value or macro identifier.
EXPR:	An expression containing recognized functions, macro identifiers or numbers.
COMMENT:	any text ignored by ***MAC*** (not processed nor output).
[XXX]:	at most one, i.e. xxx is optional, a sequence of xxx is not authorized.
XXX:	exactly one, i.e. xxx is mandatory, a sequence of xxx is not authorized.
[XXX..]:	0, 1 or more, i.e. xxx is optional, a sequence of xxx is authorized.
XXX [XXX..]:	1 or more, i.e. xxx is mandatory, a sequence of xxx is authorized.
➔	keyboard input.
←	screen output.

MAC Command Line

MAC [option..] [filename..]

Options and filename can be mixed in any order. Options are processed immediately from left to right. Files are stored in a stack waiting for sequential processing. The first file to be processed is the last one.

MAC is compatible with UNIX pipes (see option "*-s[tdin]*"):

```
... UNIX_Command | MAC -s | UNIX_Command ...
... UNIX_Command | MAC -s > output_file
```

Command Line Options

-u [sage]

Usage on standard output.

This command produces a short usage on the standard output (see also appendix A).

When this option is checked, other options are ignored.

-b [uilt]

Built information on standard output.

When this option is checked, other options are ignored.

-h [elp]

Help on standard output.

This command produces a help panel on the standard output (see also appendix B).

When this option is checked, other options are ignored.

-s [tdin]

Standard input filter.

MAC considers the standard input "*stdin"* as its only input if no input files are provided. Keyboard entry is possible or data can be piped from other UNIX commands.

If input files are provided together with "*stdin*", all input files will always be processed before standard input.

-e [cho] file_pathname

Echoes macros from standard input into file.

It is sometimes useful to trap the keyboard entry to record a ***MAC*** session.

If the file <file_pathname> already exists, or if ***MAC*** is unable to open it, ***MAC*** will stop, producing an error message.

It is strongly recommended to use single quotes around the pathname as the UNIX parser could break its pathname into pieces.

All macro directives input through standard input "*stdin*" will be recorded in the echo file. Data will not be recorded. The echo file is directly reusable by ***MAC*** as is.

This option is automatically disabled, if option "*-s[tdin]*" is not chosen.

-d [efine] nam val

Equivalent to directive *"#define nam val"*.

It is strongly recommended to use single quotes around the value as the UNIX parser could break the value into pieces.

Value <val> is mandatory for this option.

-i [nt] nam expr

Equivalent to directive *"#int nam expr"*.

It is strongly recommended to use single quotes around the expression as the UNIX parser could break the expression into pieces.

Expression <expr> is mandatory for this option.

-r [eal] nam expr

Equivalent to directive *"#real6 nam expr"*.

It is strongly recommended to use single quotes around the expression as the UNIX parser could break the expression into pieces.

Expression <expr> is mandatory for this option.

-f [ix] nam expr

Equivalent to directive *"#fix2 nam expr"*.

It is strongly recommended to use single quotes around the expression as the UNIX parser could break the expression into pieces.

Expression <expr> is mandatory for this option.

-v [erbose]

Verbose mode enforced, trace to standard error output.

Verbose option produces extended comments on standard error output "*stderr*" about the processing of the directives and data. This option should be used with keyboard entry or during debugging.

This option enforces the verbose mode during all the ***MAC*** process and cannot be turned off by macro directive "*#verbose*".

It is strongly recommended to redirect the output into an output file to separate the trace generated by the verbose mode from the data output. It is possible to redirect trace and output into separate files using UNIX redirection (see examples next chapter).

-q [uiet]

Remove warning messages.

MAC issues warning messages, especially when redefining existing macros, removing non-existent objects... If these messages bother you, use this option to suppress warnings. This option is not generally recommended as it can hide precious warning messages.

-l [ine]

Replace macros by blank lines in data output.

By default, **MAC** does not output a blank line when processing a macro directive. It is sometimes necessary that the processed output data remain on the same line number as the input. In many cases, with or without checking this option, ***MAC*** can produce error messages with the correct error location.

-p [refix] nam

Defines prefix for a macro identifier.

It is often convenient to use a prefix for the macro identifier as the input file is more readable. The processing is more straightforward, ***MAC*** is faster especially when you are building a huge table of macros and processing a huge amount of text. There is no new constraint to the names of the macros: macros continue to be recognized inside other directives but macros inside data will not be processed if their names do not begin by the prefixes. For internal reasons, if "*-p[refix]*" option is checked, the prefixes '**$**' and '**@**' are added automatically to the list of prefixes you have defined. They are the prefixes of predefined macros (**$N, $V, $D, $F, $T**) or the prefix of macro indirection (**@**).

-c [omment]

Comment line traced on standard error output.

There are two types of macro comments. Active comment beginning with "**##**" can be traced on standard error output *"stderr*" when this option is checked. It helps to check and document the flow of data processing. Another comment, the passive comment beginning with "**#***" is never traced on "*stderr*" and can be used to document the source files.

[filename..]

The pathname of ASCII file(s) to be expanded sequentially. The processing is done according to the rule:

last in, first processed,

with the exception of standard input "*stdin*" (option -s[tdin]), which is always processed after the process of these files is completed.

It is strongly recommended to use single quotes around the filename as the UNIX parser could break its pathname into pieces.

Non-existent files or locked files will cause ***MAC*** to issue an error message and to exit.

MAC Predefined Macros

Some macros are predefined automatically by ***MAC***. They are not protected and can be overwritten during a ***MAC*** session. They are especially useful to document the output file.

$N: empty string.

$D: current time and date at the beginning of the process.

$V: the current version of ***MAC***.

$F: current file name.

$T: current file tag name (see directive "*#tag*").

Macro directives

Inside processed files, directives recognized by the MACro expander begin with the symbol **#**. ***MAC*** directives MUST be the first word of the line. Unrecognized directives will cause a warning.

#include val

File to be processed. <val> can be a pathname (single quotes are recommended if the pathname contains weird symbols). If <val> is itself a macro, <val> is replaced by its definition.

Including a file that cannot be accessed causes an error message and ***MAC*** exit.

Pathname <val> must be a token.

#insert val

File to be copied without processing. <val> can be a pathname (single quotes are recommended if the pathname contains weird symbols). If <val> is itself a macro, <val> is replaced by its definition.

Inserting a file that cannot be accessed causes an error message and ***MAC*** exit.

Pathname <val> must be a token.

#define nam [val]

Definition without arithmetic evaluation. <nam> must be an identifier. If <val> is itself an existing macro, <val> is replaced by its definition.

If <val> is omitted, and the macro was not yet defined, the macro is defined as containing an empty string.

If <val> is omitted and the macro already exists, its definition is reevaluated, i.e. <val> will be scanned for macro replacement.

