

**Name**

addftinfo – add font metrics to troff fonts for use with groff

**Synopsis**

**addftinfo** [**-asc-height** *n*] [**-body-depth** *n*] [**-body-height** *n*] [**-cap-height** *n*] [**-comma-depth** *n*]  
 [**-desc-depth** *n*] [**-fig-height** *n*] [**-x-height** *n*] *resolution unit-width font*

**addftinfo** **--help**

**addftinfo** **-v**

**addftinfo** **--version**

**Description**

*addftinfo* reads an AT&T *troff* font description file *font*, adds additional font metric information required by GNU *troff*(1), and writes the combined result to the standard output. The information added is derived from the font's existing parameters and assumptions about traditional *troff* names for characters. Among the font metrics added are the heights and depths of characters (how far each extends vertically above and below the baseline). The *resolution* and *unit-width* arguments should be the same as the corresponding parameters in the *DESC* file. *font* is the name of the file describing the font; if *font* ends with "I", the font is assumed to be oblique (or italic).

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

All other options change parameters that are used to derive the heights and depths. Like the existing quantities in the font description file, each value *n* is in inches/*resolution* for a font whose point size is *unit-width*.

**-asc-height** *n*

height of characters with ascenders, such as "b", "d", or "l"

**-body-depth** *n*

depth of characters such as parentheses

**-body-height** *n*

height of characters such as parentheses

**-cap-height** *n*

height of uppercase letters such as "A"

**-comma-depth** *n*

depth of a comma

**-desc-depth** *n*

depth of characters with descenders, such as "p", "q", or "y"

**-fig-height**

height of figures (numerals)

**-x-height** *n*

height of lowercase letters without ascenders such as "x"

*addftinfo* makes no attempt to use the specified parameters to infer unspecified parameters. If a parameter is not specified, the default will be used. The defaults are chosen to produce reasonable values for a Times font.

**See also**

[groff\\_font\(5\)](#), [groff\(1\)](#), [groff\\_char\(7\)](#)

**Name**

afmtodit – adapt Adobe Font Metrics files for groff –Tps and –Tpdf

**Synopsis**

**afmtodit** [**-ckmnsx**] [**-a** *slant*] [**-d** *device-description-file*] [**-e** *encoding-file*] [**-f** *internal-name*]  
 [**-i** *italic-correction-factor*] [**-o** *output-file*] *afm-file map-file font-description-file*

**afmtodit -v**

**Description**

*afmtodit* adapts an Adobe Font Metric file, *afm-file*, for use with the **ps** and **pdf** output devices of *groff*(1). *map-file* associates a *groff* glyph name with a PostScript glyph name. Output is written in *groff\_font*(5) format to *font-description-file*, a file named for the intended *groff* font name (but see the **-o** option).

*map-file* should contain a sequence of lines of the form

```
ps-glyph groff-glyph
```

where *ps-glyph* is the PostScript glyph name and *groff-glyph* is the *groff* special character identifier for the glyph (as used in the *groff* font description file). The same *ps-glyph* can occur multiple times in the file; each *groff-glyph* must occur at most once. Lines starting with “#” and blank lines are ignored. If the file isn’t found in the current directory, it is sought in the *devps/generate* subdirectory of the default font directory.

If a PostScript glyph is not mentioned in *map-file*, and a generic *groff* glyph name can’t be deduced using the Adobe Glyph List (AGL, built into *afmtodit*), then *afmtodit* puts the PostScript glyph into the *groff* font description file as an unnamed glyph which can only be accessed by the “\N” escape sequence in a *roff* document. In particular, this is true for glyph variants named in the form “*foo.bar*”; all glyph names containing one or more periods are mapped to unnamed entities. Unless **-e** is specified, the encoding defined in the AFM file (i.e., entries with non-negative codes) is used. Refer to section “Using Symbols” in *Groff: The GNU Implementation of troff*, the *groff* Texinfo manual, which describes how *groff* glyph names are constructed.

Glyphs not encoded in the AFM file (i.e., entries indexed as “-1”) are still available in *groff*; they get glyph index values greater than 255 (or greater than the biggest code used in the AFM file in the unlikely case that it is greater than 255) in the *groff* font description file. Unencoded glyph indices don’t have a specific order; it is best to access them with glyph names only.

If the font is downloadable to the device as a file, it may be listed in the file */usr/local/share/groff/1.23.0/font/devps/download*; see *grops*(1).

If the **-i** option is used, *afmtodit* automatically generates an italic correction, a left italic correction, and a subscript correction for each glyph (the significance of these is explained in *groff\_font*(5)); they can be specified for individual glyphs by adding to the *afm-file* lines of the form:

```
italicCorrection ps-glyph n
leftItalicCorrection ps-glyph n
subscriptCorrection ps-glyph n
```

where *ps-glyph* is the PostScript glyph name, and *n* is the desired value of the corresponding parameter in thousandths of an em. Such parameters are normally needed only for italic (or oblique) fonts.

The **-s** option should be given if the font is “special”, meaning that *groff* should search it whenever a glyph is not found in the current font. In that case, *font-description-file* should be listed as an argument to the **fonts** directive in the output device’s *DESC* file; if it is not special, there is no need to do so, since *troff*(1) will automatically mount it when it is first used.

**Options**

**-a** *slant*

Use *slant* as the slant (“angle”) parameter in the font description file; this is used by *groff* in the positioning of accents. By default *afmtodit* uses the negative of the **ItalicAngle** specified in the AFM file; with true italic fonts it is sometimes desirable to use a slant that is less than this. If you find that an italic font places accents over base glyphs too far to the right, use **-a** to give it a smaller slant.

- c** Include comments in the font description file identifying the PostScript font.
- d** *device-description-file*  
The device description file is *desc-file* rather than the default *DESC*. If not found in the current directory, the *devps* subdirectory of the default font directory is searched (this is true for both the default device description file and a file given with option **-d**).
- e** *encoding-file*  
The PostScript font should be reencoded to use the encoding described in *enc-file*. The format of *enc-file* is described in [grops\(1\)](#). If not found in the current directory, the *devps* subdirectory of the default font directory is searched.
- f** *internal-name*  
The internal name of the *groff* font is set to *name*.
- i** *italic-correction-factor*  
Generate an italic correction for each glyph so that its width plus its italic correction is equal to *italic-correction-factor* thousandths of an em plus the amount by which the right edge of the glyph's bounding box is to the right of its origin. If this would result in a negative italic correction, use a zero italic correction instead.  
  
Also generate a subscript correction equal to the product of the tangent of the slant of the font and four fifths of the x-height of the font. If this would result in a subscript correction greater than the italic correction, use a subscript correction equal to the italic correction instead.  
  
Also generate a left italic correction for each glyph equal to *italic-correction-factor* thousandths of an em plus the amount by which the left edge of the glyph's bounding box is to the left of its origin. The left italic correction may be negative unless option **-m** is given.  
  
This option is normally needed only with italic (or oblique) fonts. The font description files distributed with *groff* were created using an option of **-i50** for italic fonts.
- o** *output-file*  
Write to *output-file* instead of *font-description-file*.
- k** Omit any kerning data from the *groff* font; use only for monospaced (constant-width) fonts.
- m** Prevent negative left italic correction values. Font description files for roman styles distributed with *groff* were created with "**-i0 -m**" to improve spacing with [eqn\(1\)](#).
- n** Don't output a **ligatures** command for this font; use with monospaced (constant-width) fonts.
- s** Add the **special** directive to the font description file.
- v** Write version information to the standard output stream and exit.
- x** Don't use the built-in Adobe Glyph List.

## Files

*/usr/local/share/groff/1.23.0/font/devps/DESC*  
describes the **ps** output device.

*/usr/local/share/groff/1.23.0/font/devps/F*  
describes the font known as *F* on device **ps**.

*/usr/local/share/groff/1.23.0/font/devps/download*  
lists fonts available for embedding within the PostScript document (or download to the device).

*/usr/local/share/groff/1.23.0/font/devps/text.enc*  
describes the encoding scheme used by most PostScript Type 1 fonts; the **encoding** directive of font description files for the **ps** device refers to it.

*/usr/local/share/groff/1.23.0/font/devps/generate/textmap*  
maps names in the Adobe Glyph List to *groff* special character identifiers.

**See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. Section “Using Symbols” may be of particular note. You can browse it interactively with “info '(groff)Using Symbols”.

[groff\(1\)](#), [gropdf\(1\)](#), [grops\(1\)](#), [groff\\_font\(5\)](#)

## Name

chem – embed chemical structure diagrams in groff documents

## Synopsis

**chem** [–] [*file* ...]

**chem -h**

**chem --help**

**chem -v**

**chem --version**

## Description

*chem* produces chemical structure diagrams. Today's version is best suited for organic chemistry (bonds, rings). The *chem* program is a *groff* preprocessor like *eqn*, *pic*, *tbl*, etc. It generates *pic* output such that all *chem* parts are translated into diagrams of the *pic* language.

If no operands are given, or if *file* is “–”, *chem* reads the standard input stream. **-h** and **--help** display a usage message, whereas **-v** and **--version** display version information; all exit.

The program *chem* originates from the Perl source file *chem.pl*. It tells *pic* to include a copy of the macro file *chem.pic*. Moreover the *groff* source file *pic.tmac* is loaded.

In a style reminiscent of *eqn* and *pic*, the *chem* diagrams are written in a special language.

A set of *chem* lines looks like this

```
.cstart
chem data
.cend
```

Lines containing the keywords **.cstart** and **.cend** start and end the input for *chem*, respectively. In *pic* context, i.e., after the call of **.PS**, *chem* input can optionally be started by the line **begin chem** and ended by the line with the single word **end** instead.

Anything outside these initialization lines is copied through without modification; all data between the initialization lines is converted into *pic* commands to draw the diagram.

As an example,

```
.cstart
CH3
bond
CH3
.cend
```

prints two **CH3** groups with a bond between them.

If you want to create just *groff* output, you must run *chem* followed by *groff* with the option **-p** for the activation of *pic*:

```
chem [file ...] | groff -p ...
```

## Language

The *chem* input language is rather small. It provides rings of several styles and a way to glue them together as desired, bonds of several styles, moieties (e.g., **C**, **NH3**, ...), and strings.

### Setting variables

There are some variables that can be set by commands. Such commands have two possible forms, either

```
variable value
```

or

```
variable = value
```

This sets the given *variable* to the argument *value*. If more arguments are given only the last argument is taken, all other arguments are ignored.

There are only a few variables to be set by these commands:

**textht** *arg*

Set the height of the text to *arg*; default is 0.16.

**cwid** *arg*

Set the character width to *arg*; default is 0.12.

**db** *arg* Set the bond length to *arg*; default is 0.2.

**size** *arg*

Scale the diagram to make it look plausible at point size *arg*; default is 10 point.

## Bonds

This

**bond** [*direction*] [*length n*] [**from** *Name*]*[picstuff]*

draws a single bond in direction from nearest corner of *Name*. **bond** can also be **double bond**, **front bond**, **back bond**, etc. (We will get back to *Name* soon.)

*direction* is the angle in degrees (0 up, positive clockwise) or a direction word like **up**, **down**, **sw** (= southwest), etc. If no direction is specified, the bond goes in the current direction (usually that of the last bond).

Normally the bond begins at the last object placed; this can be changed by naming a **from** place. For instance, to make a simple alkyl chain:

```

CH3
bond           (this one goes right from the CH3)
C             (at the right end of the bond)
double bond up (from the C)
O           (at the end of the double bond)
bond right from C
CH3

```

A length in inches may be specified to override the default length. Other *pic* commands can be tacked on to the end of a bond command, to create dotted or dashed bonds or to specify a **to** place.

## Rings

There are lots of rings, but only five- and six-sided rings get much support. **ring** by itself is a six-sided ring; **benzene** is the benzene ring with a circle inside. **aromatic** puts a circle into any kind of ring.

**ring** [**pointing** (**up**|**right**|**left**|**down**)] [**aromatic**] [**put Mol at n**] [**double** *i,j,k,l* ... *[picstuff]*]

The vertices of a ring are numbered 1, 2, ... from the vertex that points in the natural compass direction. So for a hexagonal ring with the point at the top, the top vertex is 1, while if the ring has a point at the east side, that is vertex 1. This is expressed as

```

R1: ring pointing up
R2: ring pointing right

```

The ring vertices are named **.V1**, ..., **.Vn**, with **.V1** in the pointing direction. So the corners of **R1** are **R1.V1** (the *top*), **R1.V2**, **R1.V3**, **R1.V4** (the *bottom*), etc., whereas for **R2**, **R2.V1** is the rightmost vertex and **R2.V4** the leftmost. These vertex names are used for connecting bonds or other rings. For example,

```

R1: benzene pointing right
R2: benzene pointing right with .V6 at R1.V2

```

creates two benzene rings connected along a side.

Interior double bonds are specified as **double** *n1,n2 n3,n4* ...; each number pair adds an interior bond. So the alternate form of a benzene ring is

**ring double 1,2 3,4 5,6**

Heterocycles (rings with something other than carbon at a vertex) are written as **put X at V**, as in

**R: ring put N at 1 put O at 2**

In this heterocycle, **R.N** and **R.O** become synonyms for **R.V1** and **R.V2**.

There are two five-sided rings. **ring5** is pentagonal with a side that matches the six-sided ring; it has four natural directions. A **flatring** is a five-sided ring created by chopping one corner of a six-sided ring so that it exactly matches the six-sided rings.

The description of a ring has to fit on a single line.

**Moieties and strings**

A moiety is a string of characters beginning with a capital letter, such as **N(C2H5)2**. Numbers are converted to subscripts (unless they appear to be fractional values, as in **N2.5H**). The name of a moiety is determined from the moiety after special characters have been stripped out: e.g., **N(C2H5)2** has the name **NC2H52**.

Moieties can be specified in two kinds. Normally a moiety is placed right after the last thing mentioned, separated by a semicolon surrounded by spaces, e.g.,

**B1: bond ; OH**

Here the moiety is **OH**; it is set after a bond.

As the second kind a moiety can be positioned as the first word in a *pic*-like command, e.g.,

**CH3 at C + (0.5,0.5)**

Here the moiety is **CH3**. It is placed at a position relative to **C**, a moiety used earlier in the chemical structure.

So moiety names can be specified as *chem* positions everywhere in the *chem* code. Beneath their printing moieties are names for places.

The moiety **BP** is special. It is not printed but just serves as a mark to be referred to in later *chem* commands. For example,

**bond ; BP**

sets a mark at the end of the bond. This can be used then for specifying a place. The name **BP** is derived from *branch point* (i.e., line crossing).

A string within double quotes " is interpreted as a part of a *chem* command. It represents a string that should be printed (without the quotes). Text within quotes "... " is treated more or less like a moiety except that no changes are made to the quoted part.

**Names**

In the alkyl chain above, notice that the carbon atom **C** was used both to draw something and as the name for a place. A moiety always defines a name for a place; you can use your own names for places instead, and indeed, for rings you will have to. A name is just

*Name: ...*

*Name* is often the name of a moiety like **CH3**, but it need not to be. Any name that begins with a capital letter and which contains only letters and numbers is valid:

**First: bond  
bond 30 from First**

**Miscellaneous**

The specific construction

**bond ... ; moiety**

is equivalent to

bond  
moiety

Otherwise, each item has to be on a separate line (and only one line). Note that there must be whitespace

after the semicolon which separates the commands.

A period character `.` or a single quote `'` in the first column of a line signals a *troff* command, which is copied through as-is.

A line whose first non-blank character is a hash character (`#`) is treated as a comment and thus ignored. However, hash characters within a word are kept.

A line whose first word is **pic** is copied through as-is after the word **pic** has been removed.

The command

**size** *n*

scales the diagram to make it look plausible at point size *n* (default is 10 point).

Anything else is assumed to be *pic* code, which is copied through with a label.

Since *chem* is a *pic* preprocessor, it is possible to include *pic* statements in the middle of a diagram to draw things not provided for by *chem* itself. Such *pic* statements should be included in *chem* code by adding **pic** as the first word of this line for clarity.

The following *pic* commands are accepted as *chem* commands, so no **pic** command word is needed:

**define** Start the definition of *pic* macro within *chem*.

```
[      Start a block composite.
]      End a block composite.
{      Start a macro definition block.
}      End a macro definition block.
```

The macro names from **define** statements are stored and their call is accepted as a *chem* command as well.

### Wish list

This TODO list was collected by Brian Kernighan.

Error checking is minimal; errors are usually detected and reported in an oblique fashion by *pic*.

There is no library or file inclusion mechanism, and there is no shorthand for repetitive structures.

The extension mechanism is to create *pic* macros, but these are tricky to get right and don't have all the properties of built-in objects.

There is no in-line chemistry yet (e.g., analogous to the `$. . $` construct of *eqn*).

There is no way to control entry point for bonds on groups. Normally a bond connects to the carbon atom if entering from the top or bottom and otherwise to the nearest corner.

Bonds from substituted atoms on heterocycles do not join at the proper place without adding a bit of *pic*.

There is no decent primitive for brackets.

Text (quoted strings) doesn't work very well.

A squiggle bond is needed.

### Files

*/usr/local/share/groff/1.23.0/pic/chem.pic*

A collection of *pic* macros needed by *chem*.

*/usr/local/share/groff/1.23.0/tmac/pic.tmac*

A macro file which redefines **.PS**, **.PE**, and **.PF** to center *pic* diagrams.

*/usr/local/share/doc/groff-1.23.0/examples/chem/\*.chem*

Example files for *chem*.

*/usr/local/share/doc/groff-1.23.0/examples/chem/I22/\*.chem*

Example files from the *chem* article by its authors, "CHEM—A Program for Typesetting Chemical Structure Diagrams: User Manual" (CSTR #122).

**Authors**

The GNU version of *chem* was written by Bernd Warken (groff-bernd.warken-72@web.de). It is based on the documentation of Brian Kernighan's original *awk* version of *chem*.

**See also**

“CHEM—A Program for Typesetting Chemical Diagrams: User Manual” by Jon L. Bentley, Lynn W. Jelinski, and Brian W. Kernighan, 1992, AT&T Bell Laboratories Computing Science Technical Report No. 122

[groff\(1\)](#), [pic\(1\)](#)

**Name**

eqn – format equations for groff or MathML

**Synopsis**

eqn [-rCNR] [-d *xy*] [-f *F*] [-m *n*] [-M *dir*] [-p *n*] [-s *n*] [-T *name*] [*file* ...]

eqn --help

eqn -v

eqn --version

**Description**

The GNU implementation of *eqn* is part of the [groff\(7\)](#) document formatting system. *eqn* is a [troff\(1\)](#) pre-processor that translates descriptions of equations embedded in [roff\(7\)](#) input files into the language understood by [troff\(1\)](#). It copies the contents of each *file* to the standard output stream, except that lines between **.EQ** and **.EN** (or “inline” within a pair of user-specified delimiters) are interpreted as equation descriptions. Normally, *eqn* is not executed directly by the user, but invoked by specifying the **-e** option to [groff\(1\)](#). While GNU *eqn*’s input syntax is highly compatible with AT&T *eqn*, the output *eqn* produces cannot be processed by AT&T *troff*; GNU *troff* (or a *troff* implementing relevant GNU extensions) must be used. If no *file* operands are given on the command line, or if *file* is “-”, the standard input stream is read.

Unless the **-R** option is given, *eqn* searches for the file *eqnrc* in the directories given with the **-M** option first, then in */usr/local/lib/groff/site-tmac*, */usr/local/share/groff/site-tmac*, and finally in the standard macro directory */usr/local/share/groff/1.23.0/tmac*. If it exists, *eqn* processes it before the other input files.

Only the differences between GNU *eqn* and AT&T *eqn* are described in this document. Most of the new features of the GNU *eqn* input language are based on  $\TeX$ . There are some references to the differences between  $\TeX$  and GNU *eqn* below; these may safely be ignored if you do not know  $\TeX$ .

Three points are worth special note.

- GNU *eqn* emits Presentation MathML output when invoked with the “**-T MathML**” option.
- GNU *eqn* does not provide the functionality of *neqn*: it does not support low-resolution, typewriter-like devices (although it may work adequately for very simple input).
- GNU *eqn* sets the input token “...” as three periods or low dots, rather than the three centered dots of AT&T *eqn*. To get three centered dots, write **cdots** or “**cdot cdot cdot**”.

**Controlling delimiters**

If not in compatibility mode, *eqn* recognizes “**delim on**” as a command to restore the delimiters which have been previously disabled with a call to “**delim off**”. If delimiters haven’t been specified, the call has no effect.

**Automatic spacing**

*eqn* gives each component of an equation a type, and adjusts the spacing between components using that type. Possible types are described in the table below.

ordinary	an ordinary character such as “1” or “x”
operator	a large operator such as “ $\Sigma$ ”
binary	a binary operator such as “+”
relation	a relation such as “=”
opening	an opening bracket such as “(”
closing	a closing bracket such as “)”
punctuation	a punctuation character such as “,”
inner	a sub-formula contained within brackets
suppress	a type without automatic spacing adjustment

Components of an equation get a type in one of two ways.

**type** *t e* This yields an equation component that contains *e* but that has type *t*, where *t* is one of the types mentioned above. For example, **times** is defined as follows.

```
type "binary" \(\mu
```

The type name doesn't have to be quoted, but doing so protects it from macro expansion.

### **chartype** *t text*

Each (unquoted) character in *text* is assigned type *t*. The type *t* can also be “**letter**” or “**digit**”; in these cases **chartype** changes the font style of the characters. See subsection “Fonts” below. For example,

```
chartype "punctuation" .,:;
```

assigns the “**punctuation**” type to each of the characters in “.,:;” wherever they subsequently appear in an equation.

### New primitives

**big** *e* Enlarges the expression it modifies; intended to have semantics like CSS “large”. In *troff* output, the point size is increased by 5; in MathML output, the expression uses

```
<mstyle mathsize='big'>
```

### *e1 smallover e2*

This is similar to **over**; **smallover** reduces the size of *e1* and *e2*; it also puts less vertical space between *e1* or *e2* and the fraction bar. The **over** primitive corresponds to the  $\TeX$  **over** primitive in display styles; **smallover** corresponds to **over** in non-display styles.

### **vcenter** *e*

This vertically centers *e* about the math axis. The math axis is the vertical position about which characters such as “+” and “−” are centered; it is also the vertical position used for fraction bars. For example, **sum** is defined as follows.

```
{ type "operator" vcenter size +5 \(*S }
```

**vcenter** is silently ignored when generating MathML.

### *e1 accent e2*

This sets *e2* as an accent over *e1*. *e2* is assumed to be at the correct height for a lowercase letter; *e2* is moved down according to whether *e1* is taller or shorter than a lowercase letter. For example, **hat** is defined as follows.

```
accent { "^" }
```

**dotdot**, **dot**, **tilde**, **vec**, and **dyad** are also defined using the **accent** primitive.

### *e1 uaccent e2*

This sets *e2* as an accent under *e1*. *e2* is assumed to be at the correct height for a character without a descender; *e2* is moved down if *e1* has a descender. **utilde** is pre-defined using **uaccent** as a tilde accent below the baseline.

### **split** “*text*”

This has the same effect as simply

```
text
```

but *text* is not subject to macro expansion because it is quoted; *text* is split up and the spacing between individual characters is adjusted.

### **nosplit** *text*

This has the same effect as

```
“text”
```

but because *text* is not quoted it is subject to macro expansion; *text* is not split up and the spacing between individual characters is not adjusted.

### *e oprime*

This is a variant of **prime** that acts as an operator on *e*. It produces a different result from **prime** in a case such as “**A oprime sub 1**”: with **oprime** the “1” is tucked under the prime as a sub-

script to the “A” (as is conventional in mathematical typesetting), whereas with **prime** the “1” is a subscript to the prime character. The precedence of **opprime** is the same as that of **bar** and **under**, which is higher than that of everything except **accent** and **uaccent**. In unquoted text, a neutral apostrophe (') that is not the first character on the input line is treated like **opprime**.

### **special** *text e*

This constructs a new object from *e* using a *troff(1)* macro named *text*. When the macro is called, the string **0s** contains the output for *e*, and the registers **0w**, **0h**, **0d**, **0skern**, and **0skew** contain the width, height, depth, subscript kern, and skew of *e*. (The *subscript kern* of an object indicates how much a subscript on that object should be “tucked in”, or placed to the left relative to a non-subscripted glyph of the same size. The *skew* of an object is how far to the right of the center of the object an accent over it should be placed.) The macro must modify **0s** so that it outputs the desired result with its origin at the current point, and increase the current horizontal position by the width of the object. The registers must also be modified so that they correspond to the result.

For example, suppose you wanted a construct that “cancels” an expression by drawing a diagonal line through it.

```
.EQ
define cancel 'special Ca'
.EN
.de Ca
.  ds 0s \
\Z'\*\*(0s'\
\v'\n(0du'\
\D'l \n(0wu -\n(0hu-\n(0du'\
\v'\n(0hu'
..
```

You could then cancel an expression *e* with “**cancel { e }**”.

Here’s a more complicated construct that draws a box around an expression.

```
.EQ
define box 'special Bx'
.EN
.de Bx
.ds 0s \
\Z'\h'1n'\*\*(0s'\
\Z'\
\v'\n(0du+1n'\
\D'l \n(0wu+2n 0'\
\D'l 0 -\n(0hu-\n(0du-2n'\
\D'l -\n(0wu-2n 0'\
\D'l 0 \n(0hu+\n(0du+2n'\
'\
\h'\n(0wu+2n'
.nr 0w +2n
.nr 0d +1n
.nr 0h +1n
..
```

### **space** *n*

A positive value of the integer *n* (in hundredths of an em) sets the vertical spacing before the equation, a negative value sets the spacing after the equation, replacing the default values. This primitive provides an interface to *groff*’s `\x` escape (but with opposite sign). This keyword has no effect if the equation is part of a *pic* picture.

**Extended primitives**

**col** *n* { ... }  
**ccol** *n* { ... }  
**lcol** *n* { ... }  
**rcol** *n* { ... }  
**pile** *n* { ... }  
**cpile** *n* { ... }  
**lpile** *n* { ... }  
**rpile** *n* { ... }

The integer value *n* (in hundredths of an em) increases the vertical spacing between rows, using *groff*'s `\x` escape (the value has no effect in MathML mode). Negative values are possible but have no effect. If there is more than a single value given in a matrix, the biggest one is used.

**Customization**

When *eqn* is generating *troff* markup, the appearance of equations is controlled by a large number of parameters. They have no effect when generating MathML mode, which pushes typesetting and fine motions downstream to a MathML rendering engine. These parameters can be set using the **set** command.

**set** *p n* This sets parameter *p* to value *n*, where *n* is an integer. For example,

```
set x_height 45
```

says that *eqn* should assume an x height of 0.45 ems.

Possible parameters are as follows. Values are in units of hundredths of an em unless otherwise stated. These descriptions are intended to be expository rather than definitive.

**minimum\_size**

*eqn* won't set anything at a smaller point size than this. The value is in points.

**fat\_offset**

The **fat** primitive emboldens an equation by overprinting two copies of the equation horizontally offset by this amount. This parameter is not used in MathML mode; fat text uses `<mstyle mathvariant='double-struck'>` instead.

**over\_hang**

A fraction bar is longer by twice this amount than the maximum of the widths of the numerator and denominator; in other words, it overhangs the numerator and denominator by at least this amount.

**accent\_width**

When **bar** or **under** is applied to a single character, the line is this long. Normally, **bar** or **under** produces a line whose length is the width of the object to which it applies; in the case of a single character, this tends to produce a line that looks too long.

**delimiter\_factor**

Extensible delimiters produced with the **left** and **right** primitives have a combined height and depth of at least this many thousandths of twice the maximum amount by which the sub-equation that the delimiters enclose extends away from the axis.

**delimiter\_shortfall**

Extensible delimiters produced with the **left** and **right** primitives have a combined height and depth not less than the difference of twice the maximum amount by which the sub-equation that the delimiters enclose extends away from the axis and this amount.

**null\_delimiter\_space**

This much horizontal space is inserted on each side of a fraction.

**script\_space**

The width of subscripts and superscripts is increased by this amount.

**thin\_space**

This amount of space is automatically inserted after punctuation characters.

**medium\_space**

This amount of space is automatically inserted on either side of binary operators.

**thick\_space**

This amount of space is automatically inserted on either side of relations.

**x\_height**

The height of lowercase letters without ascenders such as “x”.

**axis\_height**

The height above the baseline of the center of characters such as “+” and “-”. It is important that this value is correct for the font you are using.

**default\_rule\_thickness**

This should be set to the thickness of the `\[ru]` character, or the thickness of horizontal lines produced with the `\D` escape sequence.

**num1** The `over` command shifts up the numerator by at least this amount.

**num2** The `smallover` command shifts up the numerator by at least this amount.

**denom1**

The `over` command shifts down the denominator by at least this amount.

**denom2**

The `smallover` command shifts down the denominator by at least this amount.

**sup1** Normally superscripts are shifted up by at least this amount.

**sup2** Superscripts within superscripts or upper limits or numerators of `smallover` fractions are shifted up by at least this amount. This is usually less than **sup1**.

**sup3** Superscripts within denominators or square roots or subscripts or lower limits are shifted up by at least this amount. This is usually less than **sup2**.

**sub1** Subscripts are normally shifted down by at least this amount.

**sub2** When there is both a subscript and a superscript, the subscript is shifted down by at least this amount.

**sup\_drop**

The baseline of a superscript is no more than this much below the top of the object on which the superscript is set.

**sub\_drop**

The baseline of a subscript is at least this much below the bottom of the object on which the subscript is set.

**big\_op\_spacing1**

The baseline of an upper limit is at least this much above the top of the object on which the limit is set.

**big\_op\_spacing2**

The baseline of a lower limit is at least this much below the bottom of the object on which the limit is set.

**big\_op\_spacing3**

The bottom of an upper limit is at least this much above the top of the object on which the limit is set.

**big\_op\_spacing4**

The top of a lower limit is at least this much below the bottom of the object on which the limit is set.

**big\_op\_spacing5**

This much vertical space is added above and below limits.

**baseline\_sep**

The baselines of the rows in a pile or matrix are normally this far apart. In most cases this should be equal to the sum of **num1** and **denom1**.

**shift\_down**

The midpoint between the top baseline and the bottom baseline in a matrix or pile is shifted down by this much from the axis. In most cases this should be equal to **axis\_height**.

**column\_sep**

This much space is added between columns in a matrix.

**matrix\_side\_sep**

This much space is added at each side of a matrix.

**draw\_lines**

If this is non-zero, lines are drawn using the **\D** escape sequence, rather than with the **\** escape sequence and the **\[ru]** character.

**body\_height**

The amount by which the height of the equation exceeds this is added as extra space before the line containing the equation (using **\x**). The default value is 85.

**body\_depth**

The amount by which the depth of the equation exceeds this is added as extra space after the line containing the equation (using **\x**). The default value is 35.

**nroff** If this is non-zero, then **ndefine** behaves like **define** and **tdefine** is ignored, otherwise **tdefine** behaves like **define** and **ndefine** is ignored. The default value is 0; the *eqnrc* file sets it to 1 for the **ascii**, **latin1**, **utf8**, and **cp1047** output devices.

A more precise description of the role of many of these parameters can be found in Appendix H of *The T<sub>E</sub>Xbook*.

**Macros**

Macros can take arguments. In a macro body,  $\$n$  where  $n$  is between 1 and 9, is replaced by the  $n$ th argument if the macro is called with arguments; if there are fewer than  $n$  arguments, it is replaced by nothing. A word containing a left parenthesis where the part of the word before the left parenthesis has been defined using the **define** command is recognized as a macro call with arguments; characters following the left parenthesis up to a matching right parenthesis are treated as comma-separated arguments. Commas inside nested parentheses do not terminate an argument.

**sdefine** *name X anything X*

This is like the **define** command, but *name* is not recognized if called with arguments.

**include** "*file*"**copy** "*file*"

Include the contents of *file* (**include** and **copy** are synonyms). Lines of *file* beginning with **.EQ** or **.EN** are ignored.

**ifdef** *name X anything X*

If *name* has been defined by **define** (or has been automatically defined because *name* is the output driver) process *anything*; otherwise ignore *anything*. *X* can be any character not appearing in *anything*.

**undef** *name*

Remove definition of *name*, making it undefined.

Besides the macros mentioned above, the following definitions are available: **Alpha**, **Beta**, ..., **Omega** (this is the same as **ALPHA**, **BETA**, ..., **OMEGA**), **ldots** (three dots on the baseline), and **dollar**.

## Fonts

*eqn* normally uses at least two fonts to set an equation: an italic font for letters, and a roman font for everything else. The AT&T *eqn* **gfont** command changes the font that is used as the italic font. By default this is **I**. The font that is used as the roman font can be changed using the new **grfont** command.

### **grfont** *f*

Set the roman font to *f*.

The **italic** primitive uses the current italic font set by **gfont**; the **roman** primitive uses the current roman font set by **grfont**. There is also a new **gbfont** command, which changes the font used by the **bold** primitive. If you only use the **roman**, **italic** and **bold** primitives to change fonts within an equation, you can change all the fonts used by your equations just by using **gfont**, **grfont** and **gbfont** commands.