It is allowed to redefine a macro if the macro is empty. Redefining a macro with a new definition causes a warning message. <val> does not need to be a token but leading and trailing spaces are dropped.

Use single quotes as a delimiter if you want to include leading or trailing spaces. Use backquotes to protect the definition from processing.

#default nam [val]

If <nam> is already defined, the "*#default*" directive is ignored. The behavior of this directive is similar to the directive "*#define*".

<val> does not need to be a token, leading and trailing spaces are dropped.

#undef nam [nam..]

Undefine a list of macros. Macros are removed and memory is freed.

Removing a macro that does not exist causes a warning message.

#int nam [expr]

[Definition with] evaluation and casting to integer (rounding).

This directive is similar to "*#define*" but the arithmetic evaluation is performed, data are cast to integer and stored as a string.

If no <expr> is provided, the definition of <nam> is cast to **int** and stored as a string.

If the result cannot be expressed as a number, an error message is issued.

#real [dig] nam [expr]

[Definition with] evaluation and casting to floating real (scientific notation with <dig> digits for the decimal part, default = 6).

This directive is similar to "*#define*" but the arithmetic evaluation is performed, data are cast to float and stored as a string.

If no <expr> is provided, the definition of <nam> is cast to **double** and stored as a string.

If the result cannot be expressed as a number, an error message is issued.

#fix [dig] nam [expr]

[Definition with] evaluation and casting to fixed real (fixed decimal notation with precision equal to <dig>, default = 2).

This directive is similar to "*#define*" but the arithmetic evaluation is performed, data are cast to fixed real and stored as a string.

If no <expr> is provided, the definition of <nam> is cast to **fixed real** and stored as a string.

If the result cannot be expressed as a number, an error message is issued.

#cat nam [val..]

Concatenate a sequence of <val> to the definition of <nam>.

If <val> is itself a macro, its definition is used.

If <nam> does not exist, the macro is created and its definition contains the result of the concatenation of <val>.

<val> must be a token or a sequence of tokens.

#ask nam [val]

If <nam> is already defined, the "*#ask*" directive is ignored.

If <nam> is not yet defined, message <val> is displayed on stderr and ***MAC*** is waiting for input data from standard input "*stdin*".

If <val> contains macros, these macros are replaced by their definition.

The behavior of this directive is similar to the directive "*#default*". Message <val> can be omitted, although it does not make sense.

#freeze nam [nam..]

Put single backquotes around the definition of <nam>. All previous backquotes are removed. New backquotes are placed at the beginning and the end of the definition. This directive can process a sequence of macros. The definition is then protected from further processing.

#melt nam [nam..]

Remove all single backquotes from the definition of <nam>. This directive can process a sequence of macros. The definition is no longer protected against processing. This directive itself does not try to reevaluate the definition.

#if expr

Execute "if block" when <expr>, evaluated and cast to integer, is not zero. If <expr> cannot be evaluated and/or cannot be cast to integer, an error message is issued.

See also "*#else*" and "*#endif*" directives.

#ifdef nam [val]

Execute "ifdef block" when <nam> is defined equal to <val> (string comparison). If <val> is itself a macro, during test <val> is replaced by its definition. If <val> is omitted, the macro is only tested for existence; its content is not checked.

See also "*#else*" and "*#endif*" directives.

<val> must be a token.

#ifndef nam [val]

Execute "ifndef" block when <nam> is defined not equal to <val> (string comparison). If <val> is itself a macro, during test <val> is replaced by its definition. If <val> is omitted, the macro is tested for non-existence.

See also "*#else*" and "*#endif*" directives.

<val> must be a token.

#else [comment]

"else block". Complete the "*#if*", "*#ifdef*" or "*#ifndef*" directives. "if block" must be complete inside a file (if, [else,] endif).

It is not allowed to begin an if directive in a file and complete it with an else directive in another one. A comment is always ignored.

#endif [comment]

End of a conditional block. An if block must be completed inside a file (if, [else,] endif).

It is not allowed to begin with an if directives in a file and close it by a "*#endif*" in another one. If the number of "*#endif*" does not match the number of if directives, ***MAC*** will abort with an error message. A comment is always ignored.

#msg [val]

Send message <val> to standard error output "*stderr*".

If <val> is a macro, it is replaced by its definition. If <val> is omitted, a blank line is sent to standard error output "*stderr*".

#exit [val]

Exit from the current file. ***MAC*** will continue to process the remaining files but ***MAC*** normal termination occurs if nothing more has to be processed.

Message <val> is issued on standard error output "*stderr*".

#quit [val]

MAC normal termination whatever remaining files to be processed exist.

Message <val> on standard error output "*stderr*".

#abort [val]

Abnormal termination, <val> is sent to standard error output "*stderr*".

If <val> is a macro, it is replaced by its definition.

#stop [val]

Enforce unconditional ***MAC*** termination. It is ALWAYS processed, independently of any if condition, "*skip*" directive... This directive is useful when using ***MAC*** in interactive mode. Message <val> on standard error output "*stderr*".

#skip [expr]

Toggle Skip Mode On|Off [or set/reset if <expr> is (not) zero].

It is ALWAYS processed, independently of any if condition... When skip mode is enforced, directives and data are skipped.

#verbose [expr]

Toggle Verbose Mode On|Off [or set/reset if <expr> is (not) zero].

This directive cannot turn off the command line option "*-v[erbose]*". Every line is analyzed and processing is detailed on standard error output "*stderr*".

#macro [nam..]

List all macros on standard error output "*stderr*" [or a sequence of macros by name]. This directive is used for debugging.

#status [val]

Show status of ***MAC*** variables on standard error output "*stderr*". This directive is used for debugging.

<val> is sent to standard error output "*stderr*" as status title. If <val> is a macro, it is replaced by its definition.

It is ALWAYS processed independently of any if condition.

[val]

MAC single line active comment. In comment mode, <val> is traced on standard error output "*stderr*".

#* [comment]

MAC single line passive comment. <comment> is always ignored and never traced.

#tag [val]

Define a file tag name for the currently processed file. The new tag is <val> and will be used in error or warning messages. Without a tag directive, the default file tag name is the file name itself.

#list nam

The definition of previously defined macro <nam> is considered as a one-dimensional list of elements separated by commas. A list of macros nam[0], nam[1], ... is created.

This is an advanced feature. Its use will be documented later.

Functions and expressions

Functions recognized by the MACro expander

Operations follow the C language convention (power function excepted: symbol **^**) applied to double. All operations apply ONLY to numbers or to macros that can be evaluated as numbers. All operations produce numbers.

TAKE CARE: Monadic functions MUST be enclosed in parentheses (see below)

Grouping sub-expressions

Parentheses are used to group subexpressions. It is recommended to use parentheses as often as possible to remove ambiguity.

✘ Parser is not complying with the priority rules of C.

MAC Monadic functions

+	-	
!		
(sin ())	(asin ())	
(cos ())	(acos ())	
(tan ())	(atan ())	
(sinh ())		
(cosh ())		
(tanh ())		
(exp ())	(log())	
(log10 ())		
(abs ())	(sign ())	
(floor ())	(ceil ())	(round ())

MAC Dyadic functions

+	-	*	/	%	^
>	<	>=	<=	==	!=
||	&&				

MAC Indirection

[@..]nam

Indirection is possible using symbol(s) '@' ahead of a macro name. MAC handles multiple levels of indirection.

Representation of strings and numbers

MAC is storing data as strings in an internal dictionary.

The macro dictionary is updated by many directives. It is possible to obtain an image of the content of the dictionary using directive "*#macro*". Memory is allocated dynamically. As a consequence, the dictionary is reordered as soon as a directive has to remove or update a previous definition.

Text

Quotes can be used to protect the text from evaluation or to delimit fields (space, weird symbols...). Quotes are interpreted slightly differently in directives and data:

'text' (directive): Delimit a field, quotes are removed in output. The text is considered as a whole (single token).

'text' (data): No effect. Quotes are considered as regular single characters. The text is processed by tokens.

`text` (data or directive): Text unprocessed by ***MAC***, backquotes are removed in output. The text is considered as a whole (single token).

"text" (data or directive): No effect. Double quotes are considered as regular single characters. The text is processed by tokens.

Strings are converted to numbers (C number of type double) when requested. All arithmetic is performed with double precision. Data are cast to integer or real at the output as requested by a dedicated directive.

Numbers accepted by *MAC*

Convention follows FORTRAN, Pascal or C languages.

Symbols reserved to *MAC*

Do not use backquotes or '@' in data lines except for text protection (`) or indirection (@).

Examples by topics

Example 1: usage and help (option)

-u[sage]
-h[elp]

Command Line: **`MAC -u`**

Result: The latest usage of ***MAC*** will be shown on screen (see also appendix A).

Command Line: **`MAC -h > 'foo.help'`**

Result: File 'foo.help' will contain the latest help of ***MAC*** (see also appendix B).

Command Line: **`MAC -h -s toto > 'foo.help'`**

Result: Result identical to the previous example. Options other than "*-h*" are ignored.

Example 2: standard input, echo, verbose (option).

-s[tdin]
-e[cho] pathname
-v[erbose]

Command Line: **`MAC -s`**

Result: **MAC** is waiting for input from the keyboard. Use exit directive ("*#exit*", "*#quit*" or "*#stop*") to quit keyboard input. Use the keyboard to input line by line macro directives and data. As input and output are interleaved on screen, it is recommended to redirect output to a file. When using the keyboard as input, it is also recommended to use the option "*-v[erbose]*" to track mistakes:

Command Line: **`MAC -s -v > foo.out`**

Result: ***MAC*** is waiting for input from the keyboard. Verbose mode is enforced. Trace of the process appears on the screen. The result is redirected to file 'foo.out' and does not mix with the trace.

Command Line: **MAC -s -v -e '/user/JDoe/foo.echo' > foo.out**

Result: ***MAC*** is waiting for input from the keyboard. Verbose mode is enforced. Trace of the process appears to standard error output "*stderr*". The result is redirected to file 'foo.out' and does not mix with the trace. File 'foo.echo' stores all macro directives (and only macro directives) you have input from the keyboard through standard input "*stdin*".

Command Line: **(MAC -v foo.in > foo.out) >& foo.err**

Result: ***MAC*** output is redirected towards 'foo.out'. Trace or messages are redirected towards 'foo.err' (UNIX).

Here is the transcription of a ***MAC*** session.

```
➔       %       MAC -s -v -e foo.echo > foo.out
➔
➔       Option -e[cho]   :  Standard Input will be echoed into file 'foo.echo'.
➔       Option -v[erbose]:  Verbose mode is enforced, trace on stderr.
➔
➔       Input files to be sequentially processed:
➔       [  1]:   Standard Input
➔
➔       No prefix defined, all macros are global.
➔
➔       Macros currently defined:
➔       [  1]:  (  global)  $N          <>
➔       [  2]:  (  global)  $V          <DOS V3.04>
➔       [  3]:  (  global)  $D          <Mon Sep 14 19:45:07 2026>
➔       [  4]:  (  global)  $F          <Standard Input>
➔       [  5]:  (  global)  $T          <Standard Input>
➔
➔          (FILE) -> processing line    0 of 'Standard Input'
➔       #quit
➔
➔          (FILE) -> exiting at line    1 of 'Standard Input'
➔
➔                   *** CALL FOR EXIT, MAC NORMAL TERMINATION ***
➔       %
```

Example 3: define, int, real, fix (option).

-d[efine] nam val
-i[nt] nam expr
-r[eal] nam expr
-f[ix] nam expr

Command Line: **MAC -s -v -i num 123**

Result: ***MAC*** is waiting for input from the keyboard. Verbose mode is enforced. Macro 'num' is defined as an integer equal to '123'.

Command Line: **MAC -s -v -d text1 ' Hello world!' -i num 123 -i count 34**

Result: ***MAC*** is waiting for input from the keyboard. Verbose mode is enforced. Macros 'text1', 'num' and 'count' are defined.

Here is the transcription of this last ***MAC*** session.

```
➔       % MAC -s -v -d text1 ' Hello world!' -i num 123 -i count 34
```

```
Option -v[erbose]:  Verbose mode is enforced, trace on stderr.

Input files to be sequentially processed:
[  1]:   Standard Input

No prefix defined, all macros are global.

Macros currently defined:
[  1]:  (  global)  $N          <>
[  2]:  (  global)  $V          <DOS V3.04>
[  3]:  (  global)  $D          <Mon Sep 14 19:45:07 2026>
[  4]:  (  global)  text1               < Hello world!>
[  5]:  (  global)  num         <123>
[  6]:  (  global)  count               <34>
[  7]:  (  global)  $F          <Standard Input>
[  8]:  (  global)  $T          <Standard Input>

   (FILE) -> processing line    0 of 'Standard Input'
#quit

   (FILE) -> exiting at line    1 of 'Standard Input'

            *** CALL FOR EXIT, MAC NORMAL TERMINATION ***
 %
```

Example 4: quiet mode (option).

-q[uiet]

Command Line: **`MAC -s -q`**

Result: ***MAC*** will issue no warning messages at all.

Example 5: prefix (option).