You can control which characters are treated as letters (and therefore set in italics) by using the **chartype** command described above. A type of **letter** causes a character to be set in italic type. A type of **digit** causes a character to be set in roman type.

## Options

- help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.
- C** Recognize **.EQ** and **.EN** even when followed by a character other than space or newline, and do not handle the “**delim on**” statement specially.
- d** *xy* Specify delimiters *x* and *y* for the left and right ends, respectively, of inline equations. Any **delim** statements in the source file override this.
- f** *F* This is equivalent to a “**gfont** *F*” command.
- m** *n* Set the minimum point size to *n*. *eqn* will not reduce the size of subscripts or superscripts to a smaller size than *n*.
- M** *dir* Search *dir* for *eqnrc* before the default directories.
- N** Don’t allow newlines within delimiters. This option allows *eqn* to recover better from missing closing delimiters.
- p** *n* This says that subscripts and superscripts should be *n* points smaller than the surrounding text. This option is deprecated. Normally, *eqn* sets subscripts and superscripts at 70% of the size of the surrounding text.
- r** Only one size reduction.
- R** Don’t load *eqnrc*.
- s** *n* This is equivalent to a “**gsize** *n*” command. This option is deprecated. *eqn* normally sets equations at whatever the current point size is when the equation is encountered.
- T** *name*  
The output is for output driver *name*. Normally, the only effect of this is to define a macro *name* with a value of **1**; *eqnrc* uses this to provide definitions appropriate for the output driver. However, if the specified driver is “MathML”, the output is MathML markup rather than *troff* commands, and *eqnrc* is not loaded at all. The default output driver is **ps**.

## Files

*/usr/local/share/groff/1.23.0/tmac/eqnrc*  
Initialization file.

## MathML mode limitations

MathML is designed on the assumption that it cannot know the exact physical characteristics of the media and devices on which it will be rendered. It does not support fine control of motions and sizes to the same degree *troff* does. Thus:

- *eqn* parameters have no effect on the generated MathML.

- The **special**, **up**, **down**, **fwd**, and **back** operations cannot be implemented, and yield a MathML “<error>” message instead.
- The **vcenter** keyword is silently ignored, as centering on the math axis is the MathML default.
- Characters that *eqn* sets extra large in *troff* mode—notably the integral sign—may appear too small and need to have their “<mstyle>” wrappers adjusted by hand.

As in its *troff* mode, *eqn* in MathML mode leaves the **.EQ** and **.EN** delimiters in place for displayed equations, but emits no explicit delimiters around inline equations. They can, however, be recognized as strings that begin with “<math>” and end with “</math>” and do not cross line boundaries.

See section “Bugs” below for translation limits specific to *eqn*.

## Bugs

Inline equations are set at the point size that is current at the beginning of the input line.

In MathML mode, the **mark** and **lineup** features don’t work. These could, in theory, be implemented with “<maligngroup>” elements.

In MathML mode, each digit of a numeric literal gets a separate “<mn></mn>” pair, and decimal points are tagged with “<mo></mo>”. This is allowed by the specification, but inefficient.

## See also

“Typesetting Mathematics—User’s Guide” (2nd edition), by Brian W. Kernighan and Lorinda L. Cherry, 1978, AT&T Bell Laboratories Computing Science Technical Report No. 17.

*The T<sub>E</sub>Xbook*, by Donald E. Knuth, 1984, Addison-Wesley Professional.

[groff\\_char\(7\)](#), particularly subsections “Logical symbols”, “Mathematical symbols”, and “Greek glyphs”, documents a variety of special character escape sequences useful in mathematical typesetting.

[groff\(1\)](#), [troff\(1\)](#), [pic\(1\)](#), [groff\\_font\(5\)](#)

**Name**

eqn2graph – convert an eqn equation into a cropped image

**Synopsis**

**eqn2graph** [**-format** *output-format*] [*convert-arguments*]

**eqn2graph** **--help**

**eqn2graph** **-v**

**eqn2graph** **--version**

**Description**

*eqn2graph* reads a one-line *eqn(1)* equation from the standard input and writes an image file, by default in Portable Network Graphics (PNG) format, to the standard output.

The input EQN code should *not* be preceded by the **.EQ** macro that normally precedes it within *groff(1)* macros; nor do you need to have dollar-sign or other delimiters around the equation.

Arguments not recognized by *eqn2graph* are passed to the ImageMagick or GraphicsMagick program *convert(1)*. By specifying these, you can give your image a border, set the image's pixel density, or perform other useful transformations.

The output image is clipped using *convert*'s **-trim** option to the smallest possible bounding box that contains all the black pixels.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-format** *output-format*

Write the image in *output-format*, which must be understood by *convert*; the default is PNG.

**Environment**

*GROFF\_TMPDIR*

*TMPDIR*

*TMP*

*TEMP* These environment variables are searched in the given order to determine the directory where temporary files will be created. If none are set, */tmp* is used.

**Authors**

*eqn2graph* was written by Eric S. Raymond <esr@thyrsus.com>, based on a recipe for *pic2graph(1)*, by W. Richard Stevens.

**See also**

*pic2graph(1)*, *grap2graph(1)*, *eqn(1)*, *groff(1)*, *convert(1)*

**Name**

gdiffmk – mark differences between groff/nroff/troff files

**Synopsis**

**gdiffmk** [**-a** *add-mark*] [**-c** *change-mark*] [**-d** *delete-mark*] [**-x** *diff-command*] [**-D** [**-B**] [**-M** *mark1* *mark2*]] [**--**] *file1* *file2* [*output*]

**gdiffmk** **--help**

**gdiffmk** **--version**

**Description**

*gdiffmk* compares two *roff*(7) documents, *file1* and *file2*, and creates an output which is *file2* with added margin character (**.mc**) requests that indicate the lines with differences.

If the *file1* or *file2* argument is “-”, the standard input stream is read for that input. If the *output* filename is present, the output is written there. If it is “-” or absent, the output is written to the standard output stream. “-” cannot be both input and output.

**Options**

**--help** displays a usage message and **--version** shows version information; both exit afterward.

**-a** *add-mark*

Use *add-mark* for source lines not in *file1* but present in *file2*. Default: “+”.

**-B** By default, the deleted texts marked by the **-D** option end with an added *roff* break request, **.br**, to ensure that the deletions are marked properly. This is the only way to guarantee that deletions and small changes get flagged. This option directs the program not to insert these breaks; it makes no sense to use it without **-D**.

**-c** *change-mark*

Use *change-mark* for changed source lines. Default: “[”.

**-d** *delete-mark*

Use the *delete-mark* for deleted source lines. Default: “\*”.

**-D** Show the deleted portions from changed and deleted text. Default delimiting marks: “[[” ... “]]”.

**-M** *mark1* *mark2*

Change the delimiting marks for the **-D** option. It makes no sense to use this option without **-D**.

**-x** *diff-command*

Use the *diff-command* command to perform the comparison of *file1* and *file2*. In particular, *diff-command* should accept the GNU *diff*(1) **-D** option. Default: **diff**.

**--** Treat all subsequent arguments as file names, even if they begin with “-”.

**Bugs**

The output is not necessarily compatible with all macro packages and all preprocessors. A workaround that often overcomes preprocessor problems is to run *gdiffmk* on the output of all the preprocessors instead of the input source.

*gdiffmk* relies on the **-D** option of GNU *diff* to make a merged “#ifdef” output format. It hasn’t been tested whether other versions of *diff* support this option. Also see the **-x** *diff-command* option.

**Authors**

*gdiffmk* was written and is maintained by Mike Bianchi (MBianchi@Foveal.com).

**See also**

*groff*(1), *nroff*(1), *gtroff*(1), *roff*(7), *diff*(1)

**Name**

gilypond – embed LilyPond musical notation in groff documents

**Synopsis**

**gilypond** [-k] [{{--ly2eps|--pdf2eps}}] [-e *directory*] [-o *output-file*] [-p *filename-prefix*] [-t *tdir*]  
[{{-v|-V}}] [--] [*file* ...]

**gilypond** [{{--ly2eps|--pdf2eps}}] [--eps\_dir *directory*] [--keep\_all] [--output *output-file*] [--prefix  
*filename-prefix*] [--temp\_dir *tdir*] [--verbose] [--] [*file* ...]

**gilypond -?**

**gilypond -h**

**gilypond --help**

**gilypond --usage**

**gilypond -l**

**gilypond --license**

**gilypond --version**

**Description**

*gilypond* is a [groff\(7\)](#) preprocessor that enables the embedding of LilyPond music scores in *groff* documents. If no operands are given, or if *file* is “-”, *gilypond* reads the standard input stream. A double-dash argument (“--”) causes all subsequent arguments to be interpreted as *file* operands, even if their names start with a dash.

**Usage**

At present, *gilypond* works with the *groff* **ps**, **dvi**, **html**, and **xhtml** devices. The **lbp** and **lj4** devices are untested. Unfortunately, the **pdf** device does not yet work.

**Option overview**

**-?|-h|--help|--usage**

Display usage information and exit.

**--version**

Display version information and exit.

**-l|--license**

Display copyright license information and exit.

**Options for building EPS files**

**--ly2eps**

Direct *lilypond(1)* to create Encapsulated PostScript (EPS) files. This is the default.

**--pdf2eps**

The program *gilypond* generates a PDF file using *lilypond*. Then the EPS file is generated by *pdf2eps* and *ps2eps*.

**Directories and files**

**-e|--eps\_dir *directory\_name***

Normally all *EPS* files are sent to the temporary directory. With this option, you can generate your own directory, in which all useful *EPS* files are sent. So at last, the temporary directory can be removed.

**-p|--prefix *begin\_of\_name***

Normally all temporary files get names that start with the **ly...** prefix. With this option, you can freely change this prefix.

**-k|--keep\_all**

Normally all temporary files without the *eps* files are deleted. With this option, all generated files either by the *lilypond* program or other format transposers are kept.

**-t|--temp\_dir** *dir*

With this option, you call a directory that is the base for the temporary directory. This directory name is used as is without any extensions. If this directory does not exist it is be created. The temporary directory is created by Perl's security operations directly under this directory. In this temporary directory, the temporary files are stored.

## Output

**-o|--output** *file\_name*

Normally all *groff* output of this program is sent to **STDOUT**. With this option, that can be changed, such that the output is stored into a file named in the option argument *file\_name*.

**-v|-V|--verbose**

A lot more of information is sent to **STDERR**.

## Short option collections

The argument handling of options

*Short options* are arguments that start with a single dash **-**. Such an argument can consist of arbitrary many options without option argument, composed as a collection of option characters following the single dash.

Such a collection can be terminated by an option character that expects an option argument. If this option character is not the last character of the argument, the following final part of the argument is the option argument. If it is the last character of the argument, the next argument is taken as the option argument.

This is the standard for *POSIX* and *GNU* option management.

For example,

**-kVe** *some\_dir*

is a collection of the short options **-k** and **-V** without option argument, followed by the short option **-e** with option argument that is the following part of the argument *some\_dir*. So this argument could also be written as several arguments **-k -V -e** *some\_dir*.

## Handling of long options

Arguments that start with a double dash **--** are so-called *long options* *R*. Each double dash argument can only have a single long option.

*Long options* have or have not an option argument. An option argument can be the next argument or can be appended with an equal sign **=** to the same argument as the long option.

**--help** is a long option without an option argument.

**--eps\_dir** *some\_dir*

**--eps\_dir=***some\_dir*

is the long option **--eps\_dir** with the option argument *some\_dir*.

Moreover the program allows abbreviations of long options, as much as possible.

The *long option* **--keep\_all** can be abbreviated from **--keep\_al** up to **--k** because the program does not have another *long option* whose name starts with the character **k**.

On the other hand, the option **--version** cannot be abbreviated further than **--vers** because there is also the *long option* **--verbose** that can be abbreviated up to **--verb**.

An option argument can also be appended to an abbreviation. So is **--e=***some\_dir* the same as **--eps\_dir** *some\_dir*.

Moreover the program allows an arbitrary usage of upper and lower case in the option name. This is *Perl* style.

For example, the *long option* **--keep\_all** can as well be written as **--Keep\_All** or even as an abbreviation like **--KeE**.

## LilyPond regions in *roff* input

**Integrated LilyPond code**

A *lilypond* part within a structure written in the *groff* language is the whole part between the marks

```
.lilypond start
```

and

```
.lilypond end
```

A *groff* input can have several of these *lilypond* parts.

When processing such a *lilypond* part between **.lilypond start** and **.lilypond end** we say that the **gilypond** program is in *lilypond mode*.

These *lilypond* parts are sent into temporary *lilypond* files with the file name extension **.ly**. These files are transformed later on into *EPS* files.

**Inclusion of .ly files**

An additional command line for file inclusion of *lilypond* files is given by

```
.lilypond include file_name
```

in *groff* input. For each such *include* command, one file of *lilypond* code can be included into the *groff* code. Arbitrarily many of these commands can be included in the *groff* input.

These include commands can only be used outside the *lilypond* parts. Within the *lilypond mode*, this inclusion is not possible. So **.lilypond include** may not be used in *lilypond mode*, i.e. between **.lilypond start** and **.lilypond end**. These included *ly*-files are also transformed into *EPS* files.

**Generated files**

By the transformation process of *lilypond* parts into *EPS* files, there are many files generated. By default, these files are regarded as temporary files and as such stored in a temporary directory.

This process can be changed by command-line options.

**Command-line options for directories**

The temporary directory for this program is either created automatically or can be named by the option **-t|--temp\_dir dir**.

Moreover, the *EPS* files that are later on referred by **.PSPIC** command in the final *groff* output can be stored in a different directory that can be set by the command-line option **-e|--eps\_dir directory\_name**. With this option, the temporary directory can be removed completely at the end of the program.

The beginning of the names of the temporary files can be set by the command-line options **-p** or **--prefix**.

All of the temporary files except the *EPS* files are deleted finally. This can be changed by setting the command-line options **-k** or **--keep\_files**. With this, all temporary files and directories are kept, not deleted.

These *EPS* files are stored in a temporary or *EPS* directory. But they cannot be deleted by the transformation process because they are needed for the display which can take a long time.

**Transformation processes for generating EPS files****Mode pdf2eps**

This mode is the actual default and can also be chosen by the option **--pdf2eps**.

In this mode, the **.ly** files are transformed by the *lilypond*(1) program into *PDF* files, using

```
lilypond --pdf --output=file-name
```

for each **.ly** file. The *file-name* must be provided without the extension **.pdf**. By this process, a file *file-name.pdf* is generated.

The next step is to transform these *PDF* files into a *PS* file. This is done by the *pdf2ps*(1) program using

```
$ pdf2ps file-name.pdf file-name.pds
```

The next step creates an *EPS* file from the *PS* file. This is done by the *ps2eps*(1) program using

```
$ ps2eps file-name.ps
```

By that, a file *file-name.eps* is created for each *lilypond* part in the *groff* file or standard input.

The last step to be done is replacing all *lilypond* parts by the *groff* command

```
.PSPIC file-name.eps
```

**Mode ly2eps**

In earlier time, this mode was the default. But now it does not work any more, so accept the new default *pdf2eps*. For testing, this mode can also be chosen by the *glilypond* option **--ly2eps**.

In this mode, the **.ly** files are transformed by the *lilypond* program into many files of different formats, including *eps* files, using

```
$ lilypond --ps -dbackend=eps -dgs-load-fonts --output=file-name
```

for each **.ly** file. The output *file-name* must be provided without an extension, its directory is temporary.

There are many *EPS* files created. One having the complete transformed **ly** file, named *file-name.eps*.

Moreover there are *EPS* files for each page, named *file-name-digit.eps*.

The last step to be done is replacing all *lilypond* parts by the collection of the corresponding *EPS* page files. This is done by *groff* commands

```
.PSPIC file-name-digit.eps
```

**Generated groff output**

The new *groff(7)* structure generated by *glilypond* is either

- 1) sent to standard output and can there be saved into a file or piped into *groff(1)* or
- 2) stored into a file by given the option **-o** | **--output** *file\_name*

**Authors**

*glilypond* was written by Bernd Warken <groff-bernd.warken-72@web.de>.

**See also**

*groff(1)* describes the usage of the *groff* command and contains pointers to further documentation of the *groff* system.

*groff\_tmac(5)*

describes the **.PSPIC** request.

*lilypond(1)*

briefly describes the *lilypond* command and contains pointers to further documentation.

*pdf2ps(1)*

transforms a *PDF* file into a *PostScript* format.

*ps2eps(1)*

transforms a *PS* file into an *EPS* format.

**Name**

gperl – execute Perl commands in groff documents

**Synopsis**

**gperl** [*file* ...]

**gperl -h**

**gperl --help**

**gperl -v**

**gperl --version**

**Description**

This is a preprocessor for *groff*(1). It allows the use of *perl*(7) code in *groff*(7) files. The result of a *Perl part* can be stored in *groff strings* or *numerical registers* based on the arguments at a final line of a *Perl part*.

If no operands are given, or if *file* is “-”, *gperl* reads the standard input stream. A double-dash argument (“--”) causes all subsequent arguments to be interpreted as *file* operands, even if their names start with a dash. **-h** and **--help** display a usage message, whereas **-v** and **--version** display version information; all exit afterward.

**Perl regions**

*Perl parts* in *groff files* are enclosed by two **.Perl** requests with different arguments, a *starting* and an *ending* command.

**Starting Perl mode**

The starting *Perl request* can either be without arguments, or by a request that has the term **start** as its only argument.

- **.Perl**
- **.Perl start**

**Ending Perl mode without storage**

A **.Perl** command line with an argument different from **start** finishes a running *Perl part*. Of course, it would be reasonable to add the argument **stop**; that’s possible, but not necessary.

- **.Perl stop**
- **.Perl other\_than\_start**

The argument *other\_than\_start* can additionally be used as a *groff* string variable name for storage — see next section.

**Ending Perl mode with storage**

A useful feature of *gperl* is to store one or more results from the *Perl mode*.

The output of a *Perl part* can be got with backticks `...`.

This program collects all printing to STDOUT (normal standard output) by the Perl **print** program. This pseudo-printing output can have several lines, due to printed line breaks with **\n**. By that, the output of a Perl run should be stored into a Perl array, with a single line for each array member.

This Perl array output can be stored by *gperl* in either

*groff strings*

by creating a groff command **.ds**

*groff register*

by creating a groff command **.nr**

The storage modes can be determined by arguments of a final stopping **.Perl** command. Each argument **.ds** changes the mode into *groff string* and **.nr** changes the mode into *groff register* for all following output parts.

By default, all output is saved as strings, so **.ds** is not really needed before the first **.nr** command. That

suits to *groff(7)*, because every output can be saved as *groff* string, but the registers can be very restrictive.

In *string mode*, *gperl* generates a *groff string* storage line

```
.ds var_name content
```

In *register mode* the following *groff* command is generated

```
.nr var_name content
```

We present argument collections in the following. You can add as first argument for all **stop**. We omit this additional element.

**.Perl .ds** *var\_name*

This will store 1 output line into the *groff* string named *var\_name* by the automatically created command

```
.ds var_name output
```

**.Perl** *var\_name*

If *var\_name* is different from **start** this is equivalent to the former command, because the string mode is string with **.ds** command. default.

**.Perl** *var\_name1* *var\_name2*

This will store 2 output lines into *groff* string names *var\_name1* and *var\_name2*, because the default mode **.ds** is active, such that no **.ds** argument is needed. Of course, this is equivalent to

```
.Perl .ds var_name1 var_name2
```

and

```
.Perl .ds var_name1 .ds var_name2
```

**.Perl .nr** *var\_name1* *varname2*

stores both variables as register variables. *gperl* generates

```
.nr var_name1 output_line1
```

```
.nr var_name2 output_line2
```

**.Perl .nr** *var\_name1* **.ds** *var\_name2*

stores the 1st argument as *register* and the second as *string* by

```
.nr var_name1 output_line1
```

```
.ds var_name2 output_line2
```

## Example

A possible *Perl part* in a *roff file* could look like that:

```
before
.Pperl start
my $result = 'some data';
print $result;
.Pperl stop .ds string_var
after
```

This stores the result **”some data”** into the *roff string* called **string\_var**, such that the following line is printed:

```
.ds string_var some data
```

by *gperl* as food for the coming *groff* run.

A *Perl part* with several outputs is:

```
.Pperl start
print "first\n";
print "second line\n";
print "3\n";
.Pperl var1 var2 .nr var3
```

This stores 3 printed lines into 3 *groff* strings. **var1,var2,var3**. So the following *groff* command lines are created:

```
.ds var1 first
.ds var2 second line
```

```
.nr var3 3
```

**Authors**

*gperl* was written by Bernd Warken <groff-bernd.warken-72@web.de>.

**See also**

Man pages related to *groff* are [groff\(1\)](#), [groff\(7\)](#), and [grog\(1\)](#).

Documents related to *Perl* are [perl\(1\)](#), [perl\(7\)](#).

**Name**

gpinyin – use Hanyu Pinyin Chinese in groff documents

**Synopsis**

**gpinyin** [*file* ...]

**gpinyin -h**

**gpinyin --help**

**gpinyin -v**

**gpinyin --version**

**Description**

*gpinyin* is a preprocessor for *groff*(1) that facilitates use of Hanyu Pinyin in *groff*(7) files. Pinyin is a method for writing the Mandarin Chinese language with the Latin alphabet. Mandarin consists of more than four hundred base syllables, each spoken with one of five different tones. Changing the tone applied to the syllable generally alters the meaning of the word it forms. In Pinyin, a syllable is written in the Latin alphabet and a numeric tone indicator can be appended to each syllable.

Each *input-file* is a file name or the character “–” to indicate that the standard input stream should be read. As usual, the argument “–” can be used in order to force interpretation of all remaining arguments as file names, even if an *input-file* argument begins with a “–”. **-h** and **--help** display a usage message, while **-v** and **--version** show version information; all exit afterward.

**Pinyin sections**

Pinyin sections in *groff* files are enclosed by two **.pinyin** requests with different arguments. The starting request is

```
.pinyin start
```

or

```
.pinyin begin
```

and the ending request is

```
.pinyin stop
```

or

```
.pinyin end
```

.

**Syllables**

In Pinyin, each syllable is represented by one to six letters drawn from the fifty-two upper- and lowercase letters of the Unicode basic Latin character set, plus the letter “U” with dieresis (umlaut) in both cases—in other words, the members of the set “[a-zA-ZüÜ]”.

In *groff* input, all basic Latin letters are written as themselves. The “u with dieresis” can be written as “[u]” in lowercase or “[U]” in uppercase. Within **.pinyin** sections, *gpinyin* supports the form “ue” for lowercase and the forms “Ue” and “UE” for uppercase.

**Tones**

Each syllable has exactly one of five *tones*. The fifth tone is not explicitly written at all, but each of the first through fourth tones is indicated with a diacritic above a specific vowel within the syllable.

In a *gpinyin* source file, these tones are written by adding a numeral in the range 0 to 5 after the syllable. The tone numbers 1 to 4 are transformed into accents above vowels in the output. The tone numbers 0 and 5 are synonymous.

The tones are written as follows.

Tone	Description	Diacritic	Example Input	Example Output
first	flat	-	ma1	mā
second	rising	ˊ	ma2	má
third	falling-rising	ˇ	ma3	mǎ
fourth	falling	ˋ	ma4	mà
fifth	neutral	(none)	ma0 ma5	ma

The neutral tone number can be omitted from a word-final syllable, but not otherwise.

### Authors

*gpinyin* was written by Bernd Warken <groff-bernd.warken-72@web.de>.

### See also

Useful documents on the World Wide Web related to Pinyin include

*Pinyin to Unicode* <<http://www.foolsworkshop.com/ptou/index.html>>,

*On-line Chinese Tools* <<http://www.mandarintools.com/>>,

*Pinyin.info: a guide to the writing of Mandarin Chinese in romanization* <<http://www.pinyin.info/index.html>>,

“Where do the tone marks go?” <<http://www.pinyin.info/rules/where.html>>,

*pinyin.txt* from the CJK macro package for T<sub>E</sub>X <[http://git.savannah.gnu.org/gitweb/?p=cjk.git;a=blob\\_plain;f=doc/pinyin.txt;hb=HEAD](http://git.savannah.gnu.org/gitweb/?p=cjk.git;a=blob_plain;f=doc/pinyin.txt;hb=HEAD)>,

and

*pinyin.sty* from the CJK macro package for T<sub>E</sub>X <[http://git.savannah.gnu.org/gitweb/?p=cjk.git;a=blob\\_plain;f=textinput/pinyin.sty;hb=HEAD](http://git.savannah.gnu.org/gitweb/?p=cjk.git;a=blob_plain;f=textinput/pinyin.sty;hb=HEAD)>.

[groff\(1\)](#) and [grog\(1\)](#) explain how to view *roff* documents.

[groff\(7\)](#) and [groff\\_char\(7\)](#) are comprehensive references covering the language elements of GNU *troff* and the available glyph repertoire, respectively.

**Name**

grap2graph – convert a GRAP diagram into a cropped image

**Synopsis**

**grap2graph** [**--unsafe**] [**--format** *output-format*] [*convert-arguments*]

**grap2graph --help**

**grap2graph -v**

**grap2graph --version**

**Description**

*grap2graph* reads a *grap*(1) program from the standard input and writes an image file, by default in Portable Network Graphics (PNG) format, to the standard output.

The input GRAP code should *not* be wrapped with the **.G1** and **.G2** macros that normally guard it within *groff*(1) documents.

Arguments not recognized by *grap2graph* are passed to the ImageMagick or GraphicsMagick program *convert*(1). By specifying these, you can give your image a border, set the image's pixel density, or perform other useful transformations.

The output image is clipped using *convert*'s **-trim** option to the smallest possible bounding box that contains all the black pixels.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**--format** *output-format*

Write the image in *output-format*, which must be understood by *convert*; the default is PNG.

**--unsafe**

Run *groff* in *unsafe* mode, enabling the PIC command **sh** to execute arbitrary Unix shell commands. The *groff* default is to forbid this.

**Environment**

*GROFF\_TMPDIR*

*TMPDIR*

*TMP*

*TEMP* These environment variables are searched in the given order to determine the directory where temporary files will be created. If none are set, */tmp* is used.

**Authors**

*grap2graph* was written by Eric S. Raymond <esr@thyrsus.com>, based on a recipe for *pic2graph*(1), by W. Richard Stevens.

**See also**

*pic2graph*(1), *eqn2graph*(1), *grap*(1), *pic*(1), *groff*(1), *convert*(1)

**Name**

grn – embed gremlin images in groff documents

**Synopsis**

**grn** [-C] [-T *dev*] [-M *dir*] [-F *dir*] [*file* ...]

**grn** -?

**grn** --help

**grn** -v

**grn** --version

**Description**

*grn* is a preprocessor for including *gremlin* pictures in *troff*(1) input. *grn* writes to standard output, processing only input lines between two that start with **.GS** and **.GE**. Those lines must contain *grn* commands (see below). These macros request a *gremlin* file; the picture in that file is converted and placed in the *troff* input stream. **.GS** may be called with a **C**, **L**, or **R** argument to center, left-, or right-justify the whole *gremlin* picture (the default is to center). If no *file* is mentioned, the standard input is read. At the end of the picture, the position on the page is the bottom of the *gremlin* picture. If the *grn* entry is ended with **.GF** instead of **.GE**, the position is left at the top of the picture.

Currently only the *me* macro package has support for **.GS**, **.GE**, and **.GF**.

*grn* produces drawing escape sequences that use *groff*'s color scheme extension (**AD'F** ...'), and thus may not work with other *troff*s.

***grn* commands**

Each input line between **.GS** and **.GE** may have one *grn* command. Commands consist of one or two strings separated by white space, the first string being the command and the second its operand. Commands may be upper- or lowercase and abbreviated down to one character.

Commands that affect a picture's environment (those listed before “**default**”, see below) are only in effect for the current picture: the environment is reinitialized to the defaults at the start of the next picture. The commands are as follows.

**1** *N*

**2** *N*

**3** *N*

**4** *N* Set *gremlin*'s text size number 1 (2, 3, or 4) to *N* points. The default is 12 (16, 24, and 36, respectively).

**roman** *f*

**italics** *f*

**bold** *f*

**special** *f*

Set the roman (italics, bold, or special) font to *troff*'s font *f* (either a name or number). The default is R (I, B, and S, respectively).

**l** *f*

**stipple** *f*

Set the stipple font to *troff*'s stipple font *f* (name or number). The command **stipple** may be abbreviated down as far as “**st**” (to avoid confusion with “**special**”). There is *no* default for stipples (unless one is set by the “**default**” command), and it is invalid to include a *gremlin* picture with polygons without specifying a stipple font.

**x** *N*

**scale** *N*

Magnify the picture (in addition to any default magnification) by *N*, a floating-point number larger than zero. The command **scale** may be abbreviated down to “**sc**”.

**narrow** *N*

**medium** *N*

**thick** *N*

Set the thickness of *gremlin*'s narrow (medium and thick, respectively) lines to *N* times 0.15pt (this value can be changed at compile time). The default is 1.0 (3.0 and 5.0, respectively), which corresponds to 0.15pt (0.45pt and 0.75pt, respectively). A thickness value of zero selects the smallest available line thickness. Negative values cause the line thickness to be proportional to the current point size.

**pointscale** [**off**]**on**

Scale text to match the picture. Gremlin text is usually printed in the point size specified with the commands **1**, **2**, **3**, or **4**, regardless of any scaling factors in the picture. Setting **pointscale** will cause the point sizes to scale with the picture (within *troff*'s limitations, of course). An operand of anything but **off** will turn text scaling on.

**default** Reset the picture environment defaults to the settings in the current picture. This is meant to be used as a global parameter setting mechanism at the beginning of the *troff* input file, but can be used at any time to reset the default settings.

**width** *N*

Force the picture to be *N* inches wide. This overrides any scaling factors present in the same picture. "**width 0**" is ignored.

**height** *N*

Force the picture to be *N* inches high, overriding other scaling factors. If both **width** and **height** are specified, the tighter constraint will determine the scale of the picture. **height** and **width** commands are not saved with a "**default**" command. They will, however, affect point size scaling if that option is set.

**file** *name*

Get picture from *gremlin* file *name* located the current directory (or in the library directory; see the **-M** option above). If multiple **file** commands are given, the last one controls. If *name* doesn't exist, an error message is reported and processing continues from the **.GE** line.

### Usage with *groff*

Since *grn* is a preprocessor, it has no access to elements of formatter state, such as indentation, line length, type size, or register values. Consequently, no *troff* input can be placed between the **.GS** and **.GE** macros. However, *gremlin* text elements are subsequently processed by *troff*, so anything valid in a single line of *troff* input is valid in a line of *gremlin* text (barring the dot control character "." at the beginning of a line). Thus, it is possible to have equations within a *gremlin* figure by including in the *gremlin* file *eqn* expressions enclosed by previously defined delimiters (e.g., "\$\$").

When using *grn* along with other preprocessors, it is best to run *tbl(1)* before *grn*, *pic(1)*, and/or *ideal* to avoid overworking *tbl*. *eqn(1)* should always be run last. *groff(1)* will automatically run preprocessors in the correct order.

A picture is considered an entity, but that doesn't stop *troff* from trying to break it up if it falls off the end of a page. Placing the picture between "keeps" in the *me* macros will ensure proper placement.

*grn* uses *troff*'s registers **g1** through **g9** and sets registers **g1** and **g2** to the width and height of the *gremlin* figure (in device units) before entering the **.GS** macro (this is for those who want to rewrite these macros).

### Gremlin file format

There exist two distinct *gremlin* file formats: the original format for AED graphic terminals, and the Sun or X11 version. An extension used by the Sun/X11 version allowing reference points with negative coordinates is *not* compatible with the AED version. As long as a *gremlin* file does not contain negative coordinates, either format will be read correctly by either version of *gremlin* or *grn*. The other difference in Sun/X11 format is the use of names for picture objects (e.g., **POLYGON**, **CURVE**) instead of numbers. Files representing the same picture are shown below.

```

sungremlinfile      gremlinfile
0 240.00 128.00    0 240.00 128.00
CENTCENT           2
240.00 128.00     240.00 128.00
185.00 120.00     185.00 120.00
240.00 120.00     240.00 120.00
296.00 120.00     296.00 120.00
*                  -1.00 -1.00
2 3                2 3
10 A Triangle      10 A Triangle
POLYGON            6
224.00 416.00     224.00 416.00
96.00 160.00      96.00 160.00
384.00 160.00     384.00 160.00
*                  -1.00 -1.00
5 1                5 1
0                  0
-1                 -1
    
```

- The first line of each *gremlin* file contains either the string “**gremlinfile**” (AED) or “**sungremlinfile**” (Sun/X11).
- The second line of the file contains an orientation and *x* and *y* values for a positioning point, separated by spaces. The orientation, either **0** or **1**, is ignored by the Sun/X11 version. **0** means that *gremlin* will display things in horizontal format (a drawing area wider than it is tall, with a menu across the top). **1** means that *gremlin* will display things in vertical format (a drawing area taller than it is wide, with a menu on the left side). *x* and *y* are floating-point values giving a positioning point to be used when this file is read into another file. The stuff on this line really isn’t all that important; a value of “**1 0.00 0.00**” is suggested.
- The rest of the file consists of zero or more element specifications. After the last element specification is a line containing the string “**-1**”.
- Lines longer than 127 characters are truncated to that length.