-p[refix] nam

Command Line: **`MAC -s -v -p 'RULE_' -p '$D' > foo.out`**

Here is the transcription of this ***MAC*** session.

```
% MAC -s -v -p 'RULE_' -p '$D' > foo.out

Option -p[refix] :  Prefix '$' and '@' are automatically added by MAC.
Option -v[erbose]:  Verbose mode is enforced, trace on stderr.

Input files to be sequentially processed:
[  1]:   Standard Input

Prefixes currently defined:
[  1]:  (  system)  $
[  2]:  (  system)  @
[  3]:  (    user)  RULE_
[  4]:  (    user)  $D

Macros currently defined:
```

```
[  1]:  (  global)  $N          <>
[  2]:  (  global)  $V          <DOS V3.04>
[  3]:  (  global)  $D          <Mon Sep 14 19:45:29 2026>
[  4]:  (  global)  $F          <Standard Input>
[  5]:  (  global)  $T          <Standard Input>

   (FILE) -> processing line    0 of 'Standard Input'
#quit

   (FILE) -> exiting at line    1 of 'Standard Input'

            *** CALL FOR EXIT, MAC NORMAL TERMINATION ***
%
```

In this session, every macro beginning with 'RULE_', '$D', '$' or '@' found in a data line will be replaced by its definition. Other macros in data lines will be ignored. Processing of macro directives is not affected by prefixes.

Example 6: blank line (option).

-l[ine]

Command Line: **MAC -s -l > foo.result**

Result: Each macro directive will be replaced by a blank line. Without option "*-l*", a macro directive does not produce a blank line in the output file.

Example 7: comment mode (option).

-c[omment]

Command Line: **MAC foo.in -c > foo.result**

Result: line beginnings by "**##**" are traced on standard error output.

Example 8: input files (command line).

filenames

Command Line: **MAC -v 'file1' -s 'file2' '/user/Doe' > foo.result**

Result: Input files are processed, beginning with the last one. Standard input will be processed after all input files.

Here is the transcription of this ***MAC*** session.

```
% MAC -v 'file1' -s 'file2' '/user/Doe' > foo.result

Option -v[erbose]:  Verbose mode is enforced, trace on stderr.

Input files to be sequentially processed:
[  1]:   /user/Doe
[  2]:   file2
[  3]:   file1
```

```
      [  4]:   Standard Input

      No prefix defined, all macros are global.

      Macros currently defined:
      [  1]:  (  global)  $N          <>
      [  2]:  (  global)  $V          <DOS V3.04>
      [  3]:  (  global)  $D          <Mon Sep 14 19:46:20 2026>
      [  4]:  (  global)  $F          <Standard Input>
      [  5]:  (  global)  $T          <Standard Input>

         (FILE) -> processing line    0 of '/user/Doe'

etc. etc.
      %
```

Example 9: predefined macros.

Predefined macros

Five macros are currently predefined by ***MAC***: $N, $V, $D, $F and $T. They can be used as user-defined macros.

```
      % MAC -s -v > foo.out

      Option -v[erbose]:  Verbose mode is enforced, trace on stderr.

      Input files to be sequentially processed:
      [  1]:   Standard Input

      No prefix defined, all macros are global.

      Macros currently defined:
      [  1]:  (  global)  $N          <>
      [  2]:  (  global)  $V          <DOS V3.04>
      [  3]:  (  global)  $D          <Mon Sep 14 19:46:05 2026>
      [  4]:  (  global)  $F          <Standard Input>
      [  5]:  (  global)  $T          <Standard Input>

         (FILE) -> processing line    0 of 'Standard Input'
      #quit

         (FILE) -> exiting at line    1 of 'Standard Input'

                  *** CALL FOR EXIT, MAC NORMAL TERMINATION ***
      %
```

Example 10: define, default, undef, int, real, fix.

#define nam [val]
#default nam [val]
#undef nam [nam..]
#int nam [expr]
#real nam [expr]
#fix [dig] nam [expr]

```
➔       % MAC foo -d C 123 > foo.out
➔       %
```

Where input file 'foo':

```
#define  A ' Hello World! '          (text including spaces)
#define  B val1                      (token not defined as a macro)
#default C 999                       (default not used as C is already defined)
#default D toto                      (default used as D is not already defined)
#int     E 432.1                     (number with casting to integer)
#real    F 1                         (number with casting to real (scientific))
#fix2    G 123.4567                  (number with casting to real (two decimals))
#define  H B                         (using definition of another macro)
#define  I C                         (using definition of  another macro)
#int     J ((abs(-1)) + 12) / 7      (evaluation of an expression and casting)
#real    K (exp(1))                  (evaluation of an expression and casting)
#fix     L 20 * (log10(1000))        (evaluation of an expression and casting)
#define  M 'my name is D'            (text where the token D is already defined)
#int     N C + 2                     (number, token C is already defined)
#define  O                           (macro with empty definition)
#define  toto qwerty                 (token not defined as a macro)
macros are defined now               (data [ 1] without token defined as macro)
`A`    =    A                        (data [ 2] with token defined as macro)
`B`    =    B                        (data [ 3] with token defined as macro)
`C`    =    C                        (data [ 4] with token defined as macro)
`D`    =    D                        (data [ 5] with token defined as macro)
`E`    =    E                        (data [ 6] with token defined as macro)
`F`    =    F                        (data [ 7] with token defined as macro)
`G`    =    G                        (data [ 8] with token defined as macro)
`H`    =    H                        (data [ 9] with token defined as macro)
`I`    =    I                        (data [10] with token defined as macro)
`J`    =    J                        (data [11] with token defined as macro)
`K`    =    K                        (data [12] with token defined as macro)
`L`    =    L                        (data [13] with token defined as macro)
`M`    =    M                        (data [14] with token defined as macro)
`N`    =    N                        (data [15] with token defined as macro)
`O`    =    O                        (data [16] with token defined as macro)
`P`    =    P                        (data [17] without token defined as macro)
`toto` =    toto                     (data [18] with token defined as macro)
#undef   A C E G I                   (remove definition of macros)
#fix     F                           (casting of already defined macro)
#real    L                           (casting of already defined macro)
#define  D                           (macro D is already defined )
                                     (data [19] is a blank line)
macros are redefined now             (data [20] without token defined as macro)
`A`    =    A                        (data [21] without token defined as macro)
`B`    =    B                        (data [22] with token defined as macro)
`C`    =    C                        (data [23] without token defined as macro)
`D`    =    D                        (data [24] with token defined as macro)
`E`    =    E                        (data [25] without token defined as macro)
`F`    =    F                        (data [26] with token defined as macro)
`G`    =    G                        (data [27] without token defined as macro)
`H`    =    H                        (data [28] with token defined as macro)
`I`    =    I                        (data [29] without token defined as macro)
`J`    =    J                        (data [30] with token defined as macro)
`K`    =    K                        (data [31] with token defined as macro)
`L`    =    L                        (data [32] with token defined as macro)
`M`    =    M                        (data [33] with token defined as macro)
`N`    =    N                        (data [34] with token defined as macro)
`O`    =    O                        (data [35] with token defined as macro)
`P`    =    P                        (data [36] without token defined as macro)
`toto` =    toto                     (data [37] with token defined as macro)
```

Data lines contained in 'foo' are processed according to macro directives,

output is located in file 'foo.out':

```
macros are defined now        (corresponding to [ 1])
A    =     Hello World!       (corresponding to [ 2])
B    =    val1                (corresponding to [ 3])
C    =    123                 (corresponding to [ 4])
D    =    toto                (corresponding to [ 5])
E    =    432                 (corresponding to [ 6])
F    =    1.000000e+00        (corresponding to [ 7])
```

```
G     =    123.46              (corresponding to [ 8])
H     =    val1                (corresponding to [ 9])
I     =    123                 (corresponding to [10])
J     =    2                   (corresponding to [11])
K     =    2.718282e+00        (corresponding to [12])
L     =    60.00               (corresponding to [13])
M     =    my name is toto     (corresponding to [14])
N     =    125                 (corresponding to [15])
O     =                        (corresponding to [16])
P     =    P                   (corresponding to [17])
toto  =    qwerty              (corresponding to [18])
                                (corresponding to [19])
macros are redefined now       (corresponding to [20])
A     =    A                   (corresponding to [21])
B     =    val1                (corresponding to [22])
C     =    C                   (corresponding to [23])
D     =    qwerty              (corresponding to [24])
E     =    E                   (corresponding to [25])
F     =    1.00                (corresponding to [26])
G     =    G                   (corresponding to [27])
H     =    val1                (corresponding to [28])
I     =    I                   (corresponding to [29])
J     =    2                   (corresponding to [30])
K     =    2.718282e+00        (corresponding to [31])
L     =    6.000000e+01        (corresponding to [32])
M     =    my name is toto     (corresponding to [33])
N     =    125                 (corresponding to [34])
O     =                        (corresponding to [35])
P     =    P                   (corresponding to [36])
toto  =    qwerty              (corresponding to [37])
```

Example 11: include and insert.

```
#include val
#insert val
```

```
➔       % MAC foo -d fnm '/user/John/Doe/' > 'foo.out'
➔       %
```

Where the input file 'foo':

```
the title is included now

inserting file
#insert '/user/title'

processing file fnm
#include fnm

`A` is equal to A
`B` is equal to B

thank you for your attention
```

Inserted file: '/user/title'

```
EXAMPLE OF FILE INSERTION
#define A 123
`A` is not defined
```

Included file: '/user/John/Doe'

```
EXAMPLE OF FILE INCLUSION
#define B 234
`B` is defined
```

Data lines contained in 'foo' are processed according to macro directives, files are inserted (copied without processing) or included (copied with processing).

The output is located in file 'foo.out':

```
the title is included now

inserting file
EXAMPLE OF FILE INSERTION
#define A 123
`A` is not defined

processing file /user/John/Doe
EXAMPLE OF FILE INCLUSION
B is defined

A is equal to A
B is equal to 234

thank you for your attention
```

Example 12: concatenation.

#cat nam [val..]

```
➔       % MAC foo -d gen RULE > 'foo.out'
➔       %
```

Where the input file 'foo':

```
#define A 1
#cat B gen '_' A
properly concatenated, the name of the rule is B
#define C ABRA
#cat C CAD C
C
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
properly concatenated, the name of the rule is RULE_1
ABRACADABRACAD
```

Example 13: ask and message.

#ask nam [val]
#msg [val]

```
➔       % MAC foo -d A 123 > 'foo.out'
➔       Hi dude!
➔       Introduce number 2:
➔       234
➔       Thank you!
➔       %
```

Where the input file 'foo':

```
#msg 'Hi dude!'
#ask A 'Introduce number 1:'          (skipped as A is already defined)
#ask B 'Introduce number 2:'
```

```
number 1 is equal to A
number 2 is equal to B
#define message  'Thank you!'
#msg message
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
number 1 is equal to 123
number 2 is equal to 234
```

Example 14: freeze and melt.

#freeze nam [nam..]
#melt nam [nam..]

```
➔       % MAC foo > 'foo.out'
➔       %
```

Where input file 'foo':

```
#define B A plus A
#define C A plus A
(B) is identical to (C)
#freeze B
#define A 123
#define B
#define C
(B) is no more identical to (C)
#melt B
#define B
(B) is identical to (C)
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
(A plus A) is identical to (A plus A)
(A plus A) is no more identical to (123 plus 123)
(123 plus 123) is identical to (123 plus 123)
```

Example 15: if, else, endif, ifdef, ifndef.

#if expr
#ifdef nam [val]
#ifndef nam [val]
#else [comment]
#endif [comment]

```
➔       % MAC foo -d AA something -d BB qwerty > 'foo.out'
➔       %
```

Where input file 'foo':

```
#define AA
#ifdef AA
`AA` is defined, but empty or not (AA)
#endif
#ifdef BB qwerty
```

```
`BB` is defined (BB)
#endif
#ifdef CC
this line will be skipped
#else
this line is processed as `CC` is not defined
#endif
#ifndef DD
this line is processed as `DD` is not defined
#endif
#define var 123
#if ((var - 122) == 1)
Yes, (var - 122) == 1 !
#endif
#if (var > 0)
Yes, var is positive
#if (var > 100)
Yes, var is greater than 100
#endif
#endif
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
AA is defined, but empty or not  (something)
BB is defined (qwerty)
this line is processed as CC is not defined
this line is processed as DD is not defined
Yes, (123 - 122) == 1 !
Yes, 123 is positive
Yes, 123 is greater than 100
```

Example 16: exit.

#exit [val]

```
➔       % MAC foo > 'foo.out'
➔       I quit as you ask it so kindly
➔       %
```

Where input file 'foo':

```
#ifdef NOTDEF
#exit 'skipped'
#else
#quit 'I quit as you ask it so kindly'
#endif
➔       % MAC foo > 'foo.out'
➔       I quit file /user/John/Doe
➔       %
```

Where the input file 'foo':

```
#include '/user/John/Doe'
Welcome back to the main file
```

and included file '/user/John/Doe':

```
Welcome to file '/user/John/Doe'
#exit 'I quit file '/user/John/Doe'
this part is skipped
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
Welcome to file '/user/John/Doe'
```

```
Welcome back to the main file
```

Example 17: quit.

#quit [val]

```
➔      % MAC foo > 'foo.out'
➔      I quit as you ask it so kindly
➔      %
```

Where the input file 'foo':

```
#ifdef NOTDEF
#quit 'skipped'
#else
#quit 'I quit as you ask it so kindly'
#endif
```

Example 18: abort.