**Element specifications**

- The first line of each element contains a single decimal number giving the type of the element (AED) or its name (Sun/X11).

*gremlin* File Format: Object Type Specification

AED Number	Sun/X11 Name	Description
<b>0</b>	<b>BOTLEFT</b>	bottom-left-justified text
<b>1</b>	<b>BOTRIGHT</b>	bottom-right-justified text
<b>2</b>	<b>CENTCENT</b>	center-justified text
<b>3</b>	<b>VECTOR</b>	vector
<b>4</b>	<b>ARC</b>	arc
<b>5</b>	<b>CURVE</b>	curve
<b>6</b>	<b>POLYGON</b>	polygon
<b>7</b>	<b>BSPLINE</b>	b-spline
<b>8</b>	<b>BEZIER</b>	Bézier
<b>10</b>	<b>TOPLEFT</b>	top-left-justified text
<b>11</b>	<b>TOPCENT</b>	top-center-justified text
<b>12</b>	<b>TOPRIGHT</b>	top-right-justified text
<b>13</b>	<b>CENTLEFT</b>	left-center-justified text
<b>14</b>	<b>CENTRIGHT</b>	right-center-justified text
<b>15</b>	<b>BOTCENT</b>	bottom-center-justified text

- After the object type comes a variable number of lines, each specifying a point used to display the element. Each line contains an x-coordinate and a y-coordinate in floating-point format, separated by spaces. The list of points is terminated by a line containing the string “-1.0 -1.0” (AED) or a single asterisk, “\*” (Sun/X11).
- After the points comes a line containing two decimal values, giving the brush and size for the element. The brush determines the style in which things are drawn. For vectors, arcs, and curves there are six valid brush values.

<b>1</b>	thin dotted lines
<b>2</b>	thin dot-dashed lines
<b>3</b>	thick solid lines
<b>4</b>	thin dashed lines
<b>5</b>	thin solid lines
<b>6</b>	medium solid lines

For polygons, one more value, 0, is valid. It specifies a polygon with an invisible border. For text, the brush selects a font as follows.

<b>1</b>	roman (R font in <i>troff</i> )
<b>2</b>	italics (I font in <i>troff</i> )
<b>3</b>	bold (B font in <i>troff</i> )
<b>4</b>	special (S font in <i>troff</i> )

If you’re using *grn* to run your pictures through *groff*, the font is really just a starting font. The text string can contain formatting sequences like “\fI” or “\d” which may change the font (as well as do many other things). For text, the size field is a decimal value between 1 and 4. It selects the size of the font in which the text will be drawn. For polygons, this size field is interpreted as a stipple number to fill the polygon with. The number is used to index into a stipple font at print time.

- The last line of each element contains a decimal number and a string of characters, separated by a single space. The number is a count of the number of characters in the string. This information is used only for text elements, and contains the text string. There can be spaces inside the text. For arcs, curves, and vectors, the character count is zero (**0**), followed by exactly one space before the newline.

### Coordinates

*gremlin* was designed for AED terminals, and its coordinates reflect the AED coordinate space. For vertical pictures, *x* values range 116 to 511, and *y* values from 0 to 483. For horizontal pictures, *x* values range from 0 to 511, and *y* values from 0 to 367. Although you needn’t absolutely stick to this range, you’ll get better results if you at least stay in this vicinity. Also, point lists are terminated by a point of (-1, -1), so you shouldn’t ever use negative coordinates. *gremlin* writes out coordinates using the *printf*(3) format “%f1.2”; it’s probably a good idea to use the same format if you want to modify the *grn* code.

### Sun/X11 coordinates

There is no restriction on the range of coordinates used to create objects in the Sun/X11 version of *gremlin*. However, files with negative coordinates *will* cause problems if displayed on the AED.

### Options

- ? and --**help** display a usage message, while -v and --**version** show version information; all exit afterward.
- T** *dev* Prepare device output using output driver *dev*. The default is **ps**. See [groff\(1\)](#) for a list of valid devices.
- M** *dir* Prepend *dir* to the search path for *gremlin* files. The default search path is the current directory, the home directory, */usr/local/lib/groff/site-tmac*, */usr/local/share/groff/site-tmac*, and */usr/local/share/groff/1.23.0/tmac*, in that order.
- F** *dir* Search *dir* for subdirectories *devname* (*name* is the name of the output driver) for the *DESC* file before the default font directories */usr/local/share/groff/site-font*, */usr/local/share/groff/1.23.0/font*, and */usr/lib/font*.

**-C** Recognize **.GS** and **.GE** (and **.GF**) even when followed by a character other than space or newline.

**Files**

*/usr/local/share/groff/1.23.0/font/devname/DESC*  
describes the output device *name*.

**Authors**

David Slattengren and Barry Roitblat wrote the original Berkeley *gn*. Daniel Senderowicz and Werner Lemberg modified it for *groff*.

**See also**

*gremlin(1)*, *groff(1)*, *pic(1)*, *ideal(1)*

**Name**

grodvi – groff output driver for TeX DVI format

**Synopsis**

**grodvi** [**-dl**] [**-F** *dir*] [**-p** *paper-format*] [**-w** *n*] [*file* ...]

**grodvi** **--help**

**grodvi** **-v**

**grodvi** **--version**

**Description**

The GNU *roff* DVI output driver translates the output of [troff\(1\)](#) into TeX DVI format. Normally, *grodvi* is invoked by [groff\(1\)](#) when the latter is given the “**-T dvi**” option. (In this installation, **ps** is the default output device.) Use *groff*’s **-P** option to pass any options shown above to *grodvi*. If no *file* arguments are given, or if *file* is “-”, *grodvi* reads the standard input stream. Output is written to the standard output stream.

The DVI file generated by *grodvi* can be printed by any correctly written DVI driver. *troff* drawing primitives are implemented using *tpic* version 2 specials. If the driver does not support these, the **\D** commands will not produce any output.

There is an additional drawing command available:

**\D'R** *dh dv*'

Draw a rule (solid black rectangle), with one corner at the current position, and the diagonally opposite corner at the current position +(*dh,dv*). Afterwards the current position will be at the opposite corner. This produces a rule in the DVI file and so can be printed even with a driver that does not support the *tpic* specials unlike the other **\D** commands.

The *groff* command **\X'anything'** is translated into the same command in the DVI file as would be produced by **\special{anything}** in TeX; *anything* may not contain a newline.

For inclusion of EPS image files, **-Tdvi** loads *pspic.tmac* automatically, providing the **.PSPIC** macro. See [groff\\_tmac\(5\)](#) for a detailed description.

Font files for *grodvi* can be created from TFM (TeX font metrics) files using [tfmtoedit\(1\)](#). The font description file should contain the following additional commands:

**internalname** *name*

The name of the TFM file (without the *.tfm* extension) is *name*.

**checksum** *n*

The checksum in the TFM file is *n*.

**designsize** *n*

The designsize in the TFM file is *n*.

These are automatically generated by *tfmtoedit*.

The default color for **\m** and **\M** is black. Currently, the drawing color for **\D** commands is always black, and fill color values are translated to gray.

In *groff*, as in AT&T *troff*, the **\N** escape sequence can be used to access characters by their position in the corresponding TFM file; all characters in the TFM file can be accessed this way.

By design, the DVI format doesn’t care about physical dimensions of the output medium. Instead, *grodvi* emits the equivalent to TeX’s **\special{papersize=width,length}** on the first page; *dvips* (and possibly other DVI drivers) then sets the page size accordingly. If either the page width or length is not positive, no **papersize** special is output.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

- d** Do not use *tpic* specials to implement drawing commands. Horizontal and vertical lines will be implemented by rules. Other drawing commands will be ignored.
- Fdir** Prepend directory *dir/devname* to the search path for font and device description files; *name* is the name of the device, usually **dvi**.
- l** Use landscape orientation rather than portrait.
- p paper-format**  
Set physical dimensions of output medium, overriding the **papersize**, **paperlength**, and **paperwidth** directives in the *DESC* file. *paper-format* can be any argument accepted by the **papersize** directive; see [groff\\_font\(5\)](#).
- w n** Draw rules (lines) with a thickness of *n* thousandths of an em. The default thickness is **40** (0.04 em).

## Usage

There are styles called **R**, **I**, **B**, and **BI** mounted at font positions 1 to 4. The fonts are grouped into families **T** and **H** having members in each of these styles:

<b>TR</b>	CM Roman (cmr10)
<b>TI</b>	CM Text Italic (cmti10)
<b>TB</b>	CM Bold Extended Roman (cmbx10)
<b>TBI</b>	CM Bold Extended Text Italic (cmbxti10)
<b>HR</b>	CM Sans Serif (cmss10)
<b>HI</b>	CM Slanted Sans Serif (cmssi10)
<b>HB</b>	CM Sans Serif Bold Extended (cmssbx10)
<b>HBI</b>	CM Slanted Sans Serif Bold Extended (cmssbxo10)

There are also the following fonts which are not members of a family:

<b>CW</b>	CM Typewriter Text (cmtt10)
<b>CWI</b>	CM Italic Typewriter Text (cmitt10)

Special fonts are **MI** (cmmi10), **S** (cmsy10), **EX** (cmex10), **SC** (cmtex10, only for **CW**), and, perhaps surprisingly, **TR**, **TI**, and **CW**, due to the different font encodings of text fonts. For italic fonts, **CWI** is used instead of **CW**.

Finally, the symbol fonts of the American Mathematical Society are available as special fonts **SA** (msam10) and **SB** (msbm10). These two fonts are not mounted by default.

Using the option **-mec** (which loads the file *ec.tmac*) selects the EC and TC fonts. The EC fonts are designed similarly to the CM fonts; additionally, they provide Euro **[Eu]** and per mille **[%0]** glyphs. *ec.tmac* must be called before any language-specific files; it doesn't take care of **.hcode** values.

## Environment

### *GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device's directory of device and font description files. See [troff\(1\)](#) and [groff\\_font\(5\)](#).

## Files

*/usr/local/share/groff/1.23.0/font/devdvi/DESC*  
describes the **dvi** output device.

*/usr/local/share/groff/1.23.0/font/devdvi/F*  
describes the font known as *F* on device **dvi**.

*/usr/local/share/groff/1.23.0/tmac/dvi.tmac*  
defines macros for use with the **dvi** output device. It is automatically loaded by *troffrc* when the **dvi** output device is selected.

*/usr/local/share/groff/1.23.0/tmac/ec.tmac*  
configures the **dvi** output device to use the EC and TC font families instead of CM (Computer Modern).

**Bugs**

DVI files produced by *grodvi* use a different resolution (57816 units per inch) from those produced by T<sub>E</sub>X. Incorrectly written drivers which assume the resolution used by T<sub>E</sub>X, rather than using the resolution specified in the DVI file will not work with *grodvi*.

When using the **-d** option with boxed tables, vertical and horizontal lines can sometimes protrude by one pixel. This is a consequence of the way T<sub>E</sub>X requires that the heights and widths of rules be rounded.

**See also**

[tjmtodit\(1\)](#), [groff\(1\)](#), [troff\(1\)](#), [groff\\_out\(5\)](#), [groff\\_font\(5\)](#), [groff\\_char\(7\)](#), [groff\\_tmac\(5\)](#)

**Name**

groff – front end to the GNU roff document formatting system

**Synopsis**

```
groff [-abcCeEgGijklNpRsStUVXzZ] [-d cs] [-d name=string] [-D enc] [-f fam] [-F dir] [-I dir]
      [-K enc] [-L arg] [-m name] [-M dir] [-n num] [-o list] [-P arg] [-r cn] [-r reg=expr] [-T dev]
      [-w name] [-W name] [file ...]
```

**groff -h**

**groff --help**

**groff -v** [option ...] [file ...]

**groff --version** [option ...] [file ...]

**Description**

*groff* is the primary front end to the GNU *roff* document formatting system. GNU *roff* transforms text input files into typeset output in a variety of formats, such as PDF and HTML. It is also used to format man pages for viewing on terminals. The *groff* command orchestrates the execution of preprocessors, the transformation of input documents into a device-independent page description language, and the production of output from that language.

**Options**

**-h** and **--help** display a usage message and exit.

Because *groff* is intended to subsume most users' direct invocations of the *troff*(1) formatter, the two programs share a set of options. However, *groff* has some options that *troff* does not share, and others which *groff* interprets differently. At the same time, not all valid *troff* options can be given to *groff*.

**groff-specific options**

The following options either do not exist for *troff* or are interpreted differently by *groff*.

**-D enc** Set default input encoding used by *preconv*(1) to *enc*; implies **-k**.

**-e** Run *eqn*(1) preprocessor.

**-g** Run *grn*(1) preprocessor.

**-G** Run *grap*(1) preprocessor; implies **-p**.

**-I dir** Works as *troff*'s option (see below), but also implies **-g** and **-s**. It is passed to *soelim*(1) and the output driver, and *grn* is passed an **-M** option with *dir* as its argument.

**-j** Run *chem*(1) preprocessor; implies **-p**.

**-k** Run *preconv*(1) preprocessor. Refer to its manual page for its behavior if neither of *groff*'s **-K** or **-D** options is also specified.

**-K enc** Set input encoding used by *preconv*(1) to *enc*; implies **-k**.

**-l** Send the output to a spooler program for printing. The **"print"** directive in the device description file specifies the default command to be used; see *groff\_font*(5). If no such directive is present for the output device, output is piped to *lpr*(1). See options **-L** and **-X**.

**-L arg** Pass *arg* to the print spooler program. If multiple *args* are required, each should be passed with a separate **-L** option. *groff* does not prefix an option dash to *arg* before passing it to the spooler program.

**-M** Works as *troff*'s option (see below), but is also passed to *eqn*(1), *grap*(1), and *grn*(1).

**-N** Prohibit newlines within *eqn* delimiters: pass **-N** to *eqn*(1).

**-p** Run *pic*(1) preprocessor.

**-P arg** Pass *arg* to the postprocessor. If multiple *args* are required, each should be passed with a separate **-P** option. *groff* does not prefix an option dash to *arg* before passing it to the postprocessor.

- R** Run *refer(1)* preprocessor. No mechanism is provided for passing arguments to *refer* because most *refer* options have equivalent language elements that can be specified within the document.
- s** Run *soelim(1)* preprocessor.
- S** Operate in “safer” mode; see **-U** below for its opposite. For security reasons, safer mode is enabled by default.
- t** Run *tbl(1)* preprocessor.
- T dev** Direct *troff* to format the input for the output device *dev*. *groff* then calls an output driver to convert *troff*’s output to a form appropriate for *dev*; see subsection “Output devices” below.
- U** Operate in unsafe mode: pass the **-U** option to *pic* and *troff*. See **-S**.
- v**
- version**  
Write version information for *groff* and all programs run by it to the standard output stream; that is, the given command line is processed in the usual way, passing **-v** to the formatter and any pre- or postprocessors invoked.
- V** Output the pipeline that would be run by *groff* (as a wrapper program) to the standard output stream, but do not execute it. If given more than once, the pipeline is both written to the standard error stream and run.
- X** Use *gxditview(1)* instead of the usual postprocessor to (pre)view a document on an X11 display.
- Z** Disable postprocessing. *troff* output will appear on the standard output stream (unless suppressed with **-z**); see *groff\_out(5)* for a description of this format.

#### Transparent options

The following options are passed as-is to the formatter program *troff(1)* and described in more detail in its man page.

- a** Generate a plain text approximation of the typeset output.
- b** Write a backtrace to the standard error stream on each error or warning.
- c** Start with color output disabled.
- C** Enable AT&T *troff* compatibility mode; implies **-c**.
- d cs**
- d name=string**  
Define string.
- E** Inhibit *troff* error messages; implies **-Ww**.
- f fam** Set default font family.
- F dir** Search in directory *dir* for the selected output device’s directory of device and font description files.
- i** Process standard input after the specified input files.
- I dir** Search *dir* for input files.
- m name**  
Process *name.tmac* before input files.
- M dir** Search directory *dir* for macro files.
- n num**  
Number the first page *num*.
- o list** Output only pages in *list*.

- r** *cn*
- r** *reg=expr*  
Define register.
- w** *name*
- W** *name*  
Enable (**-w**) or inhibit (**-W**) emission of warnings in category *name*.
- z**  
Suppress formatted device-independent output of *troff*.

## Usage

The architecture of the GNU *roff* system follows that of other device-independent *roff* implementations, comprising preprocessors, macro packages, output drivers (or “postprocessors”), a suite of utilities, and the formatter *troff* at its heart. See [roff\(7\)](#) for a survey of how a *roff* system works.

The front end programs available in the GNU *roff* system make it easier to use than traditional *roff*s that required the construction of pipelines or use of temporary files to carry a source document from maintainable form to device-ready output. The discussion below summarizes the constituent parts of the GNU *roff* system. It complements [roff\(7\)](#) with *groff*-specific information.

## Getting started

Those who prefer to learn by experimenting or are desirous of rapid feedback from the system may wish to start with a “Hello, world!” document.

```
$ echo "Hello, world!" | groff -Tascii | sed '/^$/d'
Hello, world!
```

We used a *sed* command only to eliminate the 65 blank lines that would otherwise flood the terminal screen. (*roff* systems were developed in the days of paper-based terminals with 66 lines to a page.)

Today’s users may prefer output to a UTF-8-capable terminal.

```
$ echo "Hello, world!" | groff -Tutf8 | sed '/^$/d'
```

Producing PDF, HTML, or T<sub>E</sub>X’s DVI is also straightforward. The hard part may be selecting a viewer program for the output.

```
$ echo "Hello, world!" | groff -Tpdf > hello.pdf
$ evince hello.pdf
$ echo "Hello, world!" | groff -Thtml > hello.html
$ firefox hello.html
$ echo "Hello, world!" | groff -Tdvi > hello.dvi
$ xdvi hello.html
```

## Using *groff* as a REPL

Those with a programmer’s bent may be pleased to know that they can use *groff* in a read-evaluate-print loop (REPL). Doing so can be handy to verify one’s understanding of the formatter’s behavior and/or the syntax it accepts. Turning on all warnings with **-ww** can aid this goal.

```
$ groff -ww -Tutf8
\# This is a comment. Let's define a register.
.nr a 1
\# Do integer arithmetic with operators evaluated left-to-right.
.nr b \n[a]+5/2
\# Let's get the result on the standard error stream.
.tm \n[b]
3
\# Now we'll define a string.
.ds name Leslie\ " This is another form of comment.
.nr b (\n[a] + (7/2))
\# Center the next two text input lines.
.ce 2
```

```

Hi, \*[name].
Your secret number is \n[b].
\# We will see that the division rounded toward zero.
It is
\# Here's an if-else control structure.
.ie (\n[b] % 2) odd.
.el even.
\# This trick sets the page length to the current vertical
\# position, so that blank lines don't spew when we're done.
.pl \n[nl]u
<Control-D>

                Hi, Leslie.
                Your secret number is 4.

It is even.

```

### Paper size

In GNU *roff*, the page dimensions for the formatter *troff* and for output devices are handled separately. In the formatter, requests are used to set the page length (**.pl**), page offset (or left margin, **.po**), and line length (**.ll**). The right margin is not explicitly configured; the combination of page offset and line length provides the information necessary to derive it. The *papersize* macro package, automatically loaded by *troff*, provides an interface for configuring page dimensions by convenient names, like “letter” or “A4”; see [groff\\_tmac\(5\)](#). The default used by the formatter depends on its build configuration; in this installation, it is “A4”.

It is up to each macro package to respect the page dimensions configured in this way. Some offer alternative mechanisms.

For each output device, the size of the output medium can be set in its *DESC* file. Most also recognize a command-line option **-p** to override the default dimensions and an option **-l** to use landscape orientation. See [groff\\_font\(5\)](#) for a description of the **papersize** directive, which takes an argument of the same form as **-p**. The output driver’s man page, such as [grops\(1\)](#), may also be helpful. *groff* uses the command-line option **-P** to pass options to output devices; for example, use the following for PostScript output on A4 paper in landscape orientation.

```
groff -Tps -dpaper=a4l -P-pa4 -P-l -ms foo.ms > foo.ps
```

### Front end

The *groff* program is a wrapper around the [troff\(1\)](#) program. It allows one to specify preprocessors via command-line options and automatically runs the appropriate postprocessor for the selected output device. Doing so, the manual construction of pipelines or management of temporary files required of users of traditional [roff\(7\)](#) systems can be avoided. The [grog\(1\)](#) program can be used to infer an appropriate *groff* command line to format a document.

### Language

Input to a *roff* system is in plain text interleaved with control lines and escape sequences. The combination constitutes a document in one of a family of languages we also call *roff*; see [roff\(7\)](#) for background. An overview of GNU *roff* language syntax and features, including lists of all supported escape sequences, requests, and pre-defined registers, can be found in [groff\(7\)](#). GNU *roff* extensions to the AT&T *troff* language, a common subset of *roff* dialects extant today, are detailed in [groff\\_diff\(7\)](#).

### Preprocessors

A preprocessor is an interpreter of a domain-specific language that produces *roff* language output. Frequently, such input is confined to sections or regions of a *roff* input file (bracketed with macro calls specific to each preprocessor), which it replaces. Preprocessors therefore often interpret a subset of *roff* syntax along with their own language. GNU *roff* provides reimplementations of most preprocessors familiar to users of AT&T *troff*; these routinely have extended features and/or require GNU *troff* to format their output. Preprocessors distributed with GNU *roff* include

- eqn(1)* for mathematical formulae,
- grn(1)* for pictures in *gremlin(1)* format,
- pic(1)* for diagrams,
- chem(1)*  
for chemical structure diagrams,
- refer(1)* for bibliographic references,
- soelim(1)*  
to preprocess files included with *roff* **.so** requests, and
- tbl(1)* for tables.

A preprocessor unique to GNU *roff* is *preconv(1)*, which converts various input encodings to something GNU *troff* can understand. When used, it is run before any other preprocessors.

### Macro packages

Macro files are *roff* input files designed to produce no output themselves but instead ease the preparation of other *roff* documents. When a macro file is installed at a standard location and suitable for use by a general audience, it is termed a *macro package*.

Macro packages can be loaded prior to any *roff* input documents with the **-m** option. The GNU *roff* system implements most well-known macro packages for AT&T *troff* in a compatible way and extends them. These have one- or two-letter names arising from intense practices of naming economy in early Unix culture, a laconic approach that led to many of the packages being identified in general usage with the *nroff* and *troff* option letter used to invoke them, sometimes to punning effect, as with “man” (short for “manual”), and even with the option dash, as in the case of the *s* package, much better known as *ms* or even *-ms*.

Macro packages serve a variety of purposes. Some are “full-service” packages, adopting responsibility for page layout among other fundamental tasks, and defining their own lexicon of macros for document composition; each such package stands alone and a given document can use at most one.

- an* is used to compose man pages in the format originating in Version 7 Unix (1979); see *groff\_man(7)*. It can be specified on the command line as **-man**.
- doc* is used to compose man pages in the format originating in 4.3BSD-Reno (1990); see *groff\_mdoc(7)*. It can be specified on the command line as **-mdoc**.
- e* is the Berkeley general-purpose macro suite, developed as an alternative to AT&T’s *s*; see *groff\_me(7)*. It can be specified on the command line as **-me**.
- m* implements the format used by the second-generation AT&T macro suite for general documents, a successor to *s*; see *groff\_mm(7)*. It can be specified on the command line as **-mm**.
- om* (invariably called “mom”) is a modern package written by Peter Schaffter specifically for GNU *roff*. Consult the *mom* HTML manual [⟨file:///usr/local/share/doc/groff-1.23.0/html/mom/toc.html⟩](file:///usr/local/share/doc/groff-1.23.0/html/mom/toc.html) for extensive documentation. She—for *mom* takes the female pronoun—can be specified on the command line as **-mom**.
- s* is the original AT&T general-purpose document format; see *groff\_ms(7)*. It can be specified on the command line as **-ms**.

Others are supplemental. For instance, *andoc* is a wrapper package specific to GNU *roff* that recognizes whether a document uses *man* or *mdoc* format and loads the corresponding macro package. It can be specified on the command line as **-mandoc**. A *man(1)* librarian program may use this macro file to delegate loading of the correct macro package; it is thus unnecessary for *man* itself to scan the contents of a document to decide the issue.

Many macro files augment the function of the full-service packages, or of *roff* documents that do not employ such a package—the latter are sometimes characterized as “raw”. These auxiliary packages are described, along with details of macro file naming and placement, in *groff\_tmac(5)*.

## Formatters

The formatter, the program that interprets *roff* language input, is *troff(1)*. It provides the features of the AT&T *troff* and *nroff* programs as well as many extensions. The command-line option **-C** switches *troff* into *compatibility mode*, which tries to emulate AT&T *troff* as closely as is practical to enable the formatting of documents written for the older system.

A shell script, *nroff(1)*, emulates the behavior of AT&T *nroff*. It attempts to correctly encode the output based on the locale, relieving the user of the need to specify an output device with the **-T** option and is therefore convenient for use with terminal output devices, described in the next subsection.

The formatter generates device-independent, but not device-agnostic, *intermediate output* in a page description language whose syntax is detailed in *groff\_out(5)*.

## Output devices

*troff* output is formatted for a particular *output device*, typically specified by the **-T** option to the formatter or a front end. If neither this option nor the *GROFF\_TYPESETTER* environment variable is used, the default output device is **ps**. An output device may be any of the following.

- ascii** for terminals using the ISO 646 1991:IRV character set and encoding, also known as US-ASCII.
- cp1047** for terminals using the IBM code page 1047 character set and encoding.
- dvi** for TeX DVI format.
- html**
- xhtml** for HTML and XHTML output, respectively.
- latin1** for terminals using the ISO Latin-1 (ISO 8859-1) character set and encoding.
- lbp** for Canon CaPSL printers (LBP-4 and LBP-8 series laser printers).
- lj4** for HP LaserJet4-compatible (or other PCL5-compatible) printers.
- pdf** for PDF output.
- ps** for PostScript output.
- utf8** for terminals using the ISO 10646 (“Unicode”) character set in UTF-8 encoding.
- X75** for previewing with *gxditview* using 75 dpi resolution and a 10-point base type size.
- X75-12** for previewing with *gxditview* using 75 dpi resolution and a 12-point base type size.
- X100** for previewing with *gxditview* using 100 dpi resolution and a 10-point base type size.
- X100-12** for previewing with *gxditview* using 100 dpi resolution and a 12-point base type size.

## Postprocessors

Any program that interprets the output of *troff* is a GNU *roff* postprocessor. All of the postprocessors provided by GNU *roff* are *output drivers*, which prepare a document for viewing or printing. Postprocessors for other purposes, such as page resequencing or statistical measurement of a document, are conceivable.

An output driver supports one or more output devices, each with its own device description file. A device determines its postprocessor with the **postpro** directive in its device description file; see *groff\_font(5)*. The **-X** option overrides this selection, causing *gxditview* to serve as the output driver.

*grodvi(1)*

provides **dvi**.

*grohtml(1)*

provides **html** and **xhtml**.

*grolbp(1)*

provides **lbp**.

*grolj4(1)*

provides **lj4**.

*gropdf(1)*provides **pdf**.*grops(1)*provides **ps**.*grotty(1)*provides **ascii**, **cp1047**, **latin1**, and **utf8**.*gxditview(1)*provides **X75**, **X75-12**, **X100**, and **X100-12**, and additionally can preview **ps**.**Utilities**GNU *roff* includes a suite of utilities.*gdiffmk(1)*marks differences between a pair of *roff* input files.*grog(1)* infers the *groff* command a document requires.

Several utilities prepare descriptions of fonts, enabling the formatter to use them when producing output for a given device.

*addftinfo(1)*adds information to AT&T *troff* font description files to enable their use with GNU *troff*.*afmtodit(1)*

creates font description files for PostScript Type 1 fonts.

*pfbtops(1)*translates a PostScript Type 1 font in PFB (Printer Font Binary) format to PFA (Printer Font ASCII), which can then be interpreted by *afmtodit*.*hpftodit(1)*

creates font description files for the HP LaserJet 4 family of printers.

*tfmtodit(1)*

creates font description files for the TeX DVI device.

*xtotroff(1)*

creates font description files for X Window System core fonts.

A trio of tools transform material constructed using *roff* preprocessor languages into graphical image files.*eqn2graph(1)*converts an *eqn* equation into a cropped image.*grap2graph(1)*converts a *grap* diagram into a cropped image.*pic2graph(1)*converts a *pic* diagram into a cropped image.Another set of programs works with the bibliographic data files used by the *refer(1)* preprocessor.*indxbib(1)*

makes inverted indices for bibliographic databases, speeding lookup operations on them.

*lkbib(1)*

searches the databases.

*lookbib(1)*

interactively searches the databases.

**Exit status***groff* exits with a failure status if there was a problem parsing its arguments and a successful status if either of the options **-h** or **--help** was specified. Otherwise, *groff* runs a pipeline to process its input; if all commands within the pipeline exit successfully, *groff* does likewise. If not, *groff*'s exit status encodes a sum-

mary of problems encountered, setting bit 0 if a command exited with a failure status, bit 1 if a command was terminated with a signal, and bit 2 if a command could not be executed. (Thus, if all three misfortunes befell one's pipeline, *groff* would exit with status  $2^0 + 2^1 + 2^2 = 1+2+4 = 7$ .) To troubleshoot pipeline problems, you may wish to re-run the *groff* command with the **-V** option and break the reported pipeline down into separate stages, inspecting the exit status of and diagnostic messages emitted by each command.

## Environment

Normally, the path separator in environment variables ending with *PATH* is the colon; this may vary depending on the operating system. For example, Windows uses a semicolon instead.

### *GROFF\_BIN\_PATH*

This search path, followed by *PATH*, is used to locate commands executed by *groff*. If it is not set, the installation directory of the GNU *roff* executables, */usr/local/bin*, is searched before *PATH*.

### *GROFF\_COMMAND\_PREFIX*

GNU *roff* can be configured at compile time to apply a prefix to the names of the programs it provides that had a counterpart in AT&T *troff*, so that name collisions are avoided at run time. The default prefix is empty.

When used, this prefix is conventionally the letter "g". For example, GNU *troff* would be installed as *groff*. Besides *troff*, the prefix applies to the preprocessors *eqn*, *grn*, *pic*, *refer*, *tbl*, and *soelim*; and the utilities *indxbib* and *lookbib*.

### *GROFF\_ENCODING*

The value of this variable is passed to the *preconv*(1) preprocessor's **-e** option to select the character encoding of input files. This variable's existence implies the *groff* option **-k**. If set but empty, *groff* calls *preconv* without an **-e** option. *groff*'s **-K** option overrides *GROFF\_ENCODING*.

### *GROFF\_FONT\_PATH*

Seek the selected output device's directory of device and font description files in this list of directories. See *troff*(1) and *groff\_font*(5).

### *GROFF\_TMAC\_PATH*

Seek macro files in this list of directories. See *troff*(1) and *groff\_tmac*(5).

### *GROFF\_TMPDIR*

Create temporary files in this directory. If not set, but the environment variable *TMPDIR* is set, temporary files are created there instead. On Windows systems, if neither of the foregoing are set, the environment variables *TMP* and *TEMP* (in that order) are checked also. Otherwise, temporary files are created in */tmp*. The *refer*(1), *grohtml*(1), and *grops*(1) commands use temporary files.

### *GROFF\_TYPESETTER*

Set the default output device. If empty or not set, **ps** is used. The **-T** option overrides *GROFF\_TYPESETTER*.

### *SOURCE\_DATE\_EPOCH*

A time stamp (expressed as seconds since the Unix epoch) to use as the output creation time stamp in place of the current time. The time is converted to human-readable form using *ctime*(3) when the formatter starts up and stored in registers usable by documents and macro packages.

*TZ* The time zone to use when converting the current time (or value of *SOURCE\_DATE\_EPOCH*) to human-readable form; see *tzset*(3).

## Examples

*roff* systems are best known for formatting man pages. Once a *man*(1) librarian program has located a man page, it may execute a *groff* command much like the following, constructing a pipeline to page the output.

```
groff -t -man /usr/share/man/man1/groff.1.man | less -R
```

To process a *roff* input file using the preprocessors *tbl* and *pic* and the *me* macro package in the way to which AT&T *troff* users were accustomed, one would type (or script) a pipeline.

```
pic foo.me | tbl | troff -me -Tutf8 | grotty
```

Using *groff*, this pipe can be shortened to the equivalent command

```
groff -p -t -me -T utf8 foo.me
```

An even easier way to do this is to use [grog\(1\)](#) to guess the preprocessor and macro options and execute the result by using the command substitution feature of the shell.

```
$(grog -Tutf8 foo.me)
```

Each command-line option to a postprocessor must be specified with any required leading dashes “-” because *groff* passes the arguments as-is to the postprocessor; this permits arbitrary arguments to be transmitted. For example, to pass a title to the *gxditview* postprocessor, the shell commands

```
groff -X -P -title -P 'trial run' mydoc.t
```

and

```
groff -X -Z mydoc.t | gxditview -title 'trial run' -
```

are equivalent.

## Limitations

When paging output for the **ascii**, **cp1047**, **latin1**, and **utf8** devices, programs like *more(1)* and *less(1)* may require command-line options to correctly handle some terminal escape sequences; see [grotty\(1\)](#).

On EBCDIC hosts such as OS/390 Unix, the output devices **ascii** and **latin1** aren’t available. Conversely, the output device **cp1047** is not available on systems based on the ISO 646 or ISO 8859 character encoding standards.

## Installation directories

GNU *roff* installs files in varying locations depending on its compile-time configuration. On this installation, the following locations are used.

*/usr/local/bin*

Directory containing *groff*’s executable commands.

*/usr/local/share/groff/1.23.0/eign*

List of common words for [indxbib\(1\)](#).

*/usr/local/share/groff/1.23.0*

Directory for data files.

*/usr/dict/papers/Ind*

Default index for [lkbib\(1\)](#) and [refer\(1\)](#).

*/usr/local/share/doc/groff-1.23.0*

Documentation directory.

*/usr/local/share/doc/groff-1.23.0/examples*

Example directory.

*/usr/local/share/groff/1.23.0/font*

Font directory.

*/usr/local/share/doc/groff-1.23.0/html*

HTML documentation directory.

*/usr/lib/font*

Legacy font directory.

*/usr/local/share/groff/site-font*

Local font directory.

*/usr/local/share/groff/site-tmac*

Local macro package (*tmac* file) directory.

*/usr/local/share/groff/1.23.0/tmac*  
Macro package (*tmac* file) directory.

*/usr/local/share/groff/1.23.0/oldfont*  
Font directory for compatibility with old versions of *groff*; see [groops\(1\)](#).

*/usr/local/share/doc/groff-1.23.0/pdf*  
PDF documentation directory.

*/usr/local/lib/groff/site-tmac*  
System macro package (*tmac* file) directory.

### **groff macro directory**

Most macro files supplied with GNU *roff* are stored in */usr/local/share/groff/1.23.0/tmac* for the installation corresponding to this document. As a rule, multiple directories are searched for macro files; for more information on that topic and a catalog of macro files GNU *roff* provides, see [groff\\_tmac\(5\)](#).

### **groff device and font description directory**

Device and font description files supplied with GNU *roff* are stored in */usr/local/share/groff/1.23.0/font* for the installation corresponding to this document. As a rule, multiple directories are searched for device and font description files; see [troff\(1\)](#). For the formats of these files, see [groff\\_font\(5\)](#).

### **Availability**

Information on how to get *groff* and related information is available at the *groff* page of the GNU website (<http://www.gnu.org/software/groff/>).

Three *groff* mailing lists are available for bug tracker activity ([bug-groff@gnu.org](mailto:bug-groff@gnu.org)) (read-only), general discussion ([groff@gnu.org](mailto:groff@gnu.org)), and source code repository commit activity ([groff-commit@gnu.org](mailto:groff-commit@gnu.org)) (read-only). Details of repository access and more can be found in the file *README* in the top-level directory of the *groff* source distribution.

A free implementation of the *grap* preprocessor, written by Ted Faber ([faber@lunabase.org](mailto:faber@lunabase.org)), can be found at the *grap* website (<http://www.lunabase.org/~faber/Vault/software/grap/>). *groff* supports only this *grap*.

### **Authors**

*groff* was written by James Clark ([jjc@jclark.com](mailto:jjc@jclark.com)). This document was rewritten, enhanced, and put under the GNU FDL license in 2002 by Bernd Warken ([groff-bernd.warken-72@web.de](mailto:groff-bernd.warken-72@web.de)).

### **See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “`info groff`”.

Introduction, history, and further reading:

[roff\(7\)](#)

Viewer for *groff* (and AT&T device-independent *troff*) documents:

[gxditview\(1\)](#)

Preprocessors:

[chem\(1\)](#), [eqn\(1\)](#), [neqn\(1\)](#), [glilypond\(1\)](#), [grn\(1\)](#), [preconv\(1\)](#), [gperl\(1\)](#), [pic\(1\)](#), [gpinyin\(1\)](#), [refer\(1\)](#), [soelim\(1\)](#), [tbl\(1\)](#)

Macro packages and package-specific utilities:

[groff\\_hdtbl\(7\)](#), [groff\\_man\(7\)](#), [groff\\_man\\_style\(7\)](#), [groff\\_mdoc\(7\)](#), [groff\\_me\(7\)](#), [groff\\_mm\(7\)](#), [groff\\_mmse\(7\)](#), [mmroff\(1\)](#), [groff\\_mom\(7\)](#), [pdfmom\(1\)](#), [groff\\_ms\(7\)](#), [groff\\_rfc1345\(7\)](#), [groff\\_trace\(7\)](#), [groff\\_www\(7\)](#)

Bibliographic database management tools:

[indxbib\(1\)](#), [lkbib\(1\)](#), [lookbib\(1\)](#)

Language, conventions, and GNU extensions:

[groff\(7\)](#), [groff\\_char\(7\)](#), [groff\\_diff\(7\)](#), [groff\\_filenames\(5\)](#), [groff\\_font\(5\)](#), [groff\\_tmac\(5\)](#)

Intermediate output language:

*groff\_out(5)*

Formatter program:

*troff(1)*

Formatter wrappers:

*nroff(1)*, *pdfroff(1)*

Postprocessors for output devices:

*grodvi(1)*, *grohtml(1)*, *grolbp(1)*, *grolj4(1)*, *lj4\_font(5)*, *gropdf(1)*, *grops(1)*, *grotty(1)*

Font support utilities:

*addftinfo(1)*, *afmtodit(1)*, *hpftodit(1)*, *pfbtops(1)*, *tfmtodit(1)*, *xtotroff(1)*

Graphics conversion utilities:

*eqn2graph(1)*, *grap2graph(1)*, *pic2graph(1)*

Difference-marking utility:

*gdiffmk(1)*

“groff guess” utility:

*grog(1)*

**Name**

grog – “grogff guess”—infer the groff command a document requires

**Synopsis**

**grog** [--run] [--ligatures] [*groff-option* ...] [--] [*file* ...]

**grog -h**

**grog --help**

**grog -v**

**grog --version**

**Description**

*grog* reads its input and guesses which *groff*(1) options are needed to render it. If no operands are given, or if *file* is “-”, *grog* reads the standard input stream. The corresponding *groff* command is normally written to the standard output stream. With the option **--run**, the inferred command is written to the standard error stream and then executed.

**Options**

**-h** and **--help** display a usage message, whereas **-v** and **--version** display version information; all exit afterward.

**--ligatures**

includes the arguments **-P-y -PU** in the inferred *groff* command. These are supported only by the **pdf** output device.

**--run** writes the inferred command to the standard error stream and then executes it.

All other specified short options (that is, arguments beginning with a minus sign “-” followed by a letter) are interpreted as *groff* options or option clusters with or without an option argument. Such options are included in the constructed *groff* command line.

**Details**

*grog* reads each *file* operand, pattern-matching strings that are statistically likely to be characteristic of *roff*(7) documents. It tries to guess which of the following *groff* options are required to correctly render the input: **-e**, **-g**, **-G**, **-j**, **-p**, **-R**, **-t** (preprocessors); and **-man**, **-mdoc**, **-mdoc-old**, **-me**, **-mm**, **-mom**, and **-ms** (macro packages). The inferred *groff* command including these options and any *file* parameters is written to the standard output stream.

It is possible to specify arbitrary *groff* options on the command line. These are included in the inferred command without change. Choices of *groff* options include **-C** to enable AT&T *troff* compatibility mode and **-T** to select a non-default output device. If the input is not encoded in US-ASCII, ISO 8859-1, or IBM code page 1047, specification of a *groff* option to run the *preconv*(1) preprocessor is advised; see the **-D**, **-k**, and **-K** options of *groff*(1). For UTF-8 input, **-k** is a good choice.

*groff* may issue diagnostic messages when an inappropriate **-m** option, or multiple conflicting ones, are specified. Consequently, it is best to specify no **-m** options to *grog* unless it cannot correctly infer all of the **-m** arguments a document requires. A *roff* document can also be written without recourse to any macro package. In such cases, *grog* will infer a *groff* command without an **-m** option.

**Limitations**

*grog* presumes that the input does not change the escape, control, or no-break control characters. *grog* does not parse *roff* input line continuation or control structures (brace escape sequences and the “**if**”, “**ie**”, and “**el**” requests) nor *groff*’s “**while**”. Thus the input

```
.if \
t .NH 1
.if n .SH
Introduction
```

will conceal the use of the *ms* macros **NH** and **SH** from *grog*. Such constructions are regarded by *grog*’s implementors as insufficiently common to cause many inference problems. Preprocessors can be even stricter when matching macro calls that bracket the regions of an input file they replace. *pic*, for example, requires **PS**, **PE**, and **PF** calls to immediately follow the default control character at the beginning of a line.

Detection of the `-s` option (the [soelim\(1\)](#) preprocessor) is tricky; to correctly infer its necessity would require *grog* to recursively open all files given as arguments to the `.so` request under the same conditions that *soelim* itself does so; see its man page. Recall that *soelim* is only necessary if sourced files need to be pre-processed. Therefore, as a workaround, you may want to run the input through *soelim* manually, piping it to *grog*, and compare the output to running *grog* on the input directly. If the “*soelim*”ed input causes *grog* to infer additional preprocessor options, then `-s` is likely necessary.

```
$ printf ".TS\nl.\nI'm a table.\n.TE\n" > 3.roff
$ printf ".so 3.roff\n" > 2.roff
$ printf ".XP\n.so 2.roff\n" > 1.roff
$ grog 1.roff
groff -ms 1.roff
$ soelim 1.roff | grog
groff -t -ms -
```

In the foregoing example, we see that this procedure enabled *grog* to detect [tbl\(1\)](#) macros, so we would add `-s` as well as the detected `-t` option to a revised *grog* or *groff* command.

```
$ grog -st 1.roff
groff -st -ms 1.roff
```

### Exit status

*grog* exits with error status **1** if a macro package appears to be in use by the input document, but *grog* was unable to infer which one, or **2** if there were problems handling an option or operand. It otherwise exits with status **0**. (If the `--run` option is specified, *groff*'s exit status is discarded.) Inferring no preprocessors or macro packages is not an error condition; a valid *roff* document need not use either. Even plain text is valid input, if one is mindful of the syntax of the control and escape characters.

### Examples

Running

```
grog /usr/local/share/doc/groff-1.23.0/meintro.me
```

at the command line results in

```
groff -me /usr/local/share/doc/groff-1.23.0/meintro.me
```

because *grog* recognizes that the file *meintro.me* is written using macros from the *me* package. The command

```
grog /usr/local/share/doc/groff-1.23.0/pic.ms
```

outputs

```
groff -e -p -t -ms /usr/local/share/doc/groff-1.23.0/pic.ms
```

on the other hand. Besides discerning the *ms* macro package, *grog* recognizes that the file *pic.ms* additionally needs the combination of `-t` for *tbl*, `-e` for *eqn*, and `-p` for *pic*.

Consider a file *doc/grnexampl.me*, which uses the *grn* preprocessor to include a *gremlin(1)* picture file in an *me* document. Let's say we want to suppress color output, produce a DVI file, and get backtraces for any errors that *troff* encounters. The command

```
grog -bc -Idoc -Tdvi doc/grnexampl.me
```

is processed by *grog* into

```
groff -bc -Idoc -Tdvi -e -g -me doc/grnexampl.me
```

where we can see that *grog* has inferred the *me* macro package along with the *eqn* and *grn* preprocessors. (The input file is located in */usr/local/share/doc/groff-1.23.0* if you'd like to try this example yourself.)

### Authors

*grog* was originally written in Bourne shell by James Clark. The current implementation in Perl was written by Bernd Warken ([groff-bernd.warcken-72@web.de](mailto:groff-bernd.warcken-72@web.de)) and heavily revised by G. Branden Robinson ([g.branden.robinson@gmail.com](mailto:g.branden.robinson@gmail.com)).

### See also

[groff\(1\)](#)

**Name**

grohtml, post-grohtml, pre-grohtml – groff output driver for HTML

**Synopsis**

**pre-grohtml** [**-epV**] [**-a** *anti-aliasing-text-bits*] [**-D** *image-directory*] [**-F** *font-directory*] [**-g** *anti-aliasing-graphic-bits*] [**-i** *resolution*] [**-I** *image-stem*] [**-o** *image-vertical-offset*] [**-x** *html-dialect*] [*troff-command*] [*troff-argument*] ...]

**pre-grohtml --help**

**pre-grohtml -v**

**pre-grohtml --version**

**post-grohtml** [**-bCGhlnrVy**] [**-F** *font-directory*] [**-j** *output-stem*] [**-s** *base-point-size*] [**-S** *heading-level*] [**-x** *html-dialect*] [*file* ...]

**post-grohtml --help**

**post-grohtml -v**

**post-grohtml --version**

**Description**

The GNU *roff* system's HTML support consists of a preprocessor, *pre-grohtml*, and an output driver, *post-grohtml*; together, they translate *roff*(7) documents to HTML. Users should always invoke *grohtml* via the *groff*(1) command with the **-Thtml** or **-Txhtml** options. If no operands are given, or if *file* is “-”, *grohtml* reads the standard input stream. Output is written to the standard output stream. When *grohtml* is run by *groff*, options can be passed to *grohtml* using *groff*'s **-P** option.

*grohtml* invokes *groff* twice. In the first pass, the preprocessor *pre-grohtml* renders pictures, equations, and tables as images in PostScript format using the **ps** output driver. In the second pass, the output driver *post-grohtml* translates the output of *troff*(1) to HTML.

*grohtml* always writes output encoded in UTF-8 and has built-in entities for all non-composite Unicode characters. In spite of this, *groff* may issue warnings about unknown special characters if they can't be found during the first pass. Such warnings can be safely ignored unless the special characters appear inside a table or equation.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-a** *anti-aliasing-text-bits*

Number of bits of antialiasing information to be used by *text* when generating PNG images. The default is 4 but valid values are 0, 1, 2, and 4. Note that your version of *gs* needs to support the **-dTextAlphaBits** and **-dGraphicAlphaBits** options in order to exploit antialiasing. A value of 0 stops *grohtml* from issuing antialiasing commands to *gs*.

**-b** Initialize the background color to white.

**-C** Suppress output of “CreationDate:” HTML comment.

**-D** *image-directory*

Instruct *grohtml* to place all image files into directory *image-directory*.

**-e** This option should not be directly specified; it is an internal option used by *groff* when **-Thtml** or **-Txhtml** is specified. *grohtml*'s preprocessor uses it to determine whether *eqn* should be directed to produce MathML (if **-Txhtml** is specified).

**-F** *font-directory*

Prepend directory *font-directory/devname* to the search path for font and device description files; *name* is the name of the device, usually **html**.

**-G** Suppress output of “Creator:” HTML comment.

- g** *anti-aliasing-graphic-bits*  
Number of bits of antialiasing information to be used by *graphics* when generating PNG images. The default is 4 but valid values are 0, 1, 2, and 4. Note your version of *gs* needs to support the **-dTextAlphaBits** and **-dGraphicAlphaBits** options in order to exploit antialiasing. A value of 0 stops *grohtml* from issuing antialiasing commands to *gs*.
- h** Generate section and number headings by using **<B>...</B>** and increasing the font size, rather than using the **<Hn>...</Hn>** tags.
- i** *resolution*  
Select the resolution for all images. By default this is 100 pixels per inch. Example: **-i200** indicates 200 pixels per inch.
- I** *image-stem*  
Determine the image file name stem. If omitted, *grohtml* uses *grohtml-XXXXXX* (where *XXXXXX* is the process ID). A dash is appended to the stem to separate it from the following image number.
- j** *output-stem*  
Instruct *grohtml* to split the HTML output into multiple files. Output is written to a new file at each section heading (but see option **-S** below) named *output-stem-n.html*.
- l** Turn off the production of automatic section links at the top of the document.
- n** Generate simple heading anchors whenever a section/number heading is found. Without the option the anchor value is the textual heading. This can cause problems when a heading contains a “?” on older versions of some browsers. This flag is automatically turned on if a heading contains an image.
- o** *image-vertical-offset*  
Specify the vertical offset of images in points.
- p** Display page rendering progress to the standard error stream. *grohtml* only displays a page number when an image is required.
- r** Turn off the automatic header and footer line (HTML rule).
- s** *base-point-size*  
Set the base point size of the source file. Thereafter when this point size is used in the source it will correspond to the HTML base size. Every increase of two points in the source will yield a **<big>** tag, and conversely when a decrease of two points is seen a **<small>** tag is emitted.
- S** *heading-level*  
When splitting HTML output (see option **-j** above), split at each nested heading level defined by *heading-level*, or higher). The default is **1**.
- V** Create an XHTML or HTML validator button at the bottom of each page of the document.
- x** *html-dialect*  
Select HTML dialect. Currently, *html-dialect* should be either the digit **4** or the letter **x**, which indicates whether *grohtml* should generate HTML 4 or XHTML, respectively. This option should not be directly invoked by the user as it is an internal option utilized by *groff* when **-Thtml** or **-Txhtml** is specified.
- y** Produce a right-justified *groff* signature at the end of the document. This is only generated if the **-V** flag is also specified.

## Usage

Font styles called **R**, **I**, **B**, and **BI** are mounted at font positions 1 to 4, respectively.

## Dependencies

*grohtml* is dependent upon the PNG utilities (*pnmcut*, *pnmcrop*, *pnmtopng*) and Ghostscript (*gs*). *pnmtopng* (version 2.37.6 or greater) and *pnmcut* from the netpbm package (version 9.16 or greater) will work also. It is also dependent upon *pselect* from the PSUtils package. Images are generated whenever a table, picture, equation or line (such as a baseline rule or box rule) is encountered.

**Files**

*grohtml* uses temporary files. See [groff\(1\)](#) for details about where such files are created.

**Environment****GROFF\_FONT\_PATH**

A list of directories in which to seek the selected output device's directory of device and font description files. See [troff\(1\)](#) and [groff\\_font\(5\)](#).

**SOURCE\_DATE\_EPOCH**

A timestamp (expressed as seconds since the Unix epoch) to use as the output creation timestamp in place of the current time. The time is converted to human-readable form using [ctime\(3\)](#) and recorded in an HTML comment.

**TZ**

The time zone to use when converting the current time (or value of *SOURCE\_DATE\_EPOCH*) to human-readable form; see [tzset\(3\)](#).

**Bugs**

*grohtml* is still beta code.

*grohtml* does not truly support hyphenation, but you can fool it into hyphenating long input lines, which can appear in HTML output with a hyphenated word followed by a space but no line break.

**See also**

[groff\(1\)](#), [troff\(1\)](#), [groff\\_font\(5\)](#)

**Name**

grolbp – groff output driver for Canon CaPSL printers

**Synopsis**

```
grolbp [-l] [-c num-copies] [-F font-directory] [-o orientation] [-p paper-size] [-w width] [file ...]
grolbp [--copies=num-copies] [--fontdir=font-directory] [--landscape] [--linewidth=width]
      [--orientation=orientation] [--papersize=paper-size] [file ...]
```

**grolbp -h**

**grolbp --help**

**grolbp -v**

**grolbp --version**

**Description**

The GNU *roff* LBP output driver translates the output of *troff*(1) into a CaPSL and VDM format suitable for Canon LBP-4 and LBP-8 printers. Normally, *grolbp* is invoked by *groff*(1) when the latter is given the “-T **lbp**” option. (In this installation, **ps** is the default output device.) Use *groff*’s -P option to pass any options shown above to *grolbp*. If no *file* arguments are given, or if *file* is “-”, *grolbp* reads the standard input stream. Output is written to the standard output stream.

For compatibility with *grolj4*(1), an additional drawing command is available.

**\D'R** *dh dv*'

Draw a rule (i.e., a solid black rectangle), with one corner at the current position, and the diagonally opposite corner at the current position +(*dh*,*dv*).

**Options**

-h and --help display a usage message, while -v and --version show version information; all exit afterward.

-c *num-copies*

--copies=*num-copies*

Print *num-copies* copies of each page.

-F *font-directory*

--fontdir=*font-directory*

Prepend directory *font-directory/devname* to the search path for font and device description files; *name* is the name of the device, usually **lbp**.

-l

--landscape

Print the document with a landscape orientation.

-o *orientation*

--orientation=*orientation*

Print the document with *orientation* orientation, which must be ‘portrait’ or ‘landscape’.

-p *paper-size*

--papersize=*paper-size*

Set the paper size to *paper-size*, which must be a valid paper size description as indicated in section “Paper Sizes”, below.

-w *width*

--linewidth=*width*

Set the default line thickness to *width* thousandths of an em; the default is 0.04 em.

**Typefaces**

The driver supports the Dutch, Swiss, and Swiss-Narrow scalable typefaces, each in the regular, bold, italic, and bold-italic styles. Additionally, the bitmapped, monospaced Courier and Elite typefaces are available in regular, bold, and italic styles; Courier at 8 and 12 points, Elite at 8 and 10 points. The following chart summarizes the *groff* font names used to access them.

Typeface	Regular	Bold	Italic	Bold-Italic
<b>Dutch</b>	TR	TB	TI	TBI
<b>Swiss</b>	HR	HB	HI	HBI
<b>Swiss Narrow</b>	HNR	HNB	HNI	HNBI
<b>Courier</b>	CR	CB	CI	
<b>Elite</b>	ER	EB	EI	

### Paper sizes

The paper size can be set in the *DESC* file or with command-line options to *grolbp*. If the paper size is specified both ways, the command-line options take precedence over the contents of the *DESC* file (this applies to the page orientation too). *groff\_font(5)* describes how to set the paper dimensions in the *DESC* file. To set the paper size on the command line, add

```
-p paper-size
```

or

```
--papersize=paper-size
```

to the other *grolbp* options, where *paper-size* is in the same format as in the *DESC* file. If no paper size is specified in the *DESC* file or on the command line, a default size of A4 is used.

### Page orientation

As with the page size, the orientation of the page (**portrait** or **landscape**) can be set in the *DESC* file or with command-line options. These keywords are case insensitive. To set the orientation in the *DESC* file, insert a line

```
orientation portrait
```

or

```
orientation landscape
```

as desired. The first valid orientation command in the *DESC* file is used. To set the page orientation with command-line options you can use the **-o** or **--orientation** options with the same parameters (**portrait** or **landscape**) as in the *DESC* file, or the **-l** option to select landscape orientation.

### Font description files

In addition to the font description file directives documented in *groff\_font(5)*, *grolbp* recognizes **lbpname**, which maps the *groff* font name to the font name used internally by the printer. Its syntax is as follows.

```
lbpname printer-font-name
```

**lbpname**'s argument is case-sensitive. The printer's font names are encoded as follows.

For bitmapped fonts, *printer-font-name* has the form

```
N<base-font-name><font-style>
```

*base-font-name* is the font name as it appears in the printer's font listings without the first letter, up to (but not including) the font size. *font-style* can be one of the letters **R**, **I**, or **B**, indicating the roman, italic, and bold styles, respectively. For instance, if the printer's "font listing A" shows "Nelite12I.ISO\_USA", the corresponding entry in the *groff* font description file is

```
lbpname NeliteI
```

You may need to modify *grolbp* to add support for new bitmapped fonts, since the available font names and font sizes of bitmapped fonts (as documented above) are hard-coded into the program.

For scalable fonts, *printer-font-name* is identical to the font name as it appears in the printer's "font listing A". For instance, to select the "Swiss" font in bold-italic style, which appears in the font listing as "Swiss-BoldOblique",

```
lbpname Swiss-BoldOblique
```

is the required directive, and this is what we find in the *groff* font description file *HBI* for the **lbp** device.

### Environment

*GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device's directory of device and font description files. See *troff(1)* and *groff\_font(5)*.

**Files**

*/usr/local/share/groff/1.23.0/font/devlbp/DESC*  
describes the **lbp** output device.

*/usr/local/share/groff/1.23.0/font/devlbp/F*  
describes the font known as *F* on device **lbp**.

*/usr/local/share/groff/1.23.0/tmac/lbp.tmac*  
defines macros for use with the **lbp** output device. It is automatically loaded by *troffrc* when the **lbp** output device is selected.

**See also**

[groff\(1\)](#), [troff\(1\)](#), [groff\\_out\(5\)](#), [groff\\_font\(5\)](#), [groff\\_char\(7\)](#)

**Name**

grolj4 – groff output driver for HP LaserJet 4 family printers

**Synopsis**

**grolj4** [-l] [-c *num-copies*] [-d [*n*]] [-F *font-directory*] [-p *paper-size*] [-w *line-width*] [*file* ...]

**grolj4 --help**

**grolj4 -v**

**grolj4 --version**

**Description**

The GNU *roff* LJ4 output driver translates the output of [troff\(1\)](#) into a PCL5 format suitable for an HP LaserJet 4 printer. Normally, *grolj4* is invoked by [groff\(1\)](#) when the latter is given the “-T **lj4**” option. (In this installation, **ps** is the default output device.) Use *groff*’s **-P** option to pass any options shown above to *grolj4*. If no *file* arguments are given, or if *file* is “-”, *grolj4* reads the standard input stream. Output is written to the standard output stream.

An additional drawing command is available beyond those documented in [groff\(7\)](#).

**VD'R** *dh dv*'

Draw a rule (solid black rectangle), with one corner at the current position, and the diagonally opposite corner at the current position +(*dh,dv*). Afterwards the current position will be at the opposite corner. This generates a PCL fill rectangle command, and so will work on printers that do not support HPGL/2 unlike the other **VD** commands.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-c** *num-copies*

Print *num-copies* copies of each page.

**-l** Print the document with a landscape orientation.

**-d** [*n*] Use duplex mode *n*: 1 is long-side binding; 2 is short-side binding; default is 1.

**-p** *paper-size*

Set the paper size to *paper-size*, which must be one of letter, legal, executive, a4, com10, monarch, c5, b5, dl.

**-w** *line-width*

Set the default line thickness to *line-width* thousandths of an em. If this option isn’t specified, the line thickness defaults to 0.04 em.

**-F** *font-directory*

Prepend directory *font-directory/devname* to the search path for font and device description files; *name* is the name of the device, usually **lj4**.

The following four commands are available additionally in the font description files:

**pclweight** *N*

The integer value *N* must be in the range -7 to +7; default is 0.

**pclstyle** *N*

The integer value *N* must be in the range 0 to 32767; default is 0.

**pclproportional** *N*

A boolean flag which can be either 0 or 1; default is 0.

**pcltypeface** *N*

The integer value *N* must be in the range 0 to 65535; default is 0.

**Environment**

**GROFF\_FONT\_PATH**

A list of directories in which to seek the selected output device’s directory of device and font description files. See [troff\(1\)](#) and [groff\\_font\(5\)](#).

**Files**

*/usr/local/share/groff/1.23.0/font/devlj4/DESC*  
describes the **lj4** output device.

*/usr/local/share/groff/1.23.0/font/devlj4/F*  
describes the font known as *F* on device **lj4**.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/Makefile*  
is a *make(1)* script that uses *hftodit(1)* to prepare the foregoing font description files from HP TFM data; it can be used to regenerate the *groff* font descriptions in the event the TFM files are updated.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/special.awk*  
is an *awk(1)* script that corrects the Intellifont-based height metrics for several glyphs in the **S** (special) font for TrueType CG Times used in the HP LaserJet 4000 and later.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/special.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/symbol.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/text.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/wingdings.map*

map MSL indices and HP Unicode Private Use Area assignments to *groff* special character identifiers.

*/usr/local/share/groff/1.23.0/tmac/lj4.tmac*

defines macros for use with the **lj4** output device. It is automatically loaded by *troffrc* when the **lj4** output device is selected.

**Bugs**

Small dots.

**See also**

*lj4\_font(5)*, *groff(1)*, *troff(1)*, *groff\_out(5)*, *groff\_font(5)*, *groff\_char(7)*

**Name**

gropdf – groff output driver for Portable Document Format

**Synopsis**

**gropdf** [**-dels**] [**-F** *dir*] [**-I** *dir*] [**-p** *paper-size*] [**-u** [*cmapfile*]] [**-y** *foundry*] [*file* ...]

**gropdf -v**

**gropdf --version**

**Description**

The GNU *roff* PDF output driver translates the output of *troff*(1) into Portable Document Format. Normally, *gropdf* is invoked by *groff*(1) when the latter is given the “**-T pdf**” option. (In this installation, **ps** is the default output device.) Use *groff*’s **-P** option to pass any options shown above to *gropdf*. If no *file* arguments are given, or if *file* is “-”, *gropdf* reads the standard input stream. Output is written to the standard output stream.

See section “Font installation” below for a guide to installing fonts for *gropdf*.

**Options**

**-v** and **--version** show version information; both exit afterward.

**-d** Include debug information as comments within the PDF. Also produces an uncompressed PDF.

**-e** Forces *gropdf* to embed *all* fonts (even the 14 base PDF fonts).

**-F** *dir* Prepend directory *dir/devname* to the search path for font, and device description files; *name* is the name of the device, usually **pdf**.

**-I** *dir* Search the directory *dir* for files named in **\X'pdf: pdfpic'** escape sequences. **-I** may be specified more than once; each *dir* is searched in the given order. To search the current working directory before others, add “**-I .**” at the desired place; it is otherwise searched last.

**-l** Orient the document in landscape format.

**-p** *paper-size*

Set physical dimension of output medium. This overrides the **papersize**, **paperlength**, and **paperwidth** commands in the *DESC* file; it accepts the same arguments as the **papersize** command. See *groff\_font*(5) for details.

**-s** Append a comment line to end of PDF showing statistics, i.e. number of pages in document. Ghostscript’s **ps2pdf** complains about this line if it is included, but works anyway.

**-u** [*cmapfile*]

**Gropdf** normally includes a ToUnicode CMap with any font created using *text.enc* as the encoding file, this makes it easier to search for words which contain ligatures. You can include your own CMap by specifying a *cmapfile* or have no CMap at all by omitting the argument.

**-y** *foundry*

Set the foundry to use for selecting fonts of the same name.

**Usage**

The input to *gropdf* must be in the format output by *troff*(1). This is described in *groff\_out*(5).

In addition, the device and font description files for the device used must meet certain requirements: The resolution must be an integer multiple of 72 times the **sizescale**. The **pdf** device uses a resolution of 72000 and a sizescale of 1000.

The device description file must contain a valid paper size; see *groff\_font*(5) for more information. *gropdf* uses the same Type 1 Adobe PostScript fonts as the **grops** device driver. Although the PDF Standard allows the use of other font types (like TrueType) this implementation only accepts the Type 1 PostScript font. Fewer Type 1 fonts are supported natively in PDF documents than the standard 35 fonts supported by **grops** and all PostScript printers, but all the fonts are available since any which aren’t supported natively are automatically embedded in the PDF.

*gropdf* supports the concept of foundries, that is different versions of basically the same font. During in-

stall a *Foundry* file controls where fonts are found and builds *groff* fonts from the files it discovers on your system.

Each font description file must contain a command

**internalname** *psname*

which says that the PostScript name of the font is *psname*. Lines starting with # and blank lines are ignored. The code for each character given in the font file must correspond to the code in the default encoding for the font. This code can be used with the **\N** escape sequence in **troff** to select the character, even if the character does not have a *groff* name. Every character in the font file must exist in the PostScript font, and the widths given in the font file must match the widths used in the PostScript font.

Note that *gropdf* is currently only able to display the first 256 glyphs in any font. This restriction will be lifted in a later version.

*gropdf* can automatically include the downloadable fonts necessary to print the document. Fonts may be in PFA or PFB format.

Any downloadable fonts which should, when required, be included by *gropdf* must be listed in the file */usr/local/share/groff/1.23.0/font/devpdf/download*; this should consist of lines of the form

*foundry font filename*

where *foundry* is the foundry name or blank for the default foundry. *font* is the PostScript name of the font, and *filename* is the name of the file containing the font; lines beginning with # and blank lines are ignored; fields must be separated by tabs (spaces are **not** allowed); *filename* is searched for using the same mechanism that is used for *groff* font metric files. The *download* file itself is also sought using this mechanism; currently, only the first file found in the font search path is read. Foundry names are usually a single character (such as 'U' for the URW foundry) or empty for the default foundry. This default uses the same fonts as *ghostscript* uses when it embeds fonts in a PDF file.