#abort [val]

```
➔      % MAC foo > 'foo.out'
➔
➔      line[1]  [foo]
➔      MAC user error - Horror!
➔      %
```

Where input file 'foo':

```
#ifdef NOTDEF
#quit 'skipped'
#else
#abort 'Horror!'
#endif
```

Example 19: stop.

#stop [val]

```
➔      % MAC foo > 'foo.out'
➔      I am forced to quit
➔      %
```

Where the input file 'foo':

```
(...anything...)
#stop 'I am forced to quit '
(...anything...)
```

Example 20: skip.

#skip [expr]

```
➔      % MAC foo > 'foo.out'
➔      %
```

Where input file 'foo':

```
#define A 'Hello world!'
#define condition 1
#skip condition                          (skip mode is set to ON)
this text will be skipped
#define SKIPPED 'forget it'
#skip (condition - 1)                    (skip mode is set to OFF)
Here is the message: A
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
Here is the message: Hello world!
```

"*#skip*" can be used as a toggle:

```
➔      % MAC foo > 'foo.out'
➔      %
```

Where the input file 'foo':

```
#define A 'Hello world!'
#skip                                    (skip mode is toggled to ON)
this text will be skipped
#define SKIPPED 'forget it'
#skip                                    (skip mode is toggled to OFF)
Here is the message: A
```

Data lines contained in 'foo' are processed according to macro directives, the output is located in file 'foo.out':

```
Here is the message: Hello world!
```

Example 21: verbose.

#verbose [expr]

```
➔      % MAC foo > 'foo.out'
➔
➔      (   3) ->  #verbose
➔      (....) <- <Verbose Mode>       <Toggled to  On>
➔
➔      (   4) ->  #define B 234
➔      (....) <- <B>  <234>
➔
➔      (   5) ->  `B` is equal to B
➔      (   2) <- <`B` is equal to 234 >
➔
➔      (   6) ->  #verbose
➔      (....) <- <Verbose Mode>       <Toggled to Off>
➔      %
```

Where input file 'foo':

```
#define A 123
`A` is equal to A
#verbose
#define B 234
`B` is equal to B
#verbose
```

```
#define C 345
`C` is equal to C
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
 A is equal to 123
 B is equal to 234
 C is equal to 345
```

Example 22: macro listing.

#macro [nam..]

```
➔      % MAC foo > 'foo.out'
➔
➔      [  1]:  (  global)  $N          <>
➔      [  2]:  (  global)  $V          <DOS V3.04>
➔      [  3]:  (  global)  $D          <Mon Sep 14 19:46:05 2026>
➔      [  4]:  (  global)  $F          <foo>
➔      [  5]:  (  global)  $T          <foo>
➔      [  6]:  (  global)  A           <123>
➔      [  7]:  (  global)  B           <>
➔      [  8]:  (  global)  C           <' Hello World!!! '>
➔      [  9]:  (  global)  D           <3>
➔
➔      [  1]:  (  global)  $N          <>
➔      [  2]:  (  global)  $V          <DOS V3.04>
➔      [  3]:  (  global)  $D          <Mon Sep 14 19:46:05 2026>
➔      [  4]:  (  global)  $F          <foo>
➔      [  5]:  (  global)  $T          <foo>
➔      [  6]:  (  global)  B           <>
➔      [  7]:  (  global)  C           <' Hello World!!! '>
➔      [  8]:  (  global)  D           <3>
➔      %
```

Where input file 'foo':

```
#define A 123
#define B
#define C ' Hello World!!! '
#int    D 1 + 2
#macro
#undef A
#macro
```

Example 23: *MAC* status.

#status [val]

```
➔      % MAC foo > 'foo.out'
➔
➔      MAC Internal Status
➔
➔      File Name       :       'foo'
➔      File Tag Name   :       'foo'
➔      File Level      :       0
➔      Current Line    :       1
```

```
←
←       Output line     :       0
←
←       Evaluation Mode :       ON
←       Skip Mode       :       OFF
←       Prefix Mode     :       OFF
←       Verbose Mode    :       OFF
←       Line Mode       :       OFF
←       Echo Mode       :       OFF
←       Comment Mode    :       OFF
←       Warning Mode    :       ON
←
←       %
```

Where input file 'foo':

```
#status
```

Example 24: active and passive comment.

```
## [val]
#* [comment]
```

```
➔       % MAC foo > 'foo.out'
←       %
➔       % MAC foo -c > 'foo.out'
←
←       ****  comment number three
←
←       %
```

Where input file 'foo':

```
#ifdef AAA
## comment number one
#* comment number two
some data line
#else
## comment number three
#* comment number four
other data line
#endif
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
another data line
```

Example 25: tag name.

```
#tag [val]
```

```
➔       % MAC foo > 'foo.out'
←
←       line[1]  [foo]
←       line[2]  [data file number 1]
←       MAC error - valid expression expected
←       %
```

Where input file 'foo':

```
#include '/user/John/Doe'
```

and include file '/user/John/Doe':

```
#tag 'data file number 1'
#int A  'not a number'
```

Example 26: indirection.

[@..]nam

```
➔       % MAC foo > 'foo.out'
➔       %
```

Where the input file 'foo':

```
#define B A
#define C A
( 1) `A` is equal to A
( 2) `B` is equal to B
( 3) `C` is equal to C
( 4) `D` is equal to D

#define @B D                          (one level of indirection)
(11) `A` is equal to A
(12) `B` is equal to B
(13) `C` is equal to C
(14) `D` is equal to D

#define @@B 123                       (two levels of indirection)
(21) `A` is equal to A
(22) `B` is equal to B
(23) `C` is equal to C
(24) `D` is equal to D
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
( 1) A is equal to A
( 2) B is equal to A
( 3) C is equal to A
( 4) D is equal to D

(11) A is equal to D
(12) B is equal to A
(13) C is equal to A
(14) D is equal to D

(21) A is equal to D
(22) B is equal to A
(23) C is equal to A
(24) D is equal to 123
```

Example 27: text manipulations.

'text' (directive)
'text' (data)
`text` (data or directive)
"text" (data or directive)

```
➔       % MAC foo > 'foo.out'
➔       %
```

Where the input file 'foo':

```
#define it  AH
( 1) there are several ways to say it
( 2) there are several ways to say 'it'
( 3) there are several ways to say `it`
( 4) there are several ways to say "it"
#define A  it
#define B 'it'
#define C `it`
#define D "it"

(11) there are several ways to say A
(12) there are several ways to say B
(13) there are several ways to say C
(14) there are several ways to say D

(21) there are several ways to say 'A'
(22) there are several ways to say 'B'
(23) there are several ways to say 'C'
(24) there are several ways to say 'D'

(31) there are several ways to say `A`
(32) there are several ways to say `B`
(33) there are several ways to say `C`
(34) there are several ways to say `D`

(41) there are several ways to say "A"
(42) there are several ways to say "B"
(43) there are several ways to say "C"
(44) there are several ways to say "D"
```

Data lines contained in 'foo' are processed according to macro directives.