In the default setup there are styles called **R**, **I**, **B**, and **BI** mounted at font positions 1 to 4. The fonts are grouped into families **A**, **BM**, **C**, **H**, **HN**, **N**, **P**, and **T** having members in each of these styles:

<b>AR</b>	<i>AvantGarde-Book</i>
<b>AI</b>	<i>AvantGarde-BookOblique</i>
<b>AB</b>	<b>AvantGarde-Demi</b>
<b>ABI</b>	<b>AvantGarde-DemiOblique</b>
<b>BMR</b>	<i>Bookman-Light</i>
<b>BMI</b>	<i>Bookman-LightItalic</i>
<b>BMB</b>	<b>Bookman-Demi</b>
<b>BMBI</b>	<b>Bookman-DemiItalic</b>
<b>CR</b>	<i>Courier</i>
<b>CI</b>	<i>Courier-Oblique</i>
<b>CB</b>	<b>Courier-Bold</b>
<b>CBI</b>	<b>Courier-BoldOblique</b>
<b>HR</b>	<i>Helvetica</i>
<b>HI</b>	<i>Helvetica-Oblique</i>
<b>HB</b>	<b>Helvetica-Bold</b>
<b>HBI</b>	<b>Helvetica-BoldOblique</b>
<b>HNR</b>	<i>Helvetica-Narrow</i>
<b>HNI</b>	<i>Helvetica-Narrow-Oblique</i>
<b>HNB</b>	<b>Helvetica-Narrow-Bold</b>
<b>HNBI</b>	<b>Helvetica-Narrow-BoldOblique</b>
<b>NR</b>	<i>NewCenturySchlbk-Roman</i>
<b>NI</b>	<i>NewCenturySchlbk-Italic</i>
<b>NB</b>	<b>NewCenturySchlbk-Bold</b>

<b>NBI</b>	<b><i>NewCenturySchlbk-BoldItalic</i></b>
<b>PR</b>	Palatino-Roman
<b>PI</b>	<i>Palatino-Italic</i>
<b>PB</b>	<b>Palatino-Bold</b>
<b>PBI</b>	<b><i>Palatino-BoldItalic</i></b>
<b>TR</b>	Times-Roman
<b>TI</b>	<i>Times-Italic</i>
<b>TB</b>	<b>Times-Bold</b>
<b>TBI</b>	<b><i>Times-BoldItalic</i></b>

There is also the following font which is not a member of a family:

**ZCMI** *ZapfChancery-MediumItalic*

There are also some special fonts called **S** for the PS Symbol font. The lower case greek characters are automatically slanted (to match the SymbolSlanted font (SS) available to PostScript). Zapf Dingbats is available as **ZD**; the “hand pointing left” glyph (`\lh`) is available since it has been defined using the `\X'pdf:xrev'` extension which reverses the direction of letters within words.

The default color for `\m` and `\M` is black.

*gropdf* understands some of the X commands produced using the `\X` escape sequences supported by **grops**. Specifically, the following is supported.

`\X'ps: invis'`

Suppress output.

`\X'ps: endinvis'`

Stop suppressing output.

`\X'ps: exec gsave currentpoint 2 copy translate n rotate neg exch neg exch translate'`

where *n* is the angle of rotation. This is to support the *align* command in **gpic**.

`\X'ps: exec grestore'`

Again used by **gpic** to restore after rotation.

`\X'ps: exec n setlinejoin'`

where *n* can be one of the following values.

0 = Miter join

1 = Round join

2 = Bevel join

`\X'ps: exec n setlinecap'`

where *n* can be one of the following values.

0 = Butt cap

1 = Round cap, and

2 = Projecting square cap

`\X'ps: ... pdfmark'`

All the *pdfmark* macros installed by using `-m pdfmark` or `-m mspdf` (see documentation in *pdfmark.pdf*). A subset of these macros are installed automatically when you use `-Tpdf` so you should not need to use `'-m pdfmark'` for using most of the PDF functionality.

*gropdf* also supports a subset of the commands introduced in *present.tmac*. Specifically it supports:-

PAUSE

BLOCKS

BLOCKE

Which allows you to create presentation type PDFs. Many of the other commands are already available in other macro packages.

These commands are implemented with *groff* X commands:-

**\X'ps: exec % % % % PAUSE'**

The section before this is treated as a block and is introduced using the current **BLOCK** transition setting (see “**\X'pdf: transition'**” below). This command can be introduced using the macro **.pdf-pause**.

**\X'ps: exec % % % % BEGINONCE'**

Any text following this command (up to %%%ENDONCE) is shown only once, the next %%%PAUSE will remove it. If producing a non presentation pdf, i.e. ignoring the pauses, see *GROPDF\_NOSLIDE* below, this text is ignored.

**\X'ps: exec % % % % ENDONCE'**

This terminates the block defined by %%%BEGINONCE. This pair of commands is what implements the **.BLOCKS Once/.BLOCKE** commands in *present.tmac*.

The **mom** macro set already has integration with these extensions so you can build slides with **mom**.

If you use *present.tmac* with *gropdf* there is no need to run the program *presentps(1)* since the output will already be a presentation pdf.

All other **ps:** tags are silently ignored.

One **\X** special used by the DVI driver is also recognised:

**\X'papersize= paper-size'**

where the *paper-size* parameter is the same as the **papersize** command. See *groff\_font(5)* for details. This means that you can alter the page size at will within the PDF file being created by *gropdf*. If you do want to change the paper size, it must be done before you start creating the page.

In addition, *gropdf* supports its own suite of **pdf:** tags. The following tags are supported:

**\X'pdf: pdfpic file alignment width height line-length'**

Place an image of the specified *width* containing the PDF drawing from file *file* of desired *width* and *height* (if *height* is missing or zero then it is scaled proportionally). If *alignment* is **-L** the drawing is left aligned. If it is **-C** or **-R** a *linelength* greater than the width of the drawing is required as well. If *width* is specified as zero then the width is scaled in proportion to the height.

**\X'pdf: xrev'**

This toggles a flag which reverses the direction of printing *letter by letter*, i.e., each separate letter is reversed, not the entire word. This is useful for reversing the direction of glyphs in the Dingbats font. To return to normal printing repeat the command again.

**\X'pdf: markstart /ANN definition'**

The macros which support PDF Bookmarks use this call internally to start the definition of bookmark hotspot (user will have called **.pdfhref L** with the text which will become the ‘hot spot’ region). Normally this is never used except from within the *pdfmark* macros.

**\X'pdf: markstart /ANN-definition'****\X'pdf: markend'**

The macros which support PDF bookmarks use these calls internally to start and stop (respectively) the definition of bookmark hot spot; the user will have called **.pdfhref L** with the text which will become the hot spot region). Normally, these are never used except from within the *pdfmark* macros.

**\X'pdf: marksuspend'****\X'pdf: markrestart'**

If you are using page traps to produce headings, footings, etc., you need to use these in case a ‘hot spot’ crosses a page boundary, otherwise any text output by the heading or footing macro will be marked as part of the ‘hot spot’. To stop this happening just place **.pdfmarksuspend** and **.pdfmarkrestart** at the start and end of the page trap macro, respectively. (These are just convenience macros which emit the corresponding **\X** escapes sequence. These macros must be used only within page traps.)

**\X'pdf: pagename name'**

This gives the current page a *name*.

There are two default names for any document which do not need to be declared 'top' and 'bottom'.

The convenience command for this is **.pdfpagename**.

**\X'pdf: switchtopage when name'**

Normally each new page is appended to the end of the document, this command allows following pages to be inserted at a 'named' position within the document (see pagename command above). 'when' can be either 'after' or 'before'. If it is omitted it defaults to 'before'.

The convenience command for this is **.pdfswitchtopage**. It should be used at the end of the page before you want the switch to happen.

This allows pages such as a TOC to be moved to elsewhere in the document, but more esoteric uses are possible.

**\X'pdf: transition feature mode duration dimension motion direction scale bool'**

where *feature* can be either SLIDE or BLOCK. When it is SLIDE the transition is used when a new slide is introduced to the screen, if BLOCK then this transition is used for the individual blocks which make up the slide.

*mode* is the transition type between slides:-

**Split** - Two lines sweep across the screen, revealing the new page. The lines may be either horizontal or vertical and may move inward from the edges of the page or outward from the center, as specified by the *dimension* and *motion* entries, respectively.

**Blinds** - Multiple lines, evenly spaced across the screen, synchronously sweep in the same direction to reveal the new page. The lines may be either horizontal or vertical, as specified by the *dimension* entry. Horizontal lines move downward; vertical lines move to the right.

**Box** - A rectangular box sweeps inward from the edges of the page or outward from the center, as specified by the *motion* entry, revealing the new page.

**Wipe** - A single line sweeps across the screen from one edge to the other in the direction specified by the *direction* entry, revealing the new page.

**Dissolve** - The old page dissolves gradually to reveal the new one.

**Glitter** - Similar to Dissolve, except that the effect sweeps across the page in a wide band moving from one side of the screen to the other in the direction specified by the *direction* entry.

**R** - The new page simply replaces the old one with no special transition effect; the *direction* entry shall be ignored.

**Fly** - (PDF 1.5) Changes are flown out or in (as specified by *motion*), in the direction specified by *direction*, to or from a location that is offscreen except when *direction* is **None**.

**Push** - (PDF 1.5) The old page slides off the screen while the new page slides in, pushing the old page out in the direction specified by *direction*.

**Cover** - (PDF 1.5) The new page slides on to the screen in the direction specified by *direction*, covering the old page.

**Uncover** - (PDF 1.5) The old page slides off the screen in the direction specified by *direction*, uncovering the new page in the direction specified by *direction*.

**Fade** - (PDF 1.5) The new page gradually becomes visible through the old one.

*duration* is the length of the transition in seconds (default 1).

*dimension* (Optional; **Split** and **Blinds** transition styles only) The dimension in which the specified transition effect shall occur: **H** Horizontal, or **V** Vertical.

*motion* (Optional; **Split**, **Box** and **Fly** transition styles only) The direction of motion for the specified transition effect: **I** Inward from the edges of the page, or **O** Outward from the center of the

page.

*direction* (Optional; **Wipe**, **Glitter**, **Fly**, **Cover**, **Uncover** and **Push** transition styles only) The direction in which the specified transition effect shall moves, expressed in degrees counterclockwise starting from a left-to-right direction. If the value is a number, it shall be one of: **0** = Left to right, **90** = Bottom to top (Wipe only), **180** = Right to left (Wipe only), **270** = Top to bottom, **315** = Top-left to bottom-right (Glitter only) The value can be **None**, which is relevant only for the **Fly** transition when the value of *scale* is not 1.0.

*scale* (Optional; PDF 1.5; **Fly** transition style only) The starting or ending scale at which the changes shall be drawn. If *motion* specifies an inward transition, the scale of the changes drawn shall progress from *scale* to 1.0 over the course of the transition. If *motion* specifies an outward transition, the scale of the changes drawn shall progress from 1.0 to *scale* over the course of the transition

*bool* (Optional; PDF 1.5; **Fly** transition style only) If **true**, the area that shall be flown in is rectangular and opaque.

This command can be used by calling the macro **.pdftransition** using the parameters described above. Any of the parameters may be replaced with a "." which signifies the parameter retains its previous value, also any trailing missing parameters are ignored.

**Note:** not all PDF Readers support any or all these transitions.

**\X'pdf: background** *cmd left top right bottom weight'*

**\X'pdf: background off'**

**\X'pdf: background footnote** *bottom'*

produces a background rectangle on the page, where

*cmd* is the command, which can be any of “**pagefill|box**” in combination. Thus, “**pagefill**” would draw a rectangle which covers the whole current page size (in which case the rest of the parameters can be omitted because the box dimensions are taken from the current media size). “**boxfill**”, on the other hand, requires the given dimensions to place the box. Including “**fill**” in the command will paint the rectangle with the current fill colour (as with **\M[]**) and including “**box**” will give the rectangle a border in the current stroke colour (as with **\m[]**).

*cmd* may also be “**off**” on its own, which will terminate drawing the current box. If you have specified a page colour with “**pagefill**”, it is always the first box in the stack, and if you specify it again, it will replace the first entry. Be aware that the “**pagefill**” box renders the page opaque, so tools that “watermark” PDF pages are unlikely to be successful. To return the background to transparent, issue an “**off**” command with no other boxes open.

Finally, *cmd* may be “**footnote**” followed by a new value for *bottom*, which will be used for all open boxes on the current page. This is to allow room for footnote areas that grow while a page is processed (to accommodate multiple footnotes, for instance). (If the value is negative, it is used as an offset from the bottom of the page.)

*left*

*top*

*right*

*bottom* are the coordinates of the box. The *top* and *bottom* coordinates are the minimum and maximum for the box, since the actual start of the box is *groff*'s drawing position when you issue the command, and the bottom of the box is the point where you turn the box “**off**”. The top and bottom coordinates are used only if the box drawing extends onto the next page; ordinarily, they would be set to the header and footer margins.

*weight* provides the line width for the border if “**box**” is included in the command.

The convenience macro for this escape sequence is **.pdfbackground**. An *sboxes* macro file is also available; see [groff\\_tmac\(5\)](#).

### Importing graphics

*gropdf* supports only the inclusion of other PDF files for inline images. Such a PDF file may, however, contain any of the graphic formats supported by the PDF standard, such as JPEG/JFIF, PNG, and GIF. Any application that outputs PDF can thus be used to prepare files for embedding in documents processed by *groff* and *gropdf*.

The PDF file you wish to insert must be a single page and the drawing must just fit inside the media size of the PDF file. In *inkscape(1)* or *gimp(1)*, for example, make sure the canvas size just fits the image.

The PDF parser *gropdf* implements has not been rigorously tested with all applications that produce PDF. If you find a single-page PDF which fails to import properly, try processing it with the *pdftk(1)* program.

```
pdftk existing-file output new-file
```

You may find that *new-file* imports successfully.

### TrueType and other font formats

*gropdf* does not yet support any font formats besides Adobe Type 1 (PFA or PFB).

### Font installation

The following is a step-by-step font installation guide for *gropdf*.

- Convert your font to something *groff* understands. This is a PostScript Type 1 font in PFA or PFB format, together with an AFM file. A PFA file begins as follows.

```
%!PS-AdobeFont-1.0:
```

A PFB file contains this string as well, preceded by some non-printing bytes. In the following steps, we will consider the use of CTAN's BrushScriptX-Italic (<https://ctan.org/tex-archive/fonts/brushscr>) font in PFA format.

- Convert the AFM file to a *groff* font description file with the *afmtodit(1)* program. For instance,

```
$ afmtodit BrushScriptX-Italic.afm textmap BSI
```

converts the Adobe Font Metric file *BrushScriptX-Italic.afm* to the *groff* font description file *BSI*.

If you have a font family which provides regular upright (roman), bold, italic, and bold-italic styles, (where “italic” may be “oblique” or “slanted”), we recommend using **R**, **B**, **I**, and **BI**, respectively, as suffixes to the *groff* font family name to enable *groff*'s font family and style selection features. An example is *groff*'s built-in support for Times: the font family name is abbreviated as **T**, and the *groff* font names are therefore **TR**, **TB**, **TI**, and **TBI**. In our example, however, the BrushScriptX font is available in a single style only, italic.

- Install the *groff* font description file(s) in a *devpdf* subdirectory in the search path that *groff* uses for device and font file descriptions. See the *GROFF\_FONT\_PATH* entry in section “Environment” of *troff(1)* for the current value of the font search path. While *groff* doesn't directly use AFM files, it is a good idea to store them alongside its font description files.
- Register fonts in the *devpdf/download* file so they can be located for embedding in PDF files *gropdf* generates. Only the first *download* file encountered in the font search path is read. If in doubt, copy the default *download* file (see section “Files” below) to the first directory in the font search path and add your fonts there. The PostScript font name used by *gropdf* is stored in the **internalname** field in the *groff* font description file. (This name does not necessarily resemble the font's file name.) If the font in our example had originated from a foundry named **Z**, we would add the following line to *download*.

```
Z→BrushScriptX-Italic→BrushScriptX-Italic.pfa
```

A tab character, depicted as →, separates the fields. The default foundry has no name: its field is empty and entries corresponding to it start with a tab character, as will the one in our example.

- Test the selection and embedding of the new font.

```
printf "\\f[BSI>Hello, world!\n" | groff -T pdf -P -e >hello.pdf
see hello.pdf
```

**Environment***GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device's directory of device and font description files. If, in the *download* file, the font file has been specified with a full path, no directories are searched. See [troff\(1\)](#) and [groff\\_font\(5\)](#).

*GROPDF\_NOSLIDE*

If this is set true, *gropdf* will ignore all commands which produce a presentation pdf, and produce a normal pdf instead.

*SOURCE\_DATE\_EPOCH*

A timestamp (expressed as seconds since the Unix epoch) to use as the output creation timestamp in place of the current time. The time is converted to human-readable form using Perl's *local-time()* function and recorded in a PDF comment.

*TZ*

The time zone to use when converting the current time (or value of *SOURCE\_DATE\_EPOCH*) to human-readable form; see [tzset\(3\)](#).

**Files**

*/usr/local/share/groff/1.23.0/font/devpdf/DESC*

describes the **pdf** output device.

*/usr/local/share/groff/1.23.0/font/devpdf/F*

describes the font known as *F* on device **pdf**.

*/usr/local/share/groff/1.23.0/font/devpdf/U-F*

describes the font from the URW foundry (versus the Adobe default) known as *F* on device **pdf**.

*/usr/local/share/groff/1.23.0/font/devpdf/download*

lists fonts available for embedding within the PDF document (by analogy to the **ps** device's downloadable font support).

*/usr/local/share/groff/1.23.0/font/devpdf/Foundry*

is a data file used by the *groff* build system to locate PostScript Type 1 fonts.

*/usr/local/share/groff/1.23.0/font/devpdf/enc/text.enc*

describes the encoding scheme used by most PostScript Type 1 fonts; the **encoding** directive of font description files for the **pdf** device refers to it.

*/usr/local/share/groff/1.23.0/tmac/pdf.tmac*

defines macros for use with the **pdf** output device. It is automatically loaded by *troffrc* when the **pdf** output device is selected.

*/usr/local/share/groff/1.23.0/tmac/pdftpic.tmac*

defines the **PDFPIC** macro for embedding images in a document; see [groff\\_tmac\(5\)](#). It is automatically loaded by *troffrc*.

**See also**

*/usr/local/share/doc/groff-1.23.0/sboxes/msboxes.ms*

*/usr/local/share/doc/groff-1.23.0/sboxes/msboxes.pdf*

“Using PDF boxes with *groff* and the *ms* macros”, by Deri James.

[afmtodit\(1\)](#), [groff\(1\)](#), [troff\(1\)](#), [groff\\_font\(5\)](#), [groff\\_out\(5\)](#)

**Name**

grops – groff output driver for PostScript

**Synopsis**

**grops** [**-glm**] [**-b** *n*] [**-c** *n*] [**-F** *dir*] [**-I** *dir*] [**-p** *paper-format*] [**-P** *prologue-file*] [**-w** *n*] [*file* ...]

**grops --help**

**grops -v**

**grops --version**

**Description**

The GNU *roff* PostScript output driver translates the output of *troff*(1) into PostScript. Normally, *grops* is invoked by *groff*(1) when the latter is given the “**-T ps**” option. (In this installation, **ps** is the default output device.) Use *groff*’s **-P** option to pass any options shown above to *grops*. If no *file* arguments are given, or if *file* is “-”, *grotty* reads the standard input stream. Output is written to the standard output stream.

When called with multiple *file* arguments, *grops* doesn’t produce a valid document structure (one conforming to the Document Structuring Conventions). To print such concatenated output, it is necessary to deactivate DSC handling in the printing program or previewer.

See section “Font installation” below for a guide to installing fonts for *grops*.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-b** *n* Work around problems with spoolers, previewers, and older printers. Normally, *grops* produces output at PostScript LanguageLevel 2 that conforms to version 3.0 of the Document Structuring Conventions. Some software and devices can’t handle such a data stream. The value of *n* determines what *grops* does to make its output acceptable to such consumers. If *n* is **0**, *grops* employs no workarounds, which is the default; it can be changed by modifying the **broken** directive in *grops*’s *DESC* file.

Add 1 to suppress generation of **%%BeginDocumentSetup** and **%%EndDocumentSetup** comments; this is needed for early versions of TranScript that get confused by anything between the **%%EndProlog** comment and the first **%%Page** comment.

Add 2 to omit lines in included files beginning with **%!** , which confuse Sun’s *pageview* previewer.

Add 4 to omit lines in included files beginning with **%%Page**, **%%Trailer** and **%%EndProlog**; this is needed for spoolers that don’t understand **%%BeginDocument** and **%%EndDocument** comments.

Add 8 to write **%!PS-Adobe-2.0** rather than **%!PS-Adobe-3.0** as the first line of the PostScript output; this is needed when using Sun’s Newsprint with a printer that requires page reversal.

Add 16 to omit media size information (that is, output neither a **%%DocumentMedia** comment nor the **setpagedevice** PostScript command). This was the behavior of *groff* 1.18.1 and earlier; it is needed for older printers that don’t understand PostScript LanguageLevel 2, and is also necessary if the output is further processed to produce an EPS file; see subsection “Escapsulated PostScript” below.

**-c** *n* Output *n* copies of each page.

**-F** *dir* Prepend directory *dir/devname* to the search path for font and device description and PostScript prologue files; *name* is the name of the device, usually **ps**.

**-g** Generate PostScript code to guess the page length. The guess is correct only if the imageable area is vertically centered on the page. This option allows you to generate documents that can be printed on both U.S. letter and A4 paper formats without change.

**-I** *dir* Search the directory *dir* for files named in **\X'ps: file'** and **\X'ps: import'** escape sequences. **-I** may be specified more than once; each *dir* is searched in the given order. To search the current working directory before others, add “**-I .**” at the desired place; it is otherwise searched last.

- l** Use landscape orientation rather than portrait.
- m** Turn on manual feed for the document.
- p** *paper-format*  
Set physical dimensions of output medium, overriding the **papersize**, **paperlength**, and **paperwidth** directives in the *DESC* file. *paper-format* can be any argument accepted by the **papersize** directive; see [groff\\_font\(5\)](#).
- P** *prologue-file*  
Use the file *prologue-file*, sought in the *groff* font search path, as the PostScript prologue, overriding the default (see section “Files” below) and the environment variable *GROPS\_PROLOGUE*.
- w** *n* Draw rules (lines) with a thickness of *n* thousandths of an em. The default thickness is **40** (0.04 em).

## Usage

The input to *grops* must be in the format output by [troff\(1\)](#), described in [groff\\_out\(5\)](#). In addition, the device and font description files for the device used must meet certain requirements. The device resolution must be an integer multiple of 72 times the **sizescale**. The device description file must contain a valid paper size; see [groff\\_font\(5\)](#). Each font description file must contain a directive

```
internalname psname
```

which says that the PostScript name of the font is *psname*.

A font description file may also contain a directive

```
encoding enc-file
```

which says that the PostScript font should be reencoded using the encoding described in *enc-file*; this file should consist of a sequence of lines of the form

```
pschar code
```

where *pschar* is the PostScript name of the character, and *code* is its position in the encoding expressed as a decimal integer; valid values are in the range 0 to 255. Lines starting with **#** and blank lines are ignored. The code for each character given in the font description file must correspond to the code for the character in encoding file, or to the code in the default encoding for the font if the PostScript font is not to be reencoded. This code can be used with the **\N** escape sequence in *troff* to select the character, even if it does not have a *groff* glyph name. Every character in the font description file must exist in the PostScript font, and the widths given in the font description file must match the widths used in the PostScript font. *grops* assumes that a character with a *groff* name of **space** is blank (makes no marks on the page); it can make use of such a character to generate more efficient and compact PostScript output.

*grops* is able to display all glyphs in a PostScript font; it is not limited to 256 of them. *enc-file* (or the default encoding if no encoding file is specified) just defines the order of glyphs for the first 256 characters; all other glyphs are accessed with additional encoding vectors which *grops* produces on the fly.

*grops* can embed fonts in a document that are necessary to render it; this is called “downloading”. Such fonts must be in PFA format. Use [pfbtops\(1\)](#) to convert a Type 1 font in PFB format. Downloadable fonts must be listed a *download* file containing lines of the form

```
psname file
```

where *psname* is the PostScript name of the font, and *file* is the name of the file containing it; lines beginning with **#** and blank lines are ignored; fields may be separated by tabs or spaces. *file* is sought using the same mechanism as that for *groff* font description files. The *download* file itself is also sought using this mechanism; currently, only the first matching file found in the device and font description search path is used.

If the file containing a downloadable font or imported document conforms to the Adobe Document Structuring Conventions, then *grops* interprets any comments in the files sufficiently to ensure that its own output is conforming. It also supplies any needed font resources that are listed in the *download* file as well as any needed file resources. It is also able to handle inter-resource dependencies. For example, suppose that you have a downloadable font called Garamond, and also a downloadable font called Garamond-Outline which depends on Garamond (typically it would be defined to copy Garamond’s font dictionary, and change the PaintType), then it is necessary for Garamond to appear before Garamond-Outline in the PostScript

document. *grops* handles this automatically provided that the downloadable font file for Garamond-Outline indicates its dependence on Garamond by means of the Document Structuring Conventions, for example by beginning with the following lines.

```
%!PS-Adobe-3.0 Resource-Font
%%DocumentNeededResources: font Garamond
%%EndComments
%%IncludeResource: font Garamond
```

In this case, both Garamond and Garamond-Outline would need to be listed in the *download* file. A downloadable font should not include its own name in a `%%DocumentSuppliedResources` comment.

*grops* does not interpret `%%DocumentFonts` comments. The `%%DocumentNeededResources`, `%%DocumentSuppliedResources`, `%%IncludeResource`, `%%BeginResource`, and `%%EndResource` comments (or possibly the old `%%DocumentNeededFonts`, `%%DocumentSuppliedFonts`, `%%IncludeFont`, `%%BeginFont`, and `%%EndFont` comments) should be used.

The default stroke and fill color is black. For colors defined in the “rgb” color space, `setrgbcolor` is used; for “cmy” and “cmyk”, `setcmykcolor`; and for “gray”, `setgray`. `setcmykcolor` is a PostScript LanguageLevel 2 command and thus not available on some older printers.

### Typefaces

Styles called **R**, **I**, **B**, and **BI** mounted at font positions 1 to 4. Text fonts are grouped into families **A**, **BM**, **C**, **H**, **HN**, **N**, **P**, and **T**, each having members in each of these styles.

<b>AR</b>	<i>AvantGarde-Book</i>
<b>AI</b>	<i>AvantGarde-BookOblique</i>
<b>AB</b>	<b>AvantGarde-Demi</b>
<b>ABI</b>	<b><i>AvantGarde-DemiOblique</i></b>
<b>BMR</b>	<i>Bookman-Light</i>
<b>BMI</b>	<i>Bookman-LightItalic</i>
<b>BMB</b>	<b>Bookman-Demi</b>
<b>BMBI</b>	<b><i>Bookman-DemiItalic</i></b>
<b>CR</b>	<i>Courier</i>
<b>CI</b>	<i>Courier-Oblique</i>
<b>CB</b>	<b>Courier-Bold</b>
<b>CBI</b>	<b><i>Courier-BoldOblique</i></b>
<b>HR</b>	<i>Helvetica</i>
<b>HI</b>	<i>Helvetica-Oblique</i>
<b>HB</b>	<b>Helvetica-Bold</b>
<b>HBI</b>	<b><i>Helvetica-BoldOblique</i></b>
<b>HNR</b>	<i>Helvetica-Narrow</i>
<b>HNI</b>	<i>Helvetica-Narrow-Oblique</i>
<b>HNB</b>	<b>Helvetica-Narrow-Bold</b>
<b>HNBI</b>	<b><i>Helvetica-Narrow-BoldOblique</i></b>
<b>NR</b>	<i>NewCenturySchlbk-Roman</i>
<b>NI</b>	<i>NewCenturySchlbk-Italic</i>
<b>NB</b>	<b>NewCenturySchlbk-Bold</b>
<b>NBI</b>	<b><i>NewCenturySchlbk-BoldItalic</i></b>
<b>PR</b>	<i>Palatino-Roman</i>
<b>PI</b>	<i>Palatino-Italic</i>
<b>PB</b>	<b>Palatino-Bold</b>
<b>PBI</b>	<b><i>Palatino-BoldItalic</i></b>
<b>TR</b>	<i>Times-Roman</i>
<b>TI</b>	<i>Times-Italic</i>
<b>TB</b>	<b>Times-Bold</b>
<b>TBI</b>	<b><i>Times-BoldItalic</i></b>

Another text font is not a member of a family.

**ZCMI** *ZapfChancery-MediumItalic*

Special fonts include **S**, the PostScript Symbol font; **ZD**, Zapf Dingbats; **SS** (slanted symbol), which contains oblique forms of lowercase Greek letters derived from Symbol; **EURO**, which offers a Euro glyph for use with old devices lacking it; and **ZDR**, a reversed version of ZapfDingbats (with symbols flipped about the vertical axis). Most glyphs in these fonts are unnamed and must be accessed using `\N`. The last three are not standard PostScript fonts, but supplied by *groff* and therefore included in the default *download* file.

### Device control commands

*groff* recognizes device control commands produced by the `\X` escape sequence, but interprets only those that begin with a “**ps:**” tag.

#### `\X'ps: exec code'`

Execute the arbitrary PostScript commands *code*. The PostScript *currentpoint* is set to the *groff* drawing position when the `\X` escape sequence is interpreted before executing *code*. The origin is at the top left corner of the page; *x* coordinates increase to the right, and *y* coordinates down the page. A procedure **u** is defined that converts *groff* basic units to the coordinate system in effect (provided the user doesn't change the scale). For example,

```
.nr x 1i
\X'ps: exec \nx u 0 rlineto stroke'
```

draws a horizontal line one inch long. *code* may make changes to the graphics state, but any changes persist only to the end of the page. A dictionary containing the definitions specified by the **def** and **mdef** commands is on top of the dictionary stack. If your code adds definitions to this dictionary, you should allocate space for them using “`\X'ps: mdef n`”. Any definitions persist only until the end of the page. If you use the `\Y` escape sequence with an argument that names a macro, *code* can extend over multiple lines. For example,

```
.nr x 1i
.de y
ps: exec
\nx u 0 rlineto
stroke
..
\Yy
```

is another way to draw a horizontal line one inch long. The single backslash before “**nx**”—the only reason to use a register while defining the macro “**y**”—is to convert a user-specified dimension “**1i**” to *groff* basic units which are in turn converted to PostScript units with the **u** procedure.

*groff* wraps user-specified PostScript code into a dictionary, nothing more. In particular, it doesn't start and end the inserted code with **save** and **restore**, respectively. This must be supplied by the user, if necessary.

#### `\X'ps: file name'`

This is the same as the **exec** command except that the PostScript code is read from file *name*.

#### `\X'ps: def code'`

Place a PostScript definition contained in *code* in the prologue. There should be at most one definition per `\X` command. Long definitions can be split over several `\X` commands; all the *code* arguments are simply joined together separated by newlines. The definitions are placed in a dictionary which is automatically pushed on the dictionary stack when an **exec** command is executed. If you use the `\Y` escape sequence with an argument that names a macro, *code* can extend over multiple lines.

#### `\X'ps: mdef n code'`

Like **def**, except that *code* may contain up to *n* definitions. *groff* needs to know how many definitions *code* contains so that it can create an appropriately sized PostScript dictionary to contain them.

**\X'ps: import** *file llx lly urx ury width [height]*'

Import a PostScript graphic from *file*. The arguments *llx*, *lly*, *urx*, and *ury* give the bounding box of the graphic in the default PostScript coordinate system. They should all be integers: *llx* and *lly* are the *x* and *y* coordinates of the lower left corner of the graphic; *urx* and *ury* are the *x* and *y* coordinates of the upper right corner of the graphic; *width* and *height* are integers that give the desired width and height in *groff* basic units of the graphic.

The graphic is scaled so that it has this width and height and translated so that the lower left corner of the graphic is located at the position associated with **\X** command. If the height argument is omitted it is scaled uniformly in the *x* and *y* axes so that it has the specified width.

The contents of the **\X** command are not interpreted by *troff*, so vertical space for the graphic is not automatically added, and the *width* and *height* arguments are not allowed to have attached scaling indicators.

If the PostScript file complies with the Adobe Document Structuring Conventions and contains a **% %BoundingBox** comment, then the bounding box can be automatically extracted from within *groff* input by using the **psbb** request.

See [groff\\_tmac\(5\)](#) for a description of the **PSPIC** macro which provides a convenient high-level interface for inclusion of PostScript graphics.

**\X'ps: invis'****\X'ps: endinvis'**

No output is generated for text and drawing commands that are bracketed with these **\X** commands. These commands are intended for use when output from *troff* is previewed before being processed with *grops*; if the previewer is unable to display certain characters or other constructs, then other substitute characters or constructs can be used for previewing by bracketing them with these **\X** commands.

For example, *gxditview* is not able to display a proper **\[em]** character because the standard X11 fonts do not provide it; this problem can be overcome by executing the following request

```
.char \[em] \X'ps: invis'\
\Z'\v'-.25m'\h'.05m'\D'l .9m 0'\h'.05m'\
\X'ps: endinvis'\[em]
```

In this case, *gxditview* is unable to display the **\[em]** character and draws the line, whereas *grops* prints the **\[em]** character and ignores the line (this code is already in file *Xps.tmac*, which is loaded if a document intended for *grops* is previewed with *gxditview*).

If a PostScript procedure **BPhook** has been defined via a “**ps: def**” or “**ps: mdef**” device control command, it is executed at the beginning of every page (before anything is drawn or written by *groff*). For example, to underlay the page contents with the word “DRAFT” in light gray, you might use

```
.de XX
ps: def
/BPhook
{ gsave .9 setgray clippath pathbbox exch 2 copy
  .5 mul exch .5 mul translate atan rotate pop pop
  /NewCenturySchlbk-Roman findfont 200 scalefont setfont
  (DRAFT) dup stringwidth pop -.5 mul -70 moveto show
  grestore }
def
..
.devicem XX
```

Or, to cause lines and polygons to be drawn with square linecaps and mitered linejoins instead of the round linecaps and linejoins normally used by *grops*, use

```
.de XX
ps: def
```

```

/BPhook { 2 setlinecap 0 setlinejoin } def
..
.devicem XX

```

(square linecaps, as opposed to butt linecaps (“**0 setlinecap**”), give true corners in boxed tables even though the lines are drawn unconnected).

### Encapsulated PostScript

*grops* itself doesn’t emit bounding box information. The following script, *groff2eps*, produces an EPS file.

```

#!/bin/sh
groff -P-b16 "$1" > "$1".ps
gs -dNOPAUSE -sDEVICE=bbbox -- "$1".ps 2> "$1".bbox
sed -e "/^%%Orientation/r $1.bbox" \
    -e "/^%!PS-Adobe-3.0/s/$/ EPSF-3.0/" "$1".ps > "$1".eps
rm "$1".ps "$1".bbox

```

You can then use “**groff2eps foo**” to convert file *foo* to *foo.eps*.

### TrueType and other font formats

TrueType fonts can be used with *grops* if converted first to Type 42 format, a PostScript wrapper equivalent to the PFA format described in *pfbtops(1)*. Several methods exist to generate a Type 42 wrapper; some of them involve the use of a PostScript interpreter such as Ghostscript—see *gs(1)*.

One approach is to use FontForge (<https://fontforge.org/>), a font editor that can convert most outline font formats. Here’s an example of using the Roboto Slab Serif font with *groff*. Several variables are used so that you can more easily adapt it into your own script.

```

MAP=/usr/local/share/groff/1.23.0/font/devps/generate/textmap
TTF=/usr/share/fonts/truetype/roboto/slab/RobotoSlab-Regular.ttf
BASE=$(basename "$TTF")
INT=${BASE%.ttf}
PFA=${INT}.pfa
AFM=${INT}.afm
GFN=RSR
DIR=$HOME/.local/groff/font
mkdir -p "$DIR"/devps
fontforge -lang=ff -c "Open(\"$TTF\");\
Generate(\"$DIR/devps/$PFA\");"
afmtodit "$DIR/devps/$AFM" "$MAP" "$DIR/devps/$GFN"
printf "$BASE\t$PFA\n" >> "$DIR/devps/download"

```

*fontforge* and *afmtodit* may generate warnings depending on the attributes of the font. The test procedure is simple.

```
printf ".ft RSR\nHello, world!\n" | groff -F "$DIR" > hello.ps
```

Once you’re satisfied that the font works, you may want to generate any available related styles (for instance, Roboto Slab also has “Bold”, “Light”, and “Thin” styles) and set up *GROFF\_FONT\_PATH* in your environment to include the directory you keep the generated fonts in so that you don’t have to use the **-F** option.

### Font installation

The following is a step-by-step font installation guide for *grops*.

- Convert your font to something *groff* understands. This is a PostScript Type 1 font in PFA format or a PostScript Type 42 font, together with an AFM file. A PFA file begins as follows.

```
%!PS-AdobeFont-1.0:
```

A PFB file contains this string as well, preceded by some non-printing bytes. If your font is in PFB format, use *groff*’s *pfbtops(1)* program to convert it to PFA. For TrueType and other font formats, we recommend *fontforge*, which can convert most outline font formats. A Type 42 font file begins as follows.

```
%!PS-TrueTypeFont
```

This is a wrapper format for TrueType fonts. Old PostScript printers might not support them (that is, they might not have a built-in TrueType font interpreter). In the following steps, we will consider the use of CTAN's BrushScriptX-Italic (<https://ctan.org/tex-archive/fonts/brushscr>) font in PFA format.

- Convert the AFM file to a *groff* font description file with the *afmtodit(1)* program. For instance,
 

```
$ afmtodit BrushScriptX-Italic.afm textmap BSI
```

 converts the Adobe Font Metric file *BrushScriptX-Italic.afm* to the *groff* font description file *BSI*.

If you have a font family which provides regular upright (roman), bold, italic, and bold-italic styles (where “italic” may be “oblique” or “slanted”), we recommend using the letters **R**, **B**, **I**, and **BI**, respectively, as suffixes to the *groff* font family name to enable *groff*'s font family and style selection features. An example is *groff*'s built-in support for Times: the font family name is abbreviated as **T**, and the *groff* font names are therefore **TR**, **TB**, **TI**, and **TBI**. In our example, however, the BrushScriptX font is available in a single style only, italic.

- Install the *groff* font description file(s) in a *devps* subdirectory in the search path that *groff* uses for device and font file descriptions. See the *GROFF\_FONT\_PATH* entry in section “Environment” of *troff(1)* for the current value of the font search path. While *groff* doesn't directly use AFM files, it is a good idea to store them alongside its font description files.
- Register fonts in the *devps/download* file so they can be located for embedding in PostScript files *grops* generates. Only the first *download* file encountered in the font search path is read. If in doubt, copy the default *download* file (see section “Files” below) to the first directory in the font search path and add your fonts there. The PostScript font name used by *grops* is stored in the **internalname** field in the *groff* font description file. (This name does not necessarily resemble the font's file name.) We add the following line to *download*.

```
BrushScriptX-Italic→BrushScriptX-Italic.pfa
```

A tab character, depicted as →, separates the fields.

- Test the selection and embedding of the new font.
 

```
printf "\\f[BSI>Hello, world!\n" | groff -T ps -P -e >hello.ps
see hello.pdf
```

## Old fonts

*groff* versions 1.19.2 and earlier contained descriptions of a slightly different set of the base 35 PostScript level 2 fonts defined by Adobe. The older set has 229 glyphs and a larger set of kerning pairs; the newer one has 314 glyphs and includes the Euro glyph. For backwards compatibility, these old font descriptions are also installed in the */usr/local/share/groff/1.23.0/oldfont/devps* directory.

To use them, make sure that *grops* finds the fonts before the default system fonts (with the same names): either give *grops* the **-F** command-line option,

```
$ groff -Tps -P-F -P/usr/local/share/groff/1.23.0/oldfont . . .
```

or add the directory to *groff*'s font and device description search path environment variable,

```
$ GROFF_FONT_PATH=/usr/local/share/groff/1.23.0/oldfont \
groff -Tps . . .
```

when the command runs.

## Environment

### *GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device's directory of device and font description files. See *troff(1)* and *groff\_font(5)*.

### *GROPS\_PROLOGUE*

If this is set to *foo*, then *grops* uses the file *foo* (in the font path) instead of the default prologue file *prologue*. The option **-P** overrides this environment variable.

### *SOURCE\_DATE\_EPOCH*

A timestamp (expressed as seconds since the Unix epoch) to use as the output creation timestamp in place of the current time. The time is converted to human-readable form using *ctime(3)* and recorded in a PostScript comment.

**TZ** The time zone to use when converting the current time (or value of *SOURCE\_DATE\_EPOCH*) to human-readable form; see *tzset*(3).

## Files

*/usr/local/share/groff/1.23.0/font/devps/DESC*

describes the **ps** output device.

*/usr/local/share/groff/1.23.0/font/devps/F*

describes the font known as *F* on device **ps**.

*/usr/local/share/groff/1.23.0/font/devps/download*

lists fonts available for embedding within the PostScript document (or download to the device).

*/usr/local/share/groff/1.23.0/font/devps/prologue*

is the default PostScript prologue prefixed to every output file.

*/usr/local/share/groff/1.23.0/font/devps/text.enc*

describes the encoding scheme used by most PostScript Type 1 fonts; the **encoding** directive of font description files for the **ps** device refers to it.

*/usr/local/share/groff/1.23.0/font/devps/generate/textmap*

maps names in the Adobe Glyph List to *groff* special character identifiers.

*/usr/local/share/groff/1.23.0/tmac/ps.tmac*

defines macros for use with the **ps** output device. It is automatically loaded by *troffrc* when the **ps** output device is selected.

*/usr/local/share/groff/1.23.0/tmac/pspic.tmac*

defines the **PSPIC** macro for embedding images in a document; see *groff\_tmac*(5). It is automatically loaded by *troffrc*.

*/usr/local/share/groff/1.23.0/tmac/psold.tmac*

provides replacement glyphs for text fonts that lack complete coverage of the ISO Latin-1 character set; using it, *groff* can produce glyphs like eth (ð) and thorn (þ) that older PostScript printers do not natively support.

*grops* creates temporary files using the template “*gropsXXXXXX*”; see *groff*(1) for details on their storage location.

## See also

PostScript Language Document Structuring Conventions Specification ([http://partners.adobe.com/public/developer/en/ps/5001.DSC\\_Spec.pdf](http://partners.adobe.com/public/developer/en/ps/5001.DSC_Spec.pdf))

*afmtodit*(1), *groff*(1), *troff*(1), *pfbtops*(1), *groff\_char*(7), *groff\_font*(5), *groff\_out*(5), *groff\_tmac*(5)

**Name**

*grotty* – groff output driver for typewriter-like (terminal) devices

**Synopsis**

**grotty** [-dfho] [-i|-r] [-F *dir*] [*file* ...]

**grotty -c** [-bBdfhouU] [-F *dir*] [*file* ...]

**grotty --help**

**grotty -v**

**grotty --version**

**Description**

The GNU *roff* TTY (“Teletype”) output driver translates the output of *troff*(1) into a form suitable for typewriter-like devices, including terminal emulators. Normally, *grotty* is invoked by *groff*(1) when the latter is given one of the “-T **ascii**”, “-T **latin1**”, “-T **latin1**”, or “-T **utf8**” options on systems using ISO character encoding standards, or with “-T **cp1047**” or “-T **utf8**” on EBCDIC-based hosts. (In this installation, **ps** is the default output device.) Use *groff*’s -P option to pass any options shown above to *grotty*. If no *file* arguments are given, or if *file* is “-”, *grotty* reads the standard input stream. Output is written to the standard output stream.

By default, *grotty* emits SGR escape sequences (from ISO 6429, popularly called “ANSI escapes”) to change text attributes (bold, italic, underline, reverse video [“negative image”] and colors). Devices supporting the appropriate sequences can view *roff* documents using eight different background and foreground colors. Following ISO 6429, the following colors are defined in *tty.tmac*: black, white, red, green, blue, yellow, magenta, and cyan. Unrecognized colors are mapped to the default color, which is dependent on the settings of the terminal. OSC 8 hyperlinks are produced for these devices.

In keeping with long-standing practice and the rarity of terminals (and emulators) that support oblique or italic fonts, italicized text is represented with underlining by default—but see the -i option below.

**SGR and OSC support in pagers**

When paging *grotty*’s output with *less*(1), the latter program must be instructed to pass SGR and OSC sequences through to the device; its -R option is one way to achieve this (*less* version 566 or later is required for OSC 8 support). Consequently, programs like *man*(1) that page *roff* documents with *less* must call it with an appropriate option.

**Legacy output format**

The -c option tells *grotty* to use an output format compatible with paper terminals, like the Teletype machines for which *roff* and *nroff* were first developed but which are no longer in wide use. SGR escape sequences are not emitted; bold, italic, and underlining character attributes are thus not manipulated. Instead, *grotty* overstrikes, representing a bold character *c* with the sequence “*c* BACKSPACE *c*”, an italic character *c* with the sequence “\_ BACKSPACE *c*”, and bold italics with “\_ BACKSPACE *c* BACKSPACE *c*”. This rendering is inherently ambiguous when the character *c* is itself the underscore.

The legacy output format can be rendered on a video terminal (or emulator) by piping *grotty*’s output through *ul*(1), which may render bold italics as reverse video. Some implementations of *more*(1) are also able to display these sequences; you may wish to experiment with that command’s -b option. *less* renders legacy bold and italics without requiring options. In contrast to the terminal output drivers of some other *roff* implementations, *grotty* never outputs reverse line feeds. There is therefore no need to filter its output through *col*(1).

**Device control commands**

*grotty* understands one device control function produced by the *roff* \X escape sequence in a document.

**\X'tty: link** [*uri* [*key=value*] ... ]'

Embed a hyperlink using the OSC 8 terminal escape sequence. Specifying *uri* starts hyperlinked text, and omitting it ends the hyperlink. When *uri* is present, any number of additional key/value pairs can be specified; their interpretation is the responsibility of the pager or terminal. Spaces or tabs cannot appear literally in *uri*, *key*, or *value*; they must be represented in an alternate form.

**Device description files**

If the *DESC* file for the character encoding contains the “**unicode**” directive, *grotty* emits Unicode characters in UTF-8 encoding. Otherwise, it emits characters in a single-byte encoding depending on the data in the font description files. See *groff\_font(5)*.

A font description file may contain a directive “**internalname** *n*” where *n* is a decimal integer. If the 01 bit in *n* is set, then the font is treated as an italic font; if the 02 bit is set, then it is treated as a bold font.

**Typefaces**

*grotty* supports the standard four styles: **R** (roman), **I** (italic), **B** (bold), and **BI** (*bold-italic*). Because the output driver operates in *nroff* mode, attempts to set or change the font family or type size are ignored.

**Options**

- help** displays a usage message, while **-v** and **—version** show version information; all exit afterward.
- b** Suppress the use of overstriking for bold characters in legacy output format.
- B** Use only overstriking for bold-italic characters in legacy output format.
- c** Use *grotty*’s legacy output format (see subsection “Legacy output format” above). SGR and OSC escape sequences are not emitted.
- d** Ignore all **\D** drawing escape sequences in the input. By default, *grotty* renders **\D'l...** escape sequences that have at least one zero argument (and so are either horizontal or vertical) using Unicode box drawing characters (for the **utf8** device) or the **-**, **|**, and **+** characters (for all other devices). *grotty* handles **\D'p...** escape sequences that consist entirely of horizontal and vertical lines similarly.
- f** Emit a form feed at the end of each page having no output on its last line.
- F dir** Prepend directory *dir/devname* to the search path for font and device description files; *name* describes the output device’s character encoding, one of **ascii**, **latin1**, **utf8**, or **cp1047**.
- h** Use literal horizontal tab characters in the output. Tabs are assumed to be set every 8 columns.
- i** Render oblique-styled fonts (**I** and **BI**) with the SGR attribute for italic text rather than underlined text. Many terminals don’t support this attribute; however, *xterm(1)*, since patch #314 (2014-12-28), does. Ignored if **-c** is also specified.
- o** Suppress overstriking (other than for bold and/or underlined characters when the legacy output format is in use).
- r** Render oblique-styled fonts (**I** and **BI**) with the SGR attribute for reverse video text rather than underlined text. Ignored if **-c** or **-i** is also specified.
- u** Suppress the use of underlining for italic characters in legacy output format.
- U** Use only underlining for bold-italic characters in legacy output format.

**Environment***GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device’s directory of device and font description files. See *troff(1)* and *groff\_font(5)*.

*GROFF\_NO\_SGR*

If set, *grotty*’s legacy output format is used just as if the **-c** option were specified; see subsection “Legacy output format” above.

**Files**

*/usr/local/share/groff/1.23.0/font/devascii/DESC*  
describes the **ascii** output device.

*/usr/local/share/groff/1.23.0/font/devascii/F*  
describes the font known as *F* on device **ascii**.

`/usr/local/share/groff/1.23.0/font/devcp1047/DESC`

describes the **cp1047** output device.

`/usr/local/share/groff/1.23.0/font/devcp1047/F`

describes the font known as *F* on device **cp1047**.

`/usr/local/share/groff/1.23.0/font/devlatin1/DESC`

describes the **latin1** output device.

`/usr/local/share/groff/1.23.0/font/devlatin1/F`

describes the font known as *F* on device **latin1**.

`/usr/local/share/groff/1.23.0/font/devutf8/DESC`

describes the **utf8** output device.

`/usr/local/share/groff/1.23.0/font/devutf8/F`

describes the font known as *F* on device **utf8**.

`/usr/local/share/groff/1.23.0/tmac/tty.tmac`

defines macros for use with the **ascii**, **cp1047**, **latin1**, and **utf8** output devices. It is automatically loaded by *troffrc* when any of those output devices is selected.

`/usr/local/share/groff/1.23.0/tmac/tty-char.tmac`

defines fallback characters for use with *grotty*. See [nroff\(1\)](#).

## Limitations

*grotty* is intended only for simple documents.

- There is no support for fractional horizontal or vertical motions.
- *roff* **VD** escape sequences producing anything other than horizontal and vertical lines are not supported.
- Characters above the first line (that is, with a vertical drawing position of 0) cannot be rendered.
- Color handling differs from other output drivers. The *groff* requests and escape sequences that set the stroke and fill colors instead set the foreground and background character cell colors, respectively.

## Examples

The following *groff* document exercises several features for which output device support varies: (1) bold style; (2) italic (underline) style; (3) bold-italic style; (4) character composition by overstriking (“coöperate”); (5) foreground color; (6) background color; and (7) horizontal and vertical line-drawing.

```
You might see \f[B]bold\f[] and \f[I]italic\f[].
Some people see \f[Bi]both\f[].
If the output device does (not) co\z\[ad]operate,
you might see \m[red]red\m[].
Black on cyan can have a \M[cyan]\m[black]prominent\m[]\M[]
\D'l 1i 0'\D'l 0 2i'\D'l 1i 0' look.
.\" If in nroff mode, end page now.
.if n .pl \n[nl]u
```

Given the foregoing input, compare and contrast the output of the following.

```
$ groff -T ascii file
$ groff -T utf8 -P -i file
$ groff -T utf8 -P -c file | ul
```

## See also

“Control Functions for Coded Character Sets” (ECMA-48) 5th edition, Ecma International, June 1991. A gratis version of ISO 6429, this document includes a normative description of SGR escape sequences. Available at <http://www.ecma-international.org/publications/files/ECMA-ST/Ecma-048.pdf>.

“Hyperlinks in Terminal Emulators” <https://gist.github.com/egmontkob/eb114294efbcd5adb1944c9f3cb5feda>, Egmont Koblinger.

[groff\(1\)](#), [troff\(1\)](#), [groff\\_out\(5\)](#), [groff\\_font\(5\)](#), [groff\\_char\(7\)](#), [ul\(1\)](#), [more\(1\)](#), [less\(1\)](#), [man\(1\)](#)

**Name**

hpftodit – create font description files for use with groff –Tlj4

**Synopsis**

**hpftodit** [-aqs] [-i n] *tfm-file* *map-file* *font-description*

**hpftodit** -d *tfm-file* [*map-file*]

**hpftodit** --help

**hpftodit** -v

**hpftodit** --version

**Description**

*hpftodit* creates a font description file for use with a Hewlett-Packard LaserJet 4-series (or newer) printer with the *grolj4*(1) output driver of *groff*(1), using data from an HP tagged font metric (TFM) file. *tfm-file* is the name of the font’s TFM file; Intellifont and TrueType TFM files are supported, but symbol set TFM files are not. *map-file* is a file giving the *groff* special character identifiers for glyphs in the font; this file should consist of a sequence of lines of the form

```
m u c1 c2 . . . [# comment]
```

where *m* is a decimal integer giving the glyph’s MSL (Master Symbol List) number, *u* is a hexadecimal integer giving its Unicode character code, and *c1*, *c2*, . . . are its *groff* glyph names (see *groff\_char*(7) for a list). The values can be separated by any number of spaces and/or tabs. The Unicode value must use uppercase hexadecimal digits A–F, and must lack a leading “0x”, “u”, or “U+”. Unicode values corresponding to composite glyphs are decomposed; that is “u00C0” becomes “u0041\_0300”. A glyph without a *groff* special character identifier may be named **uXXXX** if the glyph corresponds to a Unicode value, or as an unnamed glyph “---”. If the given Unicode value is in the Private Use Area (PUA) (0xE000–0xF8FF), the glyph is included as an unnamed glyph. Refer to *groff\_diff*(1) for additional information about unnamed glyphs and how to access them.

Blank lines and lines beginning with “#” are ignored. A “#” following one or more *groff* names begins a comment. Because “#” is a valid *groff* name, it must appear first in a list of *groff* names if a comment is included, as in

```
3 0023 # # number sign
```

or

```
3 0023 # sh # number sign
```

whereas in

```
3 0023 sh # # number sign
```

the first “#” is interpreted as the beginning of the comment.

Output is written in *groff\_font*(5) format to *font-description*, a file named for the intended *groff* font name; if this operand is “-”, the font description is written to the standard output stream.

If the **-i** option is used, *hpftodit* automatically will generate an italic correction, a left italic correction, and a subscript correction for each glyph (the significance of these parameters is explained in *groff\_font*(5)).

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-a** Include glyphs in the TFM file that are not included in *map-file*. A glyph with corresponding Unicode value is given the name **uXXXX**; a glyph without a Unicode value is included as an unnamed glyph “---”. A glyph with a Unicode value in the Private Use Area (0xE000–0xF8FF) is also included as an unnamed glyph.

This option provides a simple means of adding Unicode-named and unnamed glyphs to a font without including them in the map file, but it affords little control over which glyphs are placed in a regular font and which are placed in a special font. The presence or absence of the **-s** option has some effect on which glyphs are included: without it, only the “text” symbol sets are searched for matching glyphs; with it, only the “mathematical” symbol sets are searched. Nonetheless, restricting the symbol sets searched isn’t very selective—many glyphs are placed in both regular and special fonts. Normally, **-a** should be used only as a last resort.

- d** Dump information about the TFM file to the standard output stream; use this to ensure that a TFM file is a proper match for a font, and that its contents are suitable. The information includes the values of important TFM tags and a listing (by MSL number for Intellifont TFM files or by Unicode value for TrueType TFM files) of the glyphs included in the TFM file. The unit of measure “DU” for some tags indicates design units; there are 8782 design units per em for Intellifont fonts, and 2048 design units per em for TrueType fonts. Note that the accessibility of a glyph depends on its inclusion in a symbol set; some TFM files list many glyphs but only a few symbol sets.  
  
The glyph listing includes the glyph index within the TFM file, the MSL or Unicode value, and the symbol set and character code that will be used to print the glyph. If *map-file* is given, *groff* names are given for matching glyphs. If only the glyph index and MSL or Unicode value are given, the glyph does not appear in any supported symbol set and cannot be printed.  
  
With the **-d** option, *map-file* is optional, and *output-font* is ignored if given.
- i n** Generate an italic correction for each glyph so that its width plus its italic correction is equal to *n* thousandths of an em plus the amount by which the right edge of the glyphs’s bounding box is to the right of its origin. If a negative italic correction would result, use a zero italic correction instead.  
  
Also generate a subscript correction equal to the product of the tangent of the slant of the font and four fifths of the x-height of the font. If a subscript correction greater than the italic correction would result, use a subscript correction equal to the italic correction instead.  
  
Also generate a left italic correction for each glyph equal to *n* thousandths of an em plus the amount by which the left edge of the glyphs’s bounding box is to the left of its origin. The left italic correction may be negative.  
  
This option normally is needed only with italic or oblique fonts; a value of 50 (0.05 em) usually is a reasonable choice.
- q** Suppress warnings about glyphs in the map file that were not found in the TFM file. Warnings never are given for unnamed glyphs or by glyphs named by their Unicode values. This option is useful when sending the output of *hpftodit* to the standard output stream.
- s** Add the **special** directive to the font description file, affecting the order in which HP symbol sets are searched for each glyph. Without this option, the “text” sets are searched before the “mathematical” symbol sets. With it, the search order is reversed.

## Files

- /usr/local/share/groff/1.23.0/font/devlj4/DESC*  
describes the **lj4** output device.
- /usr/local/share/groff/1.23.0/font/devlj4/F*  
describes the font known as *F* on device **lj4**.
- /usr/local/share/groff/1.23.0/font/devlj4/generate/Makefile*  
is a *make*(1) script that uses *hpftodit*(1) to prepare the *groff* font description files above from HP TFM data; in can be used to regenerate them in the event the TFM files are updated.
- /usr/local/share/groff/1.23.0/font/devlj4/generate/special.awk*  
is an *awk*(1) script that corrects the Intellifont-based height metrics for several glyphs in the **S** (special) font for TrueType CG Times used in the HP LaserJet 4000 and later.
- /usr/local/share/groff/1.23.0/font/devlj4/generate/special.map*
- /usr/local/share/groff/1.23.0/font/devlj4/generate/symbol.map*
- /usr/local/share/groff/1.23.0/font/devlj4/generate/text.map*
- /usr/local/share/groff/1.23.0/font/devlj4/generate/wingdings.map*  
map MSL indices and HP Unicode PUA assignments to *groff* special character identifiers.

## See also

*groff*(1), *groff\_diff*(1), *grolj4*(1), *groff\_font*(5), *lj4\_font*(5)

**Name**

indxbib – make inverted index for bibliographic databases

**Synopsis**

**indxbib** [**-w**] [**-c** *common-words-file*] [**-d** *dir*] [**-f** *list-file*] [**-h** *min-hash-table-size*] [**-i** *excluded-fields*]  
 [**-k** *max-keys-per-record*] [**-l** *min-key-length*] [**-n** *threshold*] [**-o** *file*] [**-t** *max-key-length*]  
 [*file ...*]

**indxbib --help**

**indxbib -v**

**indxbib --version**

**Description**

*indxbib* makes an inverted index for the bibliographic databases in each *file* for use with *refer(1)*, *lookbib(1)*, and *lkbib(1)*. Each created index is named *file.i*; writing is done to a temporary file which is then renamed to this. If no *file* operands are given on the command line because the **-f** option has been used, and no **-o** option is given, the index will be named *Ind.i*.

Bibliographic databases are divided into records by blank lines. Within a record, each field starts with a *%* character at the beginning of a line. Fields have a one letter name that follows the *%* character.

The values set by the **-c**, **-l**, **-n**, and **-t** options are stored in the index: when the index is searched, keys will be discarded and truncated in a manner appropriate to these options; the original keys will be used for verifying that any record found using the index actually contains the keys. This means that a user of an index need not know whether these options were used in the creation of the index, provided that not all the keys to be searched for would have been discarded during indexing and that the user supplies at least the part of each key that would have remained after being truncated during indexing. The value set by the **-i** option is also stored in the index and will be used in verifying records found using the index.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-c** *common-words-file*

Read the list of common words from *common-words-file* instead of */usr/local/share/groff/1.23.0/eign*.

**-d** *dir* Use *dir* as the name of the directory to store in the index, instead of that returned by *getcwd(2)*. Typically, *dir* will be a symbolic link whose target is the current working directory.

**-f** *list-file*

Read the files to be indexed from *list-file*. If *list-file* is *-*, files will be read from the standard input stream. The **-f** option can be given at most once.

**-h** *min-hash-table-size*

Use the first prime number greater than or equal to the argument for the size of the hash table. Larger values will usually make searching faster, but will make the index file larger and cause *indxbib* to use more memory. The default hash table size is 997.

**-i** *excluded-fields*

Don't index the contents of fields whose names are in *excluded-fields*. Field names are one character each. If this option is not present, *indxbib* excludes fields **X**, **Y**, and **Z**.

**-k** *max-keys-per-record*

Use no more keys per input record than specified in the argument. If this option is not present, the maximum is 100.

**-l** *min-key-length*

Discard any key whose length in characters is shorter than the value of the argument. If this option is not present, the minimum key length is 3.

- n** *threshold*  
Discard the *threshold* most common words from the common words file. If this option is not present, the 100 most common words are discarded.
- o** *basename*  
Name the index basename.*i*.
- t** *max-key-length*  
Truncate keys to *max-key-length* in characters. If this option is not present, keys are truncated to 6 characters.
- w**  
Index whole files. Each file is a separate record.

**Files**

*file.i* index for *file*

*Ind.i* default index name

*/usr/local/share/groff/1.23.0/eign*

contains the list of common words. The traditional name, “*eign*”, is an abbreviation of “English ignored [word list]”.

*indxbibXXXXXX*

temporary file

**See also**

“Some Applications of Inverted Indexes on the Unix System”, by M. E. Lesk, 1978, AT&T Bell Laboratories Computing Science Technical Report No. 69.

[refer\(1\)](#), [lkbib\(1\)](#), [lookbib\(1\)](#)

**Name**

lkbib – search bibliographic databases

**Synopsis**

**lkbib** [-n] [-i *fields*] [-p *file*] [-t *n*] *key* ...

**lkbib** --help

**lkbib** -v

**lkbib** --version

**Description**

*lkbib* searches bibliographic databases for references that contain the keys *key* ... and prints any references found on the standard output. *lkbib* will search any databases given by **-p** options, and then a default database. The default database is taken from the *REFER* environment variable if it is set, otherwise it is */usr/dict/papers/Ind*. For each database *file* to be searched, if an index file *i* created by [indxbib\(1\)](#) exists, then it will be searched instead; each index can cover multiple databases.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-i** *string*

When searching files for which no index exists, ignore the contents of fields whose names are in *string*.

**-p** *file* Search *file*. Multiple **-p** options can be used.

**-t** *n* Only require the first *n* characters of keys to be given. Initially, *n* is 6.

**Environment**

*REFER*

Default database.

**Files**

*/usr/dict/papers/Ind*

Default database to be used if the *REFER* environment variable is not set.

*file.i* Index files.

**See also**

“Some Applications of Inverted Indexes on the Unix System”, by M. E. Lesk, 1978, AT&T Bell Laboratories Computing Science Technical Report No. 69.

[refer\(1\)](#), [lookbib\(1\)](#), [indxbib\(1\)](#)

**Name**

lookbib – search bibliographic databases

**Synopsis**

**lookbib** [-i *string*] [-t *n*] *file* ...

**lookbib** --help

**lookbib** -v

**lookbib** --version

**Description**

*lookbib* prints a prompt on the standard error (unless the standard input is not a terminal), reads from the standard input a line containing a set of keywords, searches the bibliographic databases *file* ... for references containing those keywords, prints any references found on the standard output, and repeats this process until the end of input. For each database *file* to be searched, if an index file *i* created by [indxbib\(1\)](#) exists, then it will be searched instead; each index can cover multiple databases.

**Options**

--help displays a usage message, while -v and --version show version information; all exit afterward.

-i *string*

When searching files for which no index exists, ignore the contents of fields whose names are in *string*.

-t *n* Only require the first *n* characters of keys to be given. Initially, *n* is 6.

**Files**

*file.i* Index files.

**See also**

“Some Applications of Inverted Indexes on the Unix System”, by M. E. Lesk, 1978, AT&T Bell Laboratories Computing Science Technical Report No. 69.

[refer\(1\)](#), [lkbib\(1\)](#), [indxbib\(1\)](#)

**Name**

mmroff – cross-referencing front end for GNU roff mm macro package

**Synopsis**

**mmroff** [-x] *groff-arguments*

**Description**

*mmroff* is a simple preprocessor for *groff*, used for expanding cross references in *mm*; see [groff\\_mm\(7\)](#). *groff* is executed twice, first with **-z** and **-rRef=1** to collect all cross references and then to do the real processing when the cross-reference file is up to date.

**Options**

**-x** Just create the cross-reference file. This can be used to refresh the cross-reference file; it isn't always needed to have accurate cross references and by using this option *groff* will only be run once.

**Authors**

*mmroff* was written by Jörgen Hägg (jh@axis.se) of Lund, Sweden.

**See also**

[groff\\_mm\(7\)](#), [groff\\_mmse\(7\)](#), [groff\(1\)](#), [troff\(1\)](#), [tbl\(1\)](#), [pic\(1\)](#), [eqn\(1\)](#)

**Name**

neqn – format equations for character-cell terminal output

**Synopsis**

**neqn** [*eqn-options*]

**Description**

*neqn* invokes the [eqn\(1\)](#) command with the **ascii** output device.

*eqn* does not support low-resolution, typewriter-like devices, although it may work adequately for very simple input.

**See also**

[eqn\(1\)](#)

**Name**

nroff – format documents with groff for TTY (terminal) devices

**Synopsis**

**nroff** [-bcCEhikpRStUVz] [-d *cs*] [-d *name=string*] [-K *enc*] [-m *name*] [-M *dir*] [-n *num*] [-o *list*]  
 [-P *arg*] [-r *cn*] [-r *reg=expr*] [-T *dev*] [-w *name*] [-W *name*] [*file ...*]

**nroff --help**

**nroff -v**

**nroff --version**

**Description**

*nroff* formats documents written in the *groff*(7) language for typewriter-like devices such as terminal emulators. GNU *nroff* emulates the AT&T *nroff* command using *groff*(1). *nroff* generates output via *grotty*(1), *groff*'s terminal output driver, which needs to know the character encoding scheme used by the device. Consequently, acceptable arguments to the -T option are **ascii**, **latin1**, **utf8**, and **cp1047**; any others are ignored. If neither the *GROFF\_TYPESETTER* environment variable nor the -T command-line option (which overrides the environment variable) specifies a (valid) device, *nroff* consults the locale to select an appropriate output device. It first tries the *locale*(1) program, then checks several locale-related environment variables; see section “Environment” below. If all of the foregoing fail, -T**ascii** is implied.