The output is located in file 'foo.out':

```
( 1) there are several ways to say AH
( 2) there are several ways to say 'AH'
( 3) there are several ways to say it
( 4) there are several ways to say "AH"

(11) there are several ways to say AH
(12) there are several ways to say AH
(13) there are several ways to say it
(14) there are several ways to say "AH"

(21) there are several ways to say 'AH'
(22) there are several ways to say 'AH'
(23) there are several ways to say 'it'
(24) there are several ways to say '"AH"'

(31) there are several ways to say A
(32) there are several ways to say B
(33) there are several ways to say C
(34) there are several ways to say D

(41) there are several ways to say "AH"
(42) there are several ways to say "AH"
(43) there are several ways to say "it"
(44) there are several ways to say ""AH""
```

Errors and Warnings

Errors cause immediate MAC abnormal termination. Complete error location is provided with a line number and file name (hierarchical).

Warning messages may be disabled by using the option "*-q[uiet]*" on the command line.

Example of Command-Line error

```
➔      %  MAC '/user/John/Doe' -d foo
➔
➔      [Command Line]
➔      MAC error - missing parameter -d foo ?
➔      %
```

Example of error generated by a bad definition of a macro at line 8 of file 'foo.include', called by a "*#include*" directive at line 6 of input file '/user/John/Doe'

```
➔      % MAC '/user/John/Doe' > foo.out
➔
➔      line[6] [/user/John/Doe]
➔      line[8] [foo.include]
➔      MAC error - valid expression expected
➔      %
```

List of warning and error messages

```
( 1)  MAC error - XXXX identifier is missing
( 2)  MAC error - XXXX identifier is too long: 'XXXX'
( 3)  MAC error - echo file already defined
( 4)  MAC error - echo file name is too long: 'XXXX'
( 5)  MAC error - arc cosine of number outside [-1, 1] is forbidden
( 6)  MAC error - arc sine of number outside [-1, 1] is forbidden
( 7)  MAC error - attempt to divide by 0
( 8)  MAC error - attempt to include files in a loop: 'XXXX'
( 9)  MAC error - attempt to rewrite existing echo file: 'XXXX'
(10)  MAC error - casting a list is forbidden
(11)  MAC error - dyadic operator expected
(12)  MAC error - empty value cannot be evaluated
(13)  MAC error - expected valid expression following '!='
(14)  MAC error - expected valid expression following '%'
(15)  MAC error - expected valid expression following '&&'
(16)  MAC error - expected valid expression following '*'
(17)  MAC error - expected valid expression following '+'
(18)  MAC error - expected valid expression following '-'
(19)  MAC error - expected valid expression following '/'
(20)  MAC error - expected valid expression following '<'
```

```
(21)  MAC error - expected valid expression following '<='
(22)  MAC error - expected valid expression following '=='
(23)  MAC error - expected valid expression following '>'
(24)  MAC error - expected valid expression following '>='
(25)  MAC error - expected valid expression following '^'
(26)  MAC error - expected valid expression following '||'
(27)  MAC error - file name is missing
(28)  MAC error - file name is too long: 'XXXX'
(29)  MAC error - if type directive is missing
(30)  MAC error - illegal TYPE identifier <XXXX>
(31)  MAC error - logarithm of number lower or equal to 0 is forbidden
(32)  MAC error - maximum depth of file inclusion reached: NNNN
(33)  MAC error - maximum number of macros reached: NNNN
(34)  MAC error - memory allocation error
(35)  MAC error - missing filename for -e
(36)  MAC error - missing macro definition -d XXXX ?
(37)  MAC error - missing macro definition -f XXXX ?
(38)  MAC error - missing macro definition -i XXXX ?
(39)  MAC error - missing macro definition -r XXXX ?
(40)  MAC error - missing macro identifier -d ?
(41)  MAC error - missing macro identifier -f ?
(42)  MAC error - missing macro identifier -i ?
(43)  MAC error - missing macro identifier -r ?
(44)  MAC error - missing prefix definition -p ?
(45)  MAC error - no answer given to #ask 'XXXX'
(46)  MAC error - no input specified, verify command line
(47)  MAC error - power of negative number is forbidden
(48)  MAC error - prefix is too long: 'XXXX'
(49)  MAC error - problem opening echo file (MODE): 'XXXX'
(50)  MAC error - problem opening input file (MODE): 'XXXX'
(51)  MAC error - valid expression expected
(52)  MAC error - string too long, unable to concatenate (max = 1024)
(53)  MAC error - tag name is too long: 'XXXX'
(54)  MAC error - too many endif
(55)  MAC error - too many prefixes
(56)  MAC error - try to break into elements an empty macro <XXXX>
(57)  MAC error - try to break into elements an undefined macro <XXXX>
(58)  MAC error - try to cast to fix an empty macro <XXXX>
(59)  MAC error - try to cast to int an empty macro <XXXX>
(60)  MAC error - try to cast to real an empty macro <XXXX>
(61)  MAC error - unable to build list definition, string too long (max = 1024)
(62)  MAC error - unable to evaluate expression
(63)  MAC error - unbalanced if/endif
(64)  MAC error - unknown monadic operator: XXXX
(65)  MAC error - unmatched parenthesis in expression <XXXX>
(66)  MAC error - unrecognized option: XXXX
(67)  MAC error - waiting for if or endif
(68)  MAC error - line too long (max = 1022 characters)
(69)  MAC error - line too long after expansion of the macros (max = 1023 characters)
(70)  MAC error - value of option -d is too long (max = 1021 characters)
(71)  MAC error - value of option -f is too long (max = 1021 characters)
(72)  MAC error - value of option -i is too long (max = 1021 characters)
(73)  MAC error - value of option -r is too long (max = 1021 characters)

(74)  MAC warning - disabling echo mode as standard input is not processed
(75)  MAC warning - '#XXXX' is not a legal MACro directive
(76)  MAC warning - attempt to remove an undefined macro <XXXX>
(77)  MAC warning - macro <XXXX> is not defined
(78)  MAC warning - macro <XXXX> is already a list
(79)  MAC warning - macro <XXXX> was already defined
(80)  MAC warning - try to cast to fix an undefined macro <XXXX>
(81)  MAC warning - try to cast to int an undefined macro <XXXX>
(82)  MAC warning - try to cast to real an undefined macro <XXXX>
(83)  MAC warning - try to freeze an undefined macro <XXXX>
(84)  MAC warning - try to melt an undefined macro <XXXX>
(85)  MAC warning - precision of fixed number = NNN reduced to 9
```