The -b, -c, -C, -d, -E, -i, -m, -M, -n, -o, -r, -U, -w, -W, and -z options have the effects described in *troff*(1). -c and -h imply “-P-c” and “-P-h”, respectively; -c is also interpreted directly by *troff*. In addition, this implementation ignores the AT&T *nroff* options -e, -q, and -s (which are not implemented in *groff*). The options -k, -K, -p, -P, -R, -t, and -S are documented in *groff*(1). -V causes *nroff* to display the constructed *groff* command on the standard output stream, but does not execute it. -v and --**version** show version information about *nroff* and the programs it runs, while --**help** displays a usage message; all exit afterward.

**Exit status**

*nroff* exits with error status 2 if there was a problem parsing its arguments, with status 0 if any of the options -V, -v, --**version**, or --**help** were specified, and with the status of *groff* otherwise.

**Environment**

Normally, the path separator in environment variables ending with *PATH* is the colon; this may vary depending on the operating system. For example, Windows uses a semicolon instead.

*GROFF\_BIN\_PATH*

is a colon-separated list of directories in which to search for the *groff* executable before searching in *PATH*. If unset, */usr/local/bin* is used.

*GROFF\_TYPESETTER*

specifies the default output device for *groff*.

*LC\_ALL**LC\_CTYPE**LANG**LESSCHARSET*

are pattern-matched in this order for contents matching standard character encodings supported by *groff* in the event no -T option is given and *GROFF\_TYPESETTER* is unset, or the values specified are invalid.

**Files**

*/usr/local/share/groff/1.23.0/tmac/tty-char.tmac*

defines fallback definitions of *roff* special characters. These definitions more poorly optically approximate typeset output compared to those of *ty.tmac* in favor of communicating semantic information. *nroff* loads it automatically.

**Notes**

Pager programs like *more*(1) and *less*(1) may require command-line options to correctly handle some output sequences; see *grotty*(1).

**See also**

*groff*(1), *troff*(1), *grotty*(1), *locale*(1), *roff*(7)

**Name**

pdfmom – produce PDF documents using the mom macro package for groff

**Synopsis**

**pdfmom** [**-Tpdf**] [*groff-options*] [*file ...*]

**pdfmom -Tps** [*pdfroff-options*] [*groff-options*] [*file ...*]

**pdfmom -v**

**Description**

*pdfmom* is a wrapper around [groff\(1\)](#) that facilitates the production of PDF documents from files formatted with the *mom* macros.

*pdfmom* prints to the standard output, so output must usually be redirected to a destination file. The size of the final PDF can be reduced by piping the output through *ps2pdf(1)*.

If called with the **-Tpdf** option (which is the default), *pdfmom* processes files using *groff*'s native PDF driver, *gropdf(1)*. If **-Tps** is given, processing is passed over to *pdfroff*, which uses *groff*'s PostScript driver. In either case, multiple runs of the source file are performed in order to satisfy any forward references in the document.

*pdfmom* accepts all the same options as *groff*. If **-Tps** is given, the options associated with *pdfroff* are accepted as well. Please note that when *pdfmom* calls *pdfroff*, the

**-mpdfmark -mom --no-toc**

options are implied and should not be given on the command line. Equally, it is not necessary to supply the **-mom** or **-m mom** options when **-Tps** is absent.

PDF integration with the *mom* macros is discussed in full in the manual “Producing PDFs with *groff* and *mom*”, which was itself produced with *pdfmom*.

If called with the **-v** option, *pdfmom* simply displays its version information and exits.

**Bugs**

*pdfmom* sometimes issues warnings of the type

```
...: can't transparently output node at top level
```

but this is more of an annoyance than a bug, and may safely be ignored.

**Authors**

*pdfmom* was written by Deri James <deri@chuzzlewit.myzen.co.uk> and Peter Schaffter <peter@schaffter.ca>.

**See also**

[/usr/local/share/doc/groff-1.23.0/pdf/mom-pdf.pdf](#)

“Producing PDFs with *groff* and *mom*”, by Deri James and Peter Schaffter. This file, together with its source, *mom-pdf.mom*, is part of the *groff* distribution.

[groff\(1\)](#), [gropdf\(1\)](#), [pdfroff\(1\)](#), [ps2pdf\(1\)](#)

**Name**

pdfroff – construct files in Portable Document Format using groff

**Synopsis**

```
pdfroff [groff-option] [--emit-ps] [--no-toc-relocation] [--no-kill-null-pages]
        [--stylesheet=name] [--no-pdf-output] [--pdf-output=name] [--no-reference-dictionary]
        [--reference-dictionary=name] [--report-progress] [--keep-temporary-files] [file ...]
```

**pdfroff -h**

**pdfroff --help**

**pdfroff -v** [*groff-option* ...]

**pdfroff --version** [*groff-option* ...]

*groff-option* is any short option supported by [groff\(1\)](#) except for **-h**, **-T**, and **-v**; see section “Usage” below.

**Description**

*pdfroff* is a wrapper program for the GNU text processing system, *groff*. It transparently handles the mechanics of multiple pass *groff* processing, when applied to suitably marked up *groff* source files, such that tables of contents and body text are formatted separately, and are subsequently combined in the correct order, for final publication as a single PDF document. A further optional “style sheet” capability is provided; this allows for the definition of content which is required to precede the table of contents, in the published document.

For each invocation of *pdfroff*, the ultimate *groff* output stream is post-processed by the Ghostscript *gs(1)* interpreter to produce a finished PDF document.

*pdfroff* makes no assumptions about, and imposes no restrictions on, the use of any *groff* macro packages which the user may choose to employ, in order to achieve a desired document format; however, it *does* include specific built in support for the *pdfmark* macro package, should the user choose to employ it. Specifically, if the *pdfhref* macro, defined in the *pdfmark.tmac* package, is used to define public reference marks, or dynamic links to such reference marks, then *pdfroff* performs as many preformatting *groff* passes as required, up to a maximum limit of *four*, in order to compile a document reference dictionary, to resolve references, and to expand the dynamically defined content of links.

**Usage**

The command line is parsed in accordance with normal GNU conventions, but with one exception—when specifying any short form option (i.e., a single character option introduced by a single hyphen), and if that option expects an argument, then it *must* be specified independently (i.e., it may *not* be appended to any group of other single character short form options).

Long form option names (i.e., those introduced by a double hyphen) may be abbreviated to their minimum length unambiguous initial substring.

Otherwise, *pdfroff* usage closely mirrors that of *groff* itself. Indeed, with the exception of the **-h**, **-v**, and **-T dev** short form options, and all long form options, which are parsed internally by *pdfroff*, all options and file name arguments specified on the command line are passed on to *groff*, to control the formatting of the PDF document. Consequently, *pdfroff* accepts all options and arguments, as specified in [groff\(1\)](#), which may also be considered as the definitive reference for all standard *pdfroff* options and argument usage.

**Options**

*pdfroff* accepts all of the short form options (i.e., those introduced by a single hyphen), which are available with *groff* itself. In most cases, these are simply passed transparently to *groff*; the following, however, are handled specially by *pdfroff*.

**-h** Same as **--help**; see below.

**-i** Process standard input, after all other specified input files. This is passed transparently to *groff*, but, if grouped with other options, it *must* be the first in the group. Hiding it within a group breaks standard input processing, in the multiple-pass *groff* processing context of *pdfroff*.

**-T dev** Only **-T ps** is supported by *pdfroff*. Attempting to specify any other device causes *pdfroff* to abort.

**-v** Same as **--version**; see below.

See *groff(1)* for a description of all other short form options, which are transparently passed through *pdfroff* to *groff*.

All long form options (i.e., those introduced by a double hyphen) are interpreted locally by *pdfroff*; they are *not* passed on to *groff*, unless otherwise stated below.

**--help** Causes *pdfroff* to display a summary of the its usage syntax, and supported options, and then exit.

**--emit-ps**

Suppresses the final output conversion step, causing *pdfroff* to emit PostScript output instead of PDF. This may be useful to capture intermediate PostScript output when using a specialised post-processor, such as *gpresent* for example, in place of the default Ghostscript PDF writer.

**--keep-temporary-files**

Suppresses the deletion of temporary files, which normally occurs after *pdfroff* has completed PDF document formatting; this may be useful when debugging formatting problems.

See section “Files” below for a description of the temporary files used by *pdfroff*.

**--no-pdf-output**

May be used with the **--reference-dictionary=name** option (described below) to eliminate the overhead of PDF formatting when running *pdfroff* to create a reference dictionary for use in a different document.

**--no-reference-dictionary**

May be used to eliminate the overhead of creating a reference dictionary, when it is known that the target PDF document contains no public references, created by the **pdfhref** macro.

**--no-toc-relocation**

May be used to eliminate the extra *groff* processing pass, which is required to generate a table of contents, and relocate it to the start of the PDF document, when processing any document which lacks an automatically generated table of contents.

**--no-kill-null-pages**

While preparing for simulation of the manual collation step, which is traditionally required to relocate a *table of contents* to the start of a document, *pdfroff* accumulates a number of empty page descriptions into the intermediate PostScript output stream. During the final collation step, these empty pages are normally discarded from the finished document; this option forces *pdfroff* to leave them in place.

**--pdf-output=name**

Specifies the name to be used for the resultant PDF document; if unspecified, the PDF output is written to standard output. A future version of *pdfroff* may use this option, to encode the document name in a generated reference dictionary.

**--reference-dictionary=name**

Specifies the name to be used for the generated reference dictionary file; if unspecified, the reference dictionary is created in a temporary file, which is deleted when *pdfroff* completes processing of the current document. This option *must* be specified, if it is desired to save the reference dictionary, for use in references placed in other PDF documents.

**--report-progress**

Causes *pdfroff* to display an informational message on standard error, at the start of each *groff* processing pass.

**--stylesheet=name**

Specifies the name of an *input file*, to be used as a style sheet for formatting of content, which is to be placed *before* the table of contents, in the formatted PDF document.

**--version**

Causes *pdfroff* to display a version identification message. The entire command line is then passed transparently to *groff*, in a *one* pass operation *only*, in order to display the associated *groff* version information, before exiting.

**Environment**

The following environment variables may be set, and exported, to modify the behaviour of *pdfroff*.

**PDFROFF\_COLLATE**

Specifies the program to be used for collation of the finished PDF document.

This collation step may be required to move *tables of contents* to the start of the finished PDF document, when formatting with traditional macro packages, which print them at the end. However, users should not normally need to specify *PDFROFF\_COLLATE*, (and indeed, are not encouraged to do so). If unspecified, *pdfroff* uses *sed(1)* by default, which normally suffices.

If *PDFROFF\_COLLATE* is specified, then it must act as a filter, accepting a list of file name arguments, and write its output to the standard output stream, whence it is piped to the *PDFROFF\_POSTPROCESSOR\_COMMAND*, to produce the finished PDF output.

When specifying *PDFROFF\_COLLATE*, it is normally necessary to also specify *PDFROFF\_KILL\_NULL\_PAGES*.

*PDFROFF\_COLLATE* is ignored, if *pdfroff* is invoked with the **--no-kill-null-pages** option.

**PDFROFF\_KILL\_NULL\_PAGES**

Specifies options to be passed to the *PDFROFF\_COLLATE* program.

It should not normally be necessary to specify *PDFROFF\_KILL\_NULL\_PAGES*. The internal default is a *sed(1)* script, which is intended to remove completely blank pages from the collated output stream, and which should be appropriate in most applications of *pdfroff*. However, if any alternative to *sed(1)* is specified for *PDFROFF\_COLLATE*, then it is likely that a corresponding alternative specification for *PDFROFF\_KILL\_NULL\_PAGES* is required.

As in the case of *PDFROFF\_COLLATE*, *PDFROFF\_KILL\_NULL\_PAGES* is ignored, if *pdfroff* is invoked with the **--no-kill-null-pages** option.

**PDFROFF\_POSTPROCESSOR\_COMMAND**

Specifies the command to be used for the final document conversion from PostScript intermediate output to PDF. It must behave as a filter, writing its output to the standard output stream, and must accept an arbitrary number of *files ...* arguments, with the special case of “-” representing the standard input stream.

If unspecified, *PDFROFF\_POSTPROCESSOR\_COMMAND* defaults to

```
gs -dBATCH -dQUIET -dNOPAUSE -dSAFER -sDEVICE=pdfwrite \
-sOutputFile=-
```

**GROFF\_TMPDIR**

Identifies the directory in which *pdfroff* should create temporary files. If *GROFF\_TMPDIR* is *not* specified, then the variables *TMPDIR*, *TMP* and *TEMP* are considered in turn as possible temporary file repositories. If none of these are set, then temporary files are created in the current directory.

**GROFF\_GHOSTSCRIPT\_INTERPRETER**

Specifies the program to be invoked when *pdfroff* converts *groff* PostScript output to PDF. If *PDFROFF\_POSTPROCESSOR\_COMMAND* is specified, then the command name it specifies is *implicitly* assigned to *GROFF\_GHOSTSCRIPT\_INTERPRETER*, overriding any explicit setting specified in the environment. If *GROFF\_GHOSTSCRIPT\_INTERPRETER* is not specified, then *pdfroff* searches the process *PATH*, looking for a program with any of the well known names for the Ghostscript interpreter; if no Ghostscript interpreter can be found, *pdfroff* aborts.

**GROFF\_AWK\_INTERPRETER**

Specifies the program to be invoked when *pdfroff* is extracting reference dictionary entries from a *groff* intermediate message stream. If *GROFF\_AWK\_INTERPRETER* is not specified, then *pdfroff* searches the process *PATH*, looking for any of the preferred programs, *gawk*, *mawk*, *nawk*, and *awk*, in that order; if none of these are found, *pdfroff* issues a warning message, and continue processing; however, in this case, no reference dictionary is created.

**OSTYPE**

Typically defined automatically by the operating system, *OSTYPE* is used on Microsoft Win32/MS-DOS platforms *only*, to infer the default *PATH\_SEPARATOR* character, which is used when parsing the process *PATH* to search for external helper programs.

**PATH\_SEPARATOR**

If set, *PATH\_SEPARATOR* overrides the default separator character, (‘.’ on POSIX/Unix systems, inferred from *OSTYPE* on Microsoft Win32/MS-DOS), which is used when parsing the process *PATH* to search for external helper programs.

**SHOW\_PROGRESS**

If this is set to a non-empty value, then *pdfroff* always behaves as if the **--report-progress** option is specified on the command line.

**Files**

Input and output files for *pdfroff* may be named according to any convention of the user’s choice. Typically, input files may be named according to the choice of the principal normatting macro package, e.g., *file.ms* might be an input file for formatting using the *ms* macros (*s.tmac*); normally, the final output file should be named *file.pdf*.

Temporary files created by *pdfroff* are placed in the file system hierarchy, in or below the directory specified by environment variables (see section “Environment” above). If *mktemp*(1) is available, it is invoked to create a private subdirectory of the nominated temporary files directory, (with subdirectory name derived from the template *pdfroff-XXXXXXXXXX*); if this subdirectory is successfully created, the temporary files will be placed within it, otherwise they will be placed directly in the directory nominated in the environment.

All temporary files themselves are named according to the convention *pdf\$\$.\**, where *\$\$* is the standard shell variable representing the process identifier of the *pdfroff* process itself, and *\** represents any of the extensions used by *pdfroff* to identify the following temporary and intermediate files.

*pdf\$\$tmp*

A scratch pad file, used to capture reference data emitted by *groff*, during the *reference dictionary* compilation phase.

*pdf\$\$ref*

The *reference dictionary*, as compiled in the last but one pass of the *reference dictionary* compilation phase; (at the start of the first pass, this file is created empty; in successive passes, it contains the *reference dictionary* entries, as collected in the preceding pass).

If the **--reference-dictionary=name** option is specified, this intermediate file becomes permanent, and is named *name*, rather than *pdf\$\$ref*.

*pdf\$\$cmp*

Used to collect *reference dictionary* entries during the active pass of the *reference dictionary* compilation phase. At the end of any pass, when the content of *pdf\$\$cmp* compares as identical to *pdf\$\$ref*, (or the corresponding file named by the **--reference-dictionary=name** option), then *reference dictionary* compilation is terminated, and the *document reference map* is appended to this intermediate file, for inclusion in the final formatting passes.

*pdf\$\$tc*

An intermediate *PostScript* file, in which “Table of Contents” entries are collected, to facilitate relocation before the body text, on ultimate output to the *Ghostsript* postprocessor.

*pdf\$\$ps*

An intermediate *PostScript* file, in which the body text is collected prior to ultimate output to the *Ghostscript* postprocessor, in the proper sequence, *after pdf\$\$tc*.

### Authors

*pdfroff* was written by Keith Marshall <keith.d.marshall@ntlworld.com>.

### See also

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

Since *pdfroff* provides a superset of all *groff* capabilities, the above manual, or its terser reference page, [groff\(7\)](#) may also be considered definitive references to all *standard* capabilities of *pdfroff*, with this document providing the reference to *pdfroff*'s extended features.

While *pdfroff* imposes neither any restriction on, nor any requirement for, the use of any specific *groff* macro package, a number of supplied macro packages, and in particular those associated with the package *pdfmark.tmac*, are best suited for use with *pdfroff* as the preferred formatter.

[/usr/local/share/doc/groff-1.23.0/pdf/pdfmark.pdf](#)

“Portable Document Format Publishing with GNU *Troff*”, by Keith Marshall, offers detailed documentation on the use of these packages. This file, together with its source, *pdfmark.ms*, is part of the *groff* distribution.

**Name**

pfbtops – translate Printer Font Binary files to PostScript ASCII

**Synopsis**

**pfbtops** [*pfb-file*]

**pfbtops** **--help**

**pfbtops** **-v**

**pfbtops** **--version**

**Description**

*pfbtops* translates a PostScript font in Printer Font Binary (PFB) format to Printer Font ASCII (PFA) format, splitting overlong lines in text packets into smaller chunks. If *pfb-file* is omitted, the PFB file will be read from the standard input stream. The PFA font will be written on the standard output stream. PostScript fonts for MS-DOS were historically supplied in PFB format.

The resulting PFA font can be used with [groff\(1\)](#) if it is first listed in */usr/local/share/groff/1.23.0/font/devps/download* and */usr/local/share/groff/1.23.0/font/devpdf/download*. The **--help** option displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**See also**

[grops\(1\)](#), [gropdf\(1\)](#)

**Name**

pic – compile pictures for troff or TeX

**Synopsis**

pic [-nCSU] [*file* ...]

pic -t [-czCSU] [*file* ...]

pic --help

pic -v

pic --version

**Description**

The GNU implementation of *pic* is part of the *groff(1)* document formatting system. *pic* is a *troff(1)* pre-processor that compiles descriptions of diagrammatic pictures embedded in *troff* or TeX input files into the language understood by TeX or *troff*. It copies the contents of each *file* to the standard output stream, except that lines between **.PS** and either **.PE** or **.PF** are interpreted as picture descriptions. Ending a *pic* picture with **.PE** leaves the page position at the bottom of the picture; ending it with **.PF** leaves the position at the top. Normally, *pic* is not executed directly by the user, but invoked by specifying the **-p** option to *groff(1)*. If no *file* operands are given on the command line, or if *file* is “-”, the standard input stream is read.

It is the user’s responsibility to provide appropriate definitions of the **PS**, **PE**, and **PF** macros. When the macro package being used does not supply such definitions (for example, old versions of *-ms*), appropriate definitions can be obtained with **-mpic**; these will center each picture.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

- c** Be more compatible with *tpic*. Implies **-t**. Lines beginning with \ are not passed through transparently. Lines beginning with . are passed through with the initial . changed to \. A line beginning with **.ps** is given special treatment: it takes an optional integer argument specifying the line thickness (pen size) in millinches; a missing argument restores the previous line thickness; the default line thickness is 8 millinches. The line thickness thus specified takes effect only when a non-negative line thickness has not been specified by use of the **thickness** attribute or by setting the **linethick** variable.
- C** Recognize **.PS**, **.PE**, and **.PF** even when followed by a character other than space or newline.
- n** Don’t use *groff* extensions to the *troff* drawing commands. You should use this if you are using a postprocessor that doesn’t support these extensions. The extensions are described in *groff\_out(5)*. The **-n** option also causes *pic* not to use zero-length lines to draw dots in *troff* mode.
- S** Safer mode; do not execute **sh** commands. This option, enabled by default, can be useful when operating on untrustworthy input.
- t** TeX mode.
- U** Unsafe mode; revert the default option **-S**.
- z** In TeX mode draw dots using zero-length lines.

The following options supported by other versions of *pic* are ignored:

- D** Draw all lines using the \D escape sequence. *pic* always does this.
- T dev** Generate output for the *troff* device *dev*. This is unnecessary because the *troff* output generated by *pic* is device-independent.

**Usage**

This section describes only the differences between GNU *pic* and the original version of *pic*. Many of these differences also apply to newer versions of Unix **pic**. A complete documentation is available in the file

*/usr/local/share/doc/groff-1.23.0/pic.ms*

**T<sub>E</sub>X mode**

T<sub>E</sub>X mode is enabled by the `-t` option. In T<sub>E</sub>X mode, *pic* will define a vbox called `\graph` for each picture. Use the `figname` command to change the name of the vbox. You must yourself print that vbox using, for example, the command

```
\centerline{\box\graph}
```

Actually, since the vbox has a height of zero (it is defined with `\vtop`) this will produce slightly more vertical space above the picture than below it;

```
\centerline{\raise 1em\box\graph}
```

would avoid this.

To make the vbox having a positive height and a depth of zero (as used e.g., by L<sup>A</sup>T<sub>E</sub>X's `graphics.sty`), define the following macro in your document:

```
\def\gpibox#1{%
  \vbox{\unvbox\csname #1\endcsname\kern 0pt}}
```

Now you can simply say `\gpibox{graph}` instead of `\box\graph`.

You must use a T<sub>E</sub>X driver that supports *tpic* version 2 specials. (*tpic* was a fork of AT&T *pic* by Tim Morgan of the University of California at Irvine that diverged from its source around 1984. It is best known today for lending its name to a group of `\special` commands it produced for T<sub>E</sub>X.)

Lines beginning with `\` are passed through transparently; a `%` is added to the end of the line to avoid unwanted spaces. You can safely use this feature to change fonts or to change the value of `\baselineskip`. Anything else may well produce undesirable results; use at your own risk. Lines beginning with a period are not given any special treatment.

**Commands**

**for** *variable* = *expr1* **to** *expr2* [**by** [\*]*expr3*] **do** *X* *body X*

Set *variable* to *expr1*. While the value of *variable* is less than or equal to *expr2*, do *body* and increment *variable* by *expr3*; if **by** is not given, increment *variable* by 1. If *expr3* is prefixed by `*` then *variable* will instead be multiplied by *expr3*. The value of *expr3* can be negative for the additive case; *variable* is then tested whether it is greater than or equal to *expr2*. For the multiplicative case, *expr3* must be greater than zero. If the constraints aren't met, the loop isn't executed. *X* can be any character not occurring in *body*.

**if** *expr* **then** *X* *if-true X* [**else** *Y* *if-false Y*]

Evaluate *expr*; if it is non-zero then do *if-true*, otherwise do *if-false*. *X* can be any character not occurring in *if-true*. *Y* can be any character not occurring in *if-false*.

**print** *arg* ...

Concatenate the arguments and print as a line on the standard error stream. Each *arg* must be an expression, a position, or text. This is useful for debugging.

**command** *arg* ...

Concatenate the arguments and pass them through as a line to *troff* or T<sub>E</sub>X. Each *arg* must be an expression, a position, or text. This has a similar effect to a line beginning with `.` or `\`, but allows the values of variables to be passed through. For example,

```
.PS
x = 14
command ".ds string x is " x "."
.PE
\[string]

prints

x is 14.
```

**sh** *X command X*

Pass *command* to a shell. *X* can be any character not occurring in *command*.

**copy** "*filename*"

Include *filename* at this point in the file.

**copy** ["*filename*"] **thru** *X body X* [**until** "*word*"]**copy** ["*filename*"] **thru** *macro* [**until** "*word*"]

This construct does *body* once for each line of *filename*; the line is split into blank-delimited words, and occurrences of  $\$i$  in *body*, for *i* between 1 and 9, are replaced by the *i*-th word of the line. If *filename* is not given, lines are taken from the current input up to **.PE**. If an **until** clause is specified, lines will be read only until a line the first word of which is *word*; that line will then be discarded. *X* can be any character not occurring in *body*. For example,

```
.PS
copy thru % circle at ($1,$2) % until "END"
1 2
3 4
5 6
END
box
.PE
```

is equivalent to

```
.PS
circle at (1,2)
circle at (3,4)
circle at (5,6)
box
.PE
```

The commands to be performed for each line can also be taken from a macro defined earlier by giving the name of the macro as the argument to **thru**.

**reset****reset** *variable1* [,] *variable2* ...

Reset pre-defined variables *variable1*, *variable2* ... to their default values. If no arguments are given, reset all pre-defined variables to their default values. Assigning a value to **scale** also causes all pre-defined variables that control dimensions to be reset to their default values times the new value of scale.

**plot** *expr* ["*text*"]

This is a text object which is constructed by using *text* as a format string for `sprintf` with an argument of *expr*. If *text* is omitted a format string of "**%g**" is used. Attributes can be specified in the same way as for a normal text object. Be very careful that you specify an appropriate format string; *pic* does only very limited checking of the string. This is deprecated in favour of **sprintf**.

*variable* := *expr*

This is similar to = except *variable* must already be defined, and *expr* will be assigned to *variable* without creating a variable local to the current block. (By contrast, = defines the variable in the current block if it is not already defined there, and then changes the value in the current block only.) For example, the following:

```
.PS
x = 3
y = 3
[
x := 5
y = 5
```

```

]
print x y
.PE

```

prints

```
5 3
```

Arguments of the form

*X anything X*

are also allowed to be of the form

{ *anything* }

In this case *anything* can contain balanced occurrences of { and }. Strings may contain *X* or imbalanced occurrences of { and }.

### Expressions

The syntax for expressions has been significantly extended:

$x ^ y$  (exponentiation)

**sin**(*x*)

**cos**(*x*)

**atan2**(*y, x*)

**log**(*x*) (base 10)

**exp**(*x*) (base 10, i.e.  $10^x$ )

**sqrt**(*x*)

**int**(*x*)

**rand**() (return a random number between 0 and 1)

**rand**(*x*) (return a random number between 1 and *x*; deprecated)

**srand**(*x*) (set the random number seed)

**max**(*e1, e2*)

**min**(*e1, e2*)

!*e*

*e1* && *e2*

*e1* || *e2*

*e1* == *e2*

*e1* != *e2*

*e1* >= *e2*

*e1* > *e2*

*e1* <= *e2*

*e1* < *e2*

"*str1*" == "*str2*"

"*str1*" != "*str2*"

String comparison expressions must be parenthesised in some contexts to avoid ambiguity.

### Other changes

A bare expression, *expr*, is acceptable as an attribute; it is equivalent to *dir expr*, where *dir* is the current direction. For example

**line 2i**

means draw a line 2 inches long in the current direction. The 'i' (or 'I') character is ignored; to use another measurement unit, set the *scale* variable to an appropriate value.

The maximum width and height of the picture are taken from the variables **maxswid** and **maxpsht**. Initially, these have values 8.5 and 11.

Scientific notation is allowed for numbers. For example

**x = 5e-2**

Text attributes can be compounded. For example,

```
"foo" above ljust
```

is valid.

There is no limit to the depth to which blocks can be examined. For example,

```
[A: [B: [C: box ]]] with .A.B.C.sw at 1,2
circle at last [].A.B.C
```

is acceptable.

Arcs now have compass points determined by the circle of which the arc is a part.

Circles, ellipses, and arcs can be dotted or dashed. In  $\text{T}_{\text{E}}\text{X}$  mode splines can be dotted or dashed also.

Boxes can have rounded corners. The **rad** attribute specifies the radius of the quarter-circles at each corner. If no **rad** or **diam** attribute is given, a radius of **boxrad** is used. Initially, **boxrad** has a value of 0. A box with rounded corners can be dotted or dashed.

Boxes can have slanted sides. This effectively changes the shape of a box from a rectangle to an arbitrary parallelogram. The **xslanted** and **yslanted** attributes specify the x and y offset of the box's upper right corner from its default position.

The **.PS** line can have a second argument specifying a maximum height for the picture. If the width of zero is specified the width will be ignored in computing the scaling factor for the picture. GNU *pic* will always scale a picture by the same amount vertically as well as horizontally. This is different from DWB 2.0 *pic* which may scale a picture by a different amount vertically than horizontally if a height is specified.

Each text object has an invisible box associated with it. The compass points of a text object are determined by this box. The implicit motion associated with the object is also determined by this box. The dimensions of this box are taken from the width and height attributes; if the width attribute is not supplied then the width will be taken to be **textwid**; if the height attribute is not supplied then the height will be taken to be the number of text strings associated with the object times **textht**. Initially, **textwid** and **textht** have a value of 0.

In (almost all) places where a quoted text string can be used, an expression of the form

```
sprintf("format", arg,...)
```

can also be used; this will produce the arguments formatted according to *format*, which should be a string as described in *printf(3)* appropriate for the number of arguments supplied. Only the flags “#”, “-”, “+”, and “ ” [sp]ace), a minimum field width, an optional precision, and the conversion specifications **%e**, **%E**, **%f**, **%g**, **%G**, and **%%** are supported.

The thickness of the lines used to draw objects is controlled by the **linethick** variable. This gives the thickness of lines in points. A negative value means use the default thickness: in  $\text{T}_{\text{E}}\text{X}$  output mode, this means use a thickness of 8 milliinches; in  $\text{T}_{\text{E}}\text{X}$  output mode with the **-c** option, this means use the line thickness specified by **.ps** lines; in *troff* output mode, this means use a thickness proportional to the pointsize. A zero value means draw the thinnest possible line supported by the output device. Initially, it has a value of -1. There is also a **thick[ness]** attribute. For example,

```
circle thickness 1.5
```

would draw a circle using a line with a thickness of 1.5 points. The thickness of lines is not affected by the value of the **scale** variable, nor by the width or height given in the **.PS** line.

Boxes (including boxes with rounded corners or slanted sides), circles and ellipses can be filled by giving them an attribute of **fill[ed]**. This takes an optional argument of an expression with a value between 0 and 1; 0 will fill it with white, 1 with black, values in between with a proportionally gray shade. A value greater than 1 can also be used: this means fill with the shade of gray that is currently being used for text and lines. Normally this will be black, but output devices may provide a mechanism for changing this. Without an argument, then the value of the variable **fillval** will be used. Initially, this has a value of 0.5. The invisible attribute does not affect the filling of objects. Any text associated with a filled object will be

added after the object has been filled, so that the text will not be obscured by the filling.

Three additional modifiers are available to specify colored objects: **outline[d]** sets the color of the outline, **shaded** the fill color, and **colo[u]r[ed]** sets both. All three keywords expect a suffix specifying the color, as shown below.

```
circle shaded "green" outline "black"
```

Currently, color support isn't available in T<sub>E</sub>X mode. Predefined color names for *groff* are in the device macro files, for example **ps.tmac**; additional colors can be defined with the **.defcolor** request (see the manual page of *troff(1)* for more details).

To change the name of the vbox in T<sub>E</sub>X mode, set the pseudo-variable **figname** (which is actually a specially parsed command) within a picture. Example:

```
.PS
figname = foobar;
...
.PE
```

The picture is then available in the box **\foobar**.

*pic* assumes that at the beginning of a picture both glyph and fill color are set to the default value.

Arrow heads will be drawn as solid triangles if the variable **arrowhead** is non-zero and either T<sub>E</sub>X mode is enabled or the **-n** option has not been given. Initially, **arrowhead** has a value of 1. Solid arrow heads are always filled with the current outline color.

The *troff* output of *pic* is device-independent. The **-T** option is therefore redundant. All numbers are taken to be in inches; numbers are never interpreted to be in *troff* machine units.

Objects can have an **aligned** attribute. This will only work if the postprocessor is *grops(1)* or *gropdf(1)*. Any text associated with an object having the **aligned** attribute will be rotated about the center of the object so that it is aligned in the direction from the start point to the end point of the object. This attribute will have no effect on objects whose start and end points are coincident.

In places where *nth* is allowed, '*exprth*' is also allowed. “**th**” is a single token: no space is allowed between the apostrophe and the “**th**”. For example,

```
for i = 1 to 4 do {
    line from 'i'th box.nw to 'i+1'th box.se
}
```

## Conversion

To obtain a stand-alone picture from a *pic* file, enclose your *pic* code with **.PS** and **.PE** requests; *roff* configuration commands may be added at the beginning of the file, but no *roff* text.

It is necessary to feed this file into *groff* without adding any page information, so you must check which **.PS** and **.PE** requests are actually called. For example, the *mm* macro package adds a page number, which is very annoying. At the moment, calling standard *groff* without any macro package works. Alternatively, you can define your own requests, e.g., to do nothing:

```
.de PS
..
.de PE
..
```

*groff* itself does not provide direct conversion into other graphics file formats. But there are lots of possibilities if you first transform your picture into PostScript® format using the *groff* option **-Tps**. Since this *ps*-file lacks BoundingBox information it is not very useful by itself, but it may be fed into other conversion programs, usually named **ps2other** or **ps2oother** or the like. Moreover, the PostScript interpreter Ghostscript (*gs(1)*) has built-in graphics conversion devices that are called with the option

```
gs -sDEVICE=<devname>
```

Call

**gs --help**

for a list of the available devices.