Appendix A: MAC Usage

```
Simple MACro expander, Version DOS V3.04, Greg Warwar and Yves Leduc, <build date>

Usage:   MAC [option..] [pathname..]

<option>:
-b[uilt]            : Built information on stdout.
-u[sage]            : Usage on stdout.
-h[elp]             : Help on stdout.
-s[tdin]            : Use MAC as filter accepting standard input (e.g. pipe).
-e[cho] 'pathname'  : Echo macros directives from stdin into file.  (*)
-d[efine] nam 'val' : Equivalent to directive #define nam val.      (*)
-i[nt] nam 'expr'   : Equivalent to directive #int nam expr.       (*)
-r[eal] nam 'expr'  : Equivalent to directive #real nam expr.      (*)
-f[ix] nam 'expr'   : Equivalent to directive #fix nam expr.       (*)
-p[refix] nam       : Prefix Mode,  declare prefix of macros used outside directives.
-v[erbose]          : Verbose Mode, detailed trace to stderr.
-c[omment]          : Comment Mode, send MAC comments to stderr.
-q[uiet]            : Quiet Mode,   remove warning messages.
-l[ine]             : Line Mode,    keep output and input lines numbering equal.

      (*) On command line, it is recommended to enclose value or expression between
          SINGLE quotes. They are mandatory if value or expression has more than one
          word, contains weird symbols...

<pathname>:

Pathname of ASCII file(s) to be expanded sequentially (last in is first processed).
Standard input is always processed after the process of these files is completed.
```

Appendix B: MAC Help

```
Simple MACro expander, Version DOS V3.04, Greg Warwar and Yves Leduc, <build date>

Usage:   MAC [option..] [pathname..]

<option>:

-b[uilt]            : Built information on stdout.
-u[sage]            : Usage on stdout.
-h[elp]             : Help on stdout.
-s[tdin]            : Use MAC as filter accepting standard input (e.g. pipe).
-e[cho] 'pathname'  : Echo macros directives from stdin into file.  (*)
-d[efine] nam 'val' : Equivalent to directive #define nam val.      (*)
-i[nt] nam 'expr'   : Equivalent to directive #int nam expr.       (*)
-r[eal] nam 'expr'  : Equivalent to directive #real nam expr.      (*)
-f[ix] nam 'expr'   : Equivalent to directive #fix nam expr.       (*)
-p[refix] nam       : Prefix Mode,  declare prefix of macros used outside directives.
-v[erbose]          : Verbose Mode, detailed trace to stderr.
-c[omment]          : Comment Mode, send MAC comments to stderr.
-q[uiet]            : Quiet Mode,   remove warning messages.
-l[ine]             : Line Mode,    keep output and input lines numbering equal.

      (*) On command line, it is recommended to enclose value or expression between
          SINGLE quotes. They are mandatory if value or expression has more than one
          word, contains weird symbols...

<pathname>:

Pathname of ASCII file(s) to be expanded sequentially (last in is first processed).
Standard input is always processed after the process of these files is completed.

Operations recognized by the MACro expander during arithmetic evaluation:

+   -   *   /   %   ^   >   <   >=   <=   ==   !=   !   ||   &&
(sin())  (cos())  (tan())  (asin())  (acos())  (atan())
(exp())  (log())  (log10()) (sinh())  (cosh())  (tanh())
(abs())  (floor())  (ceil())  (round())  (sign())


Inside processed files, directives recognized by the MACro expander:

#define nam [val]    : Macro definition.
#default nam [val]   : Macro definition, if macro was not yet defined.
#undef nam [nam..]   : Undefine the macro[s].
#int nam [expr]      : [Macro definition with] arithmetic evaluation, casting to int.
#real[dig] nam [expr]: [Macro definition with] arithmetic evaluation, casting to real (scientific).
#fix[dig] nam [expr] : [Macro definition with] arithmetic evaluation, casting to real (fixed precision).
#ask nam [val]       : Macro definition by [question 'val' and] answer from user, if not yet defined.
#msg [val]           : Send message 'val' to stderr.
#cat nam [val..]     : Concatenate 'val..' into first macro.
#freeze nam [nam..]  : Protect content of macros from processing.
```

```
#melt nam [nam..]    : Unprotect content of macros from processing.
#if expr             : Execute if block when 'expr' is not 0, after arithmetic evaluation.
#ifdef nam [val]     : Execute ifdef block when 'nam' is defined [equal to 'val'].
#ifndef nam [val]    : Execute ifndef block when 'nam' is undefined [or not equal to 'val'].
#else [comment]      : Else block. ['comment' ignored.]
#endif [comment]     : End of conditional block. ['comment' ignored.]
#include val         : File to be included (pathname between single quotes).
#insert val          : Data file to copy without processing (pathname between single quotes).
#exit [val]          : Exit from current file. [Send message 'val' on stderr.]
#quit [val]          : Normal MAC termination. [Send message 'val' on stderr.]
#abort [val]         : Abnormal termination. [Send message 'val' on stderr.]
## [val]             : MAC single line comment. [In comment mode, 'val' is traced on stderr.]
#* [comment]         : MAC single line comment. ['comment' ignored.]

- MACro expander advanced features:

#list nam            : Declare existing macro as a list and split it into elements.
[@..]nam             : Indirection using symbol '@' ahead macro name 'nam'.

- Debug oriented macro directives (normally processed):
#verbose [val]       : Toggle verbose mode On|Off [or set/reset if value is (not) 0].
#macro [nam..]       : List all macros on stderr [or macros by name 'nam..'].
#tag [val]           : Define file tag name 'val' of currently processed file.

- Debug oriented macro directives (unconditionally processed):

#skip [expr]         : Toggle Skip Mode On|Off [set/reset if 'expr' is (not) 0].
#stop [val]          : MAC normal termination. [Send message 'val' on stderr.]
#status [val]        : Current status of MAC on stderr. ['val' is a title.]


Predefined macros:

$V                   : Current version of MAC (DOS V3.04).
$D                   : Current time and date at the beginning of the process.
$F                   : Current file name.
$T                   : Current file tag name (default: file name).
$N                   : Empty string.


Quotes in MAC:

'text'   (    option) : Field delimiters, quotes are removed by UNIX.
'text'   ( directive) : Delimit a field, quotes are removed in output.
'text'   (      data) : No effect. Quotes remain.
`text`   (dir & data) : Text unprocessed by MAC, quotes are removed at output.
"text"   (dir & data) : No effect. Quotes remain.


Valid macro identifier in MAC:

First character      : A..Z  a..z  $  or _
Other characters     : A..Z  a..z  0..9  [  ]  $  or  _
```

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