An alternative may be to use the **-Tpdf** option to convert your picture directly into **PDF** format. The Medi-aBox of the file produced can be controlled by passing a **-P-p** papersize to *groff*.

As the Encapsulated PostScript File Format **EPS** is getting more and more important, and the conversion wasn't regarded trivial in the past you might be interested to know that there is a conversion tool named *ps2eps* which does the right job. It is much better than the tool *ps2epsi* packaged with *gs*.

For bitmapped graphic formats, you should use *pstopnm*; the resulting (intermediate) *pnm(5)* file can be then converted to virtually any graphics format using the tools of the **netpbm** package.

## Files

*/usr/local/share/groff/1.23.0/tmac/pic.tmac*

Example definitions of the **PS**, **PE**, and **PF** macros.

## Bugs

Characters that are invalid as input to GNU *troff* (see the *groff* Texinfo manual or [groff\\_char\(7\)](#) for a list) are rejected even in  $\TeX$  mode.

The interpretation of **fillval** is incompatible with the *pic* in Tenth Edition Research Unix, which interprets 0 as black and 1 as white.

## See also

*/usr/local/share/doc/groff-1.23.0/pic.ps*

“Making Pictures with GNU pic”, by Eric S. Raymond. This file, together with its source, *pic.ms*, is part of the *groff* distribution.

“PIC—A Graphics Language for Typesetting: User Manual”, by Brian W. Kernighan, 1991, AT&T Bell Laboratories Computing Science Technical Report No. 116

**ps2eps** is available from CTAN mirrors, e.g., <ftp://ftp.dante.de/tex-archive/support/ps2eps/>

W. Richard Stevens, *Turning PIC into HTML* (<http://www.kohala.com/start/troff/pic2html.html>)

W. Richard Stevens, *Examples of pic Macros* (<http://www.kohala.com/start/troff/pic.examples.ps>)

[troff\(1\)](#), [groff\\_out\(5\)](#), [tex\(1\)](#), [gs\(1\)](#), [ps2eps\(1\)](#), [pstopnm\(1\)](#), [ps2epsi\(1\)](#), [pnm\(5\)](#)

**Name**

pic2graph – convert a PIC diagram into a cropped image

**Synopsis**

**pic2graph** [**-unsafe**] [**-format** *output-format*] [**-eqn** *delimiters*] [*convert-arguments*]

**pic2graph --help**

**pic2graph -v**

**pic2graph --version**

**Description**

*pic2graph* reads a *pic(1)* program from the standard input and writes an image file, by default in Portable Network Graphics (PNG) format, to the standard output. It furthermore translates *eqn(1)* constructs, so it can be used for generating images of mathematical formulae.

The input PIC code should *not* be wrapped with the **.PS** and **.PE/.PF** macros that normally guard it within *groff(1)* documents.

Arguments not recognized by *pic2graph* are passed to the ImageMagick or GraphicsMagick program *convert(1)*. By specifying these, you can give your image a border, set the image's pixel density, or perform other useful transformations.

The output image is clipped using *convert*'s **-trim** option to the smallest possible bounding box that contains all the black pixels.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-eqn** *delimiters*

Use *delimiters* as the opening and closing characters that delimit *eqn* directives; the default is “\$\$. The option argument *delimiters* should be a two-character string, but an empty string (“”) is accepted as a directive to disable *eqn* processing.

**-format** *output-format*

Write the image in *output-format*, which must be understood by *convert*; the default is PNG.

**-unsafe**

Run *groff* in *unsafe* mode, enabling the PIC command **sh** to execute arbitrary Unix shell commands. The *groff* default is to forbid this.

**Environment**

*GROFF\_TMPDIR*

*TMPDIR*

*TMP*

*TEMP* These environment variables are searched in the given order to determine the directory where temporary files will be created. If none are set, */tmp* is used.

**Authors**

*pic2graph* was written by Eric S. Raymond (esr@thyrus.com), based on a recipe by W. Richard Stevens.

**See also**

W. Richard Stevens, *Turning PIC into HTML* (<http://www.kohala.com/start/troff/pic2html.html>)

*eqn2graph(1)*, *grap2graph(1)*, *pic(1)*, *eqn(1)*, *groff(1)*, *convert(1)*

**Name**

preconv – prepare files for typesetting with groff

**Synopsis**

**preconv** [-dr] [-D *default-encoding*] [-e *encoding*] [*file* ...]

**preconv -h**

**preconv --help**

**preconv -v**

**preconv --version**

**Description**

*preconv* reads each *file*, converts its encoded characters to a form *troff*(1) can interpret, and sends the result to the standard output stream. Currently, this means that code points in the range 0–127 (in US-ASCII, ISO 8859, or Unicode) remain as-is and the remainder are converted to the *groff* special character form “[uXXXX]”, where XXXX is a hexadecimal number of four to six digits corresponding to a Unicode code point. By default, *preconv* also inserts a *roff* .If request at the beginning of each *file*, identifying it for the benefit of later processing (including diagnostic messages); the **-r** option suppresses this behavior.

In typical usage scenarios, *preconv* need not be run directly; instead it should be invoked with the **-k** or **-K** options of *groff*. If no *file* operands are given on the command line, or if *file* is “-”, the standard input stream is read.

*preconv* tries to find the input encoding with the following algorithm, stopping at the first success.

1. If the input encoding has been explicitly specified with option **-e**, use it.
2. Check whether the input starts with a Unicode Byte Order Mark. If so, determine the encoding as UTF-8, UTF-16, or UTF-32 accordingly.
3. If the input stream is seekable, check the first and second input lines for a recognized GNU Emacs file-local variable identifying the character encoding, here referred to as the “coding tag” for brevity. If found, use it.
4. If the input stream is seekable, and if the *ucharset* library is available on the system, use it to try to infer the encoding of the file.
5. If the **-D** option specifies an encoding, use it.
6. Use the encoding specified by the current locale (*LC\_CTYPE*), unless the locale is “C”, “POSIX”, or empty, in which case assume Latin-1 (ISO 8859-1).

The coding tag and *ucharset* methods in the above procedure rely upon a seekable input stream; when *preconv* reads from a pipe, the stream is not seekable, and these detection methods are skipped. If character encoding detection of your input files is unreliable, arrange for one of the other methods to succeed by using *preconv*’s **-D** or **-e** options, or by configuring your locale appropriately. *groff* also supports a *GROFF\_ENCODING* environment variable, which can be overridden by its **-K** option. Valid values for (or parameters to) all of these are enumerated in the lists of recognized coding tags in the next subsection, and are further influenced by *iconv* library support.

**Coding tags**

Text editors that support more than a single character encoding need tags within the input files to mark the file’s encoding. While it is possible to guess the right input encoding with the help of heuristics that are reliable for a preponderance of natural language texts, they are not absolutely reliable. Heuristics can fail on inputs that are too short or don’t represent a natural language.

Consequently, *preconv* supports the coding tag convention used by GNU Emacs (with some restrictions). This notation appears in specially marked regions of an input file designated for “file-local variables”.

*preconv* interprets the following syntax if it occurs in a *roff* comment in the first or second line of the input file. Both “\” and “\#” comment forms are recognized, but the control (or no-break control) character must be the default and must begin the line. Similarly, the escape character must be the default.

```
-*- [. . . ;] coding: encoding[; . . .] -*-
```

The only variable *preconv* interprets is “coding”, which can take the values listed below.

The following list comprises all MIME “charset” parameter values recognized, case-insensitively, by *preconv*.

big5, cp1047, euc-jp, euc-kr, gb2312, iso-8859-1, iso-8859-2, iso-8859-5, iso-8859-7, iso-8859-9, iso-8859-13, iso-8859-15, koi8-r, us-ascii, utf-8, utf-16, utf-16be, utf-16le

In addition, the following list of other coding tags is recognized, each of which is mapped to an appropriate value from the list above.

ascii, chinese-big5, chinese-euc, chinese-iso-8bit, cn-big5, cn-gb, cn-gb-2312, cp878, csascii, csisolatin1, cyrillic-iso-8bit, cyrillic-koi8, euc-china, euc-cn, euc-japan, euc-japan-1990, euc-korea, greek-iso-8bit, iso-10646/utf8, iso-10646/utf-8, iso-latin-1, iso-latin-2, iso-latin-5, iso-latin-7, iso-latin-9, japanese-euc, japanese-iso-8bit, jis8, koi8, korean-euc, korean-iso-8bit, latin-0, latin1, latin-1, latin-2, latin-5, latin-7, latin-9, mule-utf-8, mule-utf-16, mule-utf-16be, mule-utf-16-be, mule-utf-16be-with-signature, mule-utf-16le, mule-utf-16-le, mule-utf-16le-with-signature, utf8, utf-16-be, utf-16-be-with-signature, utf-16be-with-signature, utf-16-le, utf-16-le-with-signature, utf-16le-with-signature

Trailing “-dos”, “-unix”, and “-mac” suffixes on coding tags (which indicate the end-of-line convention used in the file) are disregarded for the purpose of comparison with the above tags.

### iconv support

While *preconv* recognizes all of the coding tags listed above, it is capable on its own of interpreting only three encodings: Latin-1, code page 1047, and UTF-8. If *iconv* support is configured at compile time and available at run time, all others are passed to *iconv* library functions, which may recognize many additional encoding strings. The command “**preconv -v**” discloses whether *iconv* support is configured.

The use of *iconv* means that characters in the input that encode invalid code points for that encoding may be dropped from the output stream or mapped to the Unicode replacement character (U+FFFD). Compare the following examples using the input “café” (note the “e” with an acute accent), which due to its short length challenges inference of the encoding used.

```
printf 'caf\351\n' | LC_ALL=en_US.UTF-8 preconv
printf 'caf\351\n' | preconv -e us-ascii
printf 'caf\351\n' | preconv -e latin-1
```

The fate of the accented “e” differs in each case. In the first, *uchardet* fails to detect an encoding (though the library on your system may behave differently) and *preconv* falls back to the locale settings, where octal 351 starts an incomplete UTF-8 sequence and results in the Unicode replacement character. In the second, it is not a representable character in the declared input encoding of US-ASCII and is discarded by *iconv*. In the last, it is correctly detected and mapped.

### Limitations

*preconv* cannot perform any transformation on input that it cannot see. Examples include files that are interpolated by preprocessors that run subsequently, including *soelim*(1); files included by *troff* itself through “so” and similar requests; and string definitions passed to *troff* through its **-d** command-line option.

### Options

- h** and **--help** display a usage message, while **-v** and **--version** show version information; all exit afterward.
- d** Emit debugging messages to the standard error stream.
- D** *default-encoding*  
Report *default-encoding* if all detection methods fail.
- e** *encoding*  
Skip detection and assume *encoding*; see *groff*’s **-K** option.
- r** Write files “raw”; do not add **.lf** requests.

### See also

[groff](#)(1), [iconv](#)(3), [locale](#)(7)

**Name**

refer – process bibliographic references for groff

**Synopsis**

```
refer [-benCPRS] [-a n] [-B field.macro] [-c fields] [-f n] [-i fields] [-k field] [-l range-expression]
      [-p database-file] [-s fields] [-t n] [file ...]
```

refer --help

refer -v

refer --version

**Description**

The GNU implementation of *refer* is part of the *groff(1)* document formatting system. *refer* is a *troff(1)* preprocessor that prepares bibliographic citations by looking up keywords specified in a *roff(7)* input document, obviating the need to type such annotations, and permitting the citation style in formatted output to be altered independently and systematically. It copies the contents of each *file* to the standard output stream, except that it interprets lines between `.[` and `.]` as citations to be translated into *groff* input, and lines between `.R1` and `.R2` as instructions regarding how citations are to be processed. Normally, *refer* is not executed directly by the user, but invoked by specifying the `-R` option to *groff(1)*. If no *file* operands are given on the command line, or if *file* is “-”, the standard input stream is read.

Each citation specifies a reference. The citation can specify a reference that is contained in a bibliographic database by giving a set of keywords that only that reference contains. Alternatively it can specify a reference by supplying a database record in the citation. A combination of these alternatives is also possible.

For each citation, *refer* can produce a mark in the text. This mark consists of some label which can be separated from the text and from other labels in various ways. For each reference it also outputs *groff(7)* language commands that can be used by a macro package to produce a formatted reference for each citation. The output of *refer* must therefore be processed using a suitable macro package, such as *me*, *mm*, *mom*, or *ms*. The commands to format a citation’s reference can be output immediately after the citation, or the references may be accumulated, and the commands output at some later point. If the references are accumulated, then multiple citations of the same reference will produce a single formatted reference.

The interpretation of lines between `.R1` and `.R2` as preprocessor commands is a feature of GNU *refer*. Documents making use of this feature can still be processed by AT&T *refer* just by adding the lines

```
.de R1
.ig R2
..
```

to the beginning of the document. This will cause *troff(1)* to ignore everything between `.R1` and `.R2`. The effect of some commands can also be achieved by options. These options are supported mainly for compatibility with AT&T *refer*. It is usually more convenient to use commands.

*refer* generates `.If` requests so that file names and line numbers in messages produced by commands that read *refer* output will be correct; it also interprets lines beginning with `.If` so that file names and line numbers in the messages and `.If` lines that it produces will be accurate even if the input has been preprocessed by a command such as *soelim(1)*.

**Options**

`--help` displays a usage message, while `-v` and `--version` show version information; all exit afterward.

Most options are equivalent to commands (for a description of these commands, see subsection “Commands” below).

<code>-b</code>	<b>no-label-in-text; no-label-in-reference</b>
<code>-e</code>	<b>accumulate</b>
<code>-n</code>	<b>no-default-database</b>
<code>-C</code>	<b>compatible</b>

<b>-P</b>	<b>move-punctuation</b>
<b>-S</b>	<b>label "(A.n Q) ', ' (D.y D)"; bracket-label " ( " ) "; "</b>
<b>-a n</b>	<b>reverse A n</b>
<b>-c fields</b>	<b>capitalize fields</b>
<b>-f n</b>	<b>label %n</b>
<b>-i fields</b>	<b>search-ignore fields</b>
<b>-k</b>	<b>label L~%a</b>
<b>-k field</b>	<b>label field~%a</b>
<b>-l</b>	<b>label A.nD.y%a</b>
<b>-l m</b>	<b>label A.n+mD.y%a</b>
<b>-l ,n</b>	<b>label A.nD.y-n%a</b>
<b>-l m,n</b>	<b>label A.n+mD.y-n%a</b>
<b>-p db-file</b>	<b>database db-file</b>
<b>-s spec</b>	<b>sort spec</b>
<b>-t n</b>	<b>search-truncate n</b>

The next options are equivalent to commands with the addition that the file names specified on the command line are processed as if they were arguments to the **bibliography** command instead of in the normal way.

<b>-B</b>	<b>annotate X AP; no-label-in-reference</b>
<b>-B field,macro</b>	<b>annotate field macro; no-label-in-reference</b>

The following option has no synonymous command.

<b>-R</b>	Don't recognize lines beginning with <b>.R1/.R2</b> .
-----------	---

## Usage

### Bibliographic databases

The bibliographic database is a text file consisting of records separated by one or more blank lines. Within each record fields start with a % at the beginning of a line. Each field has a one character name that immediately follows the %. It is best to use only upper and lower case letters for the names of fields. The name of the field should be followed by exactly one space, and then by the contents of the field. Empty fields are ignored. The conventional meaning of each field is as follows:

<b>%A</b>	The name of an author. If the name contains a suffix such as "Jr.", it should be separated from the last name by a comma. There can be multiple occurrences of the %A field. The order is significant. It is a good idea always to supply an %A field or a %Q field.
<b>%B</b>	For an article that is part of a book, the title of the book.
<b>%C</b>	The place (city) of publication.
<b>%D</b>	The date of publication. The year should be specified in full. If the month is specified, the name rather than the number of the month should be used, but only the first three letters are required. It is a good idea always to supply a %D field; if the date is unknown, a value such as <b>in press</b> or <b>unknown</b> can be used.
<b>%E</b>	For an article that is part of a book, the name of an editor of the book. Where the work has editors and no authors, the names of the editors should be given as %A fields and ", (ed.)" or ", (eds.)" should be appended to the last author.
<b>%G</b>	U.S. government ordering number.

<b>%I</b>	The publisher (issuer).
<b>%J</b>	For an article in a journal, the name of the journal.
<b>%K</b>	Keywords to be used for searching.
<b>%L</b>	Label.
<b>%N</b>	Journal issue number.
<b>%O</b>	Other information. This is usually printed at the end of the reference.
<b>%P</b>	Page number. A range of pages can be specified as <i>m–n</i> .
<b>%Q</b>	The name of the author, if the author is not a person. This will only be used if there are no <b>%A</b> fields. There can only be one <b>%Q</b> field.
<b>%R</b>	Technical report number.
<b>%S</b>	Series name.
<b>%T</b>	Title. For an article in a book or journal, this should be the title of the article.
<b>%V</b>	Volume number of the journal or book.
<b>%X</b>	Annotation.

For all fields except **%A** and **%E**, if there is more than one occurrence of a particular field in a record, only the last such field will be used.

If accent strings are used, they should follow the character to be accented. This means that an *ms* document must call the **.AM** macro when it initializes. Accent strings should not be quoted: use one `\` rather than two. Accent strings are an obsolescent feature of the *me* and *ms* macro packages; modern documents should use *groff* special character escape sequences instead; see [groff\\_char\(7\)](#).

## Citations

Citations have a characteristic format.

```
. [opening-text
  flags keywords
  fields
. ]closing-text
```

The *opening-text*, *closing-text*, and *flags* components are optional. Only one of the *keywords* and *fields* components need be specified.

The *keywords* component says to search the bibliographic databases for a reference that contains all the words in *keywords*. It is an error if more than one reference is found.

The *fields* component specifies additional fields to replace or supplement those specified in the reference. When references are being accumulated and the *keywords* component is non-empty, then additional fields should be specified only on the first occasion that a particular reference is cited, and will apply to all citations of that reference.

The *opening-text* and *closing-text* components specify strings to be used to bracket the label instead of those in the **bracket-label** command. If either of these components is non-empty, the strings specified in the **bracket-label** command will not be used; this behavior can be altered using the [ and ] flags. Leading and trailing spaces are significant for these components.

The *flags* component is a list of non-alphanumeric characters each of which modifies the treatment of this particular citation. AT&T *refer* will treat these flags as part of the keywords and so will ignore them since they are non-alphanumeric. The following flags are currently recognized.

- #** Use the label specified by the **short-label** command, instead of that specified by the **label** command. If no short label has been specified, the normal label will be used. Typically the short label is used with author-date labels and consists of only the date and possibly a disambiguating letter; the “#” is supposed to be suggestive of a numeric type of label.

- [ Precede *opening-text* with the first string specified in the **bracket-label** command.
- ] Follow *closing-text* with the second string specified in the **bracket-label** command.

An advantage of using the [ and ] flags rather than including the brackets in *opening-text* and *closing-text* is that you can change the style of bracket used in the document just by changing the **bracket-label** command. Another is that sorting and merging of citations will not necessarily be inhibited if the flags are used.

If a label is to be inserted into the text, it will be attached to the line preceding the .[ line. If there is no such line, then an extra line will be inserted before the .[ line and a warning will be given.

There is no special notation for making a citation to multiple references. Just use a sequence of citations, one for each reference. Don't put anything between the citations. The labels for all the citations will be attached to the line preceding the first citation. The labels may also be sorted or merged. See the description of the <> label expression, and of the **sort-adjacent-labels** and **abbreviate-label-ranges** commands. A label will not be merged if its citation has a non-empty *opening-text* or *closing-text*. However, the labels for a citation using the ] flag and without any *closing-text* immediately followed by a citation using the [ flag and without any *opening-text* may be sorted and merged even though the first citation's *opening-text* or the second citation's *closing-text* is non-empty. (If you wish to prevent this, use the non-printing input break escape sequence \& as the first citation's *closing-text*.)

## Commands

Commands are contained between lines starting with **.R1** and **.R2**. Recognition of these lines can be prevented by the **-R** option. When a **.R1** line is recognized any accumulated references are flushed out. Neither **.R1** nor **.R2** lines, nor anything between them, is output.

Commands are separated by newlines or semicolons. A number sign (#) introduces a comment that extends to the end of the line, but does not conceal the newline. Each command is broken up into words. Words are separated by spaces or tabs. A word that begins with a (neutral) double quote (") extends to the next double quote that is not followed by another double quote. If there is no such double quote, the word extends to the end of the line. Pairs of double quotes in a word beginning with a double quote collapse to one double quote. Neither a number sign nor a semicolon is recognized inside double quotes. A line can be continued by ending it with a backslash "\"; this works everywhere except after a number sign.

Each command *name* that is marked with \* has an associated negative command **no-name** that undoes the effect of *name*. For example, the **no-sort** command specifies that references should not be sorted. The negative commands take no arguments.

In the following description each argument must be a single word; *field* is used for a single upper or lower case letter naming a field; *fields* is used for a sequence of such letters; *m* and *n* are used for a non-negative numbers; *string* is used for an arbitrary string; *file* is used for the name of a file.

### **abbreviate\*** *fields string1 string2 string3 string4*

Abbreviate the first names of *fields*. An initial letter will be separated from another initial letter by *string1*, from the last name by *string2*, and from anything else (such as "von" or "de") by *string3*. These default to a period followed by a space. In a hyphenated first name, the initial of the first part of the name will be separated from the hyphen by *string4*; this defaults to a period. No attempt is made to handle any ambiguities that might result from abbreviation. Names are abbreviated before sorting and before label construction.

### **abbreviate-label-ranges\*** *string*

Three or more adjacent labels that refer to consecutive references will be abbreviated to a label consisting of the first label, followed by *string*, followed by the last label. This is mainly useful with numeric labels. If *string* is omitted, it defaults to "-".

### **accumulate\***

Accumulate references instead of writing out each reference as it is encountered. Accumulated references will be written out whenever a reference of the form

```
. [
  $LIST$
```

**.]**

is encountered, after all input files have been processed, and whenever a **.R1** line is recognized.

**annotate\*** *field string*

*field* is an annotation; print it at the end of the reference as a paragraph preceded by the line

*.string*

If *string* is omitted, it will default to **AP**; if *field* is also omitted it will default to **X**. Only one field can be an annotation.

**articles** *string ...*

Each *string* is a definite or indefinite article, and should be ignored at the beginning of **T** fields when sorting. Initially, “a”, “an”, and “the” are recognized as articles.

**bibliography** *file ...*

Write out all the references contained in each bibliographic database *file*. This command should come last in an **.R1/.R2** block.

**bracket-label** *string1 string2 string3*

In the text, bracket each label with *string1* and *string2*. An occurrence of *string2* immediately followed by *string1* will be turned into *string3*. The default behavior is as follows.

```
bracket-label \* ([. \*(. ] ", "
```

**capitalize** *fields*

Convert *fields* to caps and small caps.

**compatible\***

Recognize **.R1** and **.R2** even when followed by a character other than space or newline.

**database** *file ...*

Search each bibliographic database *file*. For each *file*, if an index file *i* created by *indxbib(1)* exists, then it will be searched instead; each index can cover multiple databases.

**date-as-label\*** *string*

*string* is a label expression that specifies a string with which to replace the **D** field after constructing the label. See subsection “Label expressions” below for a description of label expressions. This command is useful if you do not want explicit labels in the reference list, but instead want to handle any necessary disambiguation by qualifying the date in some way. The label used in the text would typically be some combination of the author and date. In most cases you should also use the **no-label-in-reference** command. For example,

```
date-as-label D.+yD.y%a*D.-y
```

would attach a disambiguating letter to the year part of the **D** field in the reference.

**default-database\***

The default database should be searched. This is the default behavior, so the negative version of this command is more useful. *refer* determines whether the default database should be searched on the first occasion that it needs to do a search. Thus a **no-default-database** command must be given before then, in order to be effective.

**discard\*** *fields*

When the reference is read, *fields* should be discarded; no string definitions for *fields* will be output. Initially, *fields* are **XYZ**.

**et-al\*** *string m n*

Control use of **et al.** in the evaluation of **@** expressions in label expressions. If the number of authors needed to make the author sequence unambiguous is *u* and the total number of authors is *t* then the last *t - u* authors will be replaced by *string* provided that *t - u* is not less than *m* and *t* is not less than *n*. The default behavior is as follows.

```
et-al " et al" 2 3
```

Note the absence of a dot from the end of the abbreviation, which is arguably not correct. (*Et al[.]* is short for *et alli*, as *etc.* is short for *et cetera.*)

**include** *file*

Include *file* and interpret the contents as commands.

**join-authors** *string1 string2 string3*

Join multiple authors together with *strings*. When there are exactly two authors, they will be joined with *string1*. When there are more than two authors, all but the last two will be joined with *string2*, and the last two authors will be joined with *string3*. If *string3* is omitted, it will default to *string1*; if *string2* is also omitted it will also default to *string1*. For example,

```
join-authors " and " ", " ", and "
```

will restore the default method for joining authors.

**label-in-reference\***

When outputting the reference, define the string [F to be the reference's label. This is the default behavior, so the negative version of this command is more useful.

**label-in-text\***

For each reference output a label in the text. The label will be separated from the surrounding text as described in the **bracket-label** command. This is the default behavior, so the negative version of this command is more useful.

**label** *string*

*string* is a label expression describing how to label each reference.

**separate-label-second-parts** *string*

When merging two-part labels, separate the second part of the second label from the first label with *string*. See the description of the <> label expression.

**move-punctuation\***

In the text, move any punctuation at the end of line past the label. It is usually a good idea to give this command unless you are using superscripted numbers as labels.

**reverse\*** *string*

Reverse the fields whose names are in *string*. Each field name can be followed by a number which says how many such fields should be reversed. If no number is given for a field, all such fields will be reversed.

**search-ignore\*** *fields*

While searching for keys in databases for which no index exists, ignore the contents of *fields*. Initially, fields **XYZ** are ignored.

**search-truncate\*** *n*

Only require the first *n* characters of keys to be given. In effect when searching for a given key words in the database are truncated to the maximum of *n* and the length of the key. Initially, *n* is 6.

**short-label\*** *string*

*string* is a label expression that specifies an alternative (usually shorter) style of label. This is used when the # flag is given in the citation. When using author-date style labels, the identity of the author or authors is sometimes clear from the context, and so it may be desirable to omit the author or authors from the label. The **short-label** command will typically be used to specify a label containing just a date and possibly a disambiguating letter.

**sort\*** *string*

Sort references according to *string*. References will automatically be accumulated. *string* should be a list of field names, each followed by a number, indicating how many fields with the name should be used for sorting. "+" can be used to indicate that all the fields with the name should be used. Also . can be used to indicate the references should be sorted using the (tentative) label. (Subsection "Label expressions" below describes the concept of a tentative label.)

**sort-adjacent-labels\***

Sort labels that are adjacent in the text according to their position in the reference list. This command should usually be given if the **abbreviate-label-ranges** command has been given, or if the

label expression contains a <> expression. This will have no effect unless references are being accumulated.

### Label expressions

Label expressions can be evaluated both normally and tentatively. The result of normal evaluation is used for output. The result of tentative evaluation, called the *tentative label*, is used to gather the information that normal evaluation needs to disambiguate the label. Label expressions specified by the **date-as-label** and **short-label** commands are not evaluated tentatively. Normal and tentative evaluation are the same for all types of expression other than @, \*, and % expressions. The description below applies to normal evaluation, except where otherwise specified.

*field*

*field n* The *n*-th part of *field*. If *n* is omitted, it defaults to 1.

'*string*' The characters in *string* literally.

@ All the authors joined as specified by the **join-authors** command. The whole of each author's name will be used. However, if the references are sorted by author (that is, the sort specification starts with "A+"), then authors' last names will be used instead, provided that this does not introduce ambiguity, and also an initial subsequence of the authors may be used instead of all the authors, again provided that this does not introduce ambiguity. The use of only the last name for the *i*-th author of some reference is considered to be ambiguous if there is some other reference, such that the first *i* - 1 authors of the references are the same, the *i*-th authors are not the same, but the *i*-th authors last names are the same. A proper initial subsequence of the sequence of authors for some reference is considered to be ambiguous if there is a reference with some other sequence of authors which also has that subsequence as a proper initial subsequence. When an initial subsequence of authors is used, the remaining authors are replaced by the string specified by the **et-al** command; this command may also specify additional requirements that must be met before an initial subsequence can be used. @ tentatively evaluates to a canonical representation of the authors, such that authors that compare equally for sorting purpose will have the same representation.

%*n*

%**a**

%**A**

%**i**

%**I**

The serial number of the reference formatted according to the character following the %. The serial number of a reference is 1 plus the number of earlier references with same tentative label as this reference. These expressions tentatively evaluate to an empty string.

*expr*\* If there is another reference with the same tentative label as this reference, then *expr*, otherwise an empty string. It tentatively evaluates to an empty string.

*expr*+*n*

*expr*-*n* The first (+) or last (-) *n* upper or lower case letters or digits of *expr*. *roff* special characters (such as \('a) count as a single letter. Accent strings are retained but do not count towards the total.

*expr*.**l** *expr* converted to lowercase.

*expr*.**u** *expr* converted to uppercase.

*expr*.**c** *expr* converted to caps and small caps.

*expr*.**r** *expr* reversed so that the last name is first.

*expr*.**a** *expr* with first names abbreviated. Fields specified in the **abbreviate** command are abbreviated before any labels are evaluated. Thus **.a** is useful only when you want a field to be abbreviated in a label but not in a reference.

*expr*.**y** The year part of *expr*.

*expr*.+**y**

The part of *expr* before the year, or the whole of *expr* if it does not contain a year.

- expr.-y* The part of *expr* after the year, or an empty string if *expr* does not contain a year.
- expr.n* The last name part of *expr*.
- expr1~expr2*  
*expr1* except that if the last character of *expr1* is `-` then it will be replaced by *expr2*.
- expr1 expr2*  
The concatenation of *expr1* and *expr2*.
- expr1|expr2*  
If *expr1* is non-empty then *expr1* otherwise *expr2*.
- expr1&expr2*  
If *expr1* is non-empty then *expr2* otherwise an empty string.
- expr1?expr2:expr3*  
If *expr1* is non-empty then *expr2* otherwise *expr3*.
- <*expr*> The label is in two parts, which are separated by *expr*. Two adjacent two-part labels which have the same first part will be merged by appending the second part of the second label onto the first label separated by the string specified in the **separate-label-second-parts** command (initially, a comma followed by a space); the resulting label will also be a two-part label with the same first part as before merging, and so additional labels can be merged into it. It is permissible for the first part to be empty; this may be desirable for expressions used in the **short-label** command.
- (*expr*) The same as *expr*. Used for grouping.

The above expressions are listed in order of precedence (highest first); **&** and **|** have the same precedence.

### Macro interface

Each reference starts with a call to the macro `]-`. The string **[F** will be defined to be the label for this reference, unless the **no-label-in-reference** command has been given. There then follows a series of string definitions, one for each field: string `[X` corresponds to field `X`. The register **[P** is set to 1 if the **P** field contains a range of pages. The **[T**, **[A** and **[O** registers are set to 1 according as the **T**, **A** and **O** fields end with any of `.?!` (an end-of-sentence character). The **[E** register will be set to 1 if the **[E** string contains more than one name. The reference is followed by a call to the `][` macro. The first argument to this macro gives a number representing the type of the reference. If a reference contains a **J** field, it will be classified as type 1, otherwise if it contains a **B** field, it will be type 3, otherwise if it contains a **G** or **R** field it will be type 4, otherwise if it contains an **I** field it will be type 2, otherwise it will be type 0. The second argument is a symbolic name for the type: **other**, **journal-article**, **book**, **article-in-book**, or **tech-report**. Groups of references that have been accumulated or are produced by the **bibliography** command are preceded by a call to the `]<` macro and followed by a call to the `]>` macro.

### Environment

*REFER*  
If set, overrides the default database.

### Files

*/usr/dict/papers/Ind*  
Default database.

*file.i* Index files.

*/usr/local/share/groff/1.23.0/tmac/refer.tmac*  
defines macros and strings facilitating integration with macro packages that wish to support *refer*.

*refer* uses temporary files. See the *groff(1)* man page for details of where such files are created.

### Bugs

In label expressions, `<>` expressions are ignored inside `.char` expressions.

## Examples

We can illustrate the operation of *refer* with a sample bibliographic database containing one entry and a simple *roff* document to cite that entry.

```
$ cat > my-db-file
%A Daniel P.\& Friedman
%A Matthias Felleisen
%C Cambridge, Massachusetts
%D 1996
%I The MIT Press
%T The Little Schemer, Fourth Edition
$ refer -p my-db-file
Read the book
.[
friedman
.]
on your summer vacation.
<Control+D>
.lf 1 -
Read the book\[.*([.1\]*(.]
.ds [F 1
.]-
.ds [A Daniel P. Friedman and Matthias Felleisen
.ds [C Cambridge, Massachusetts
.ds [D 1996
.ds [I The MIT Press
.ds [T The Little Schemer, Fourth Edition
.nr [T 0
.nr [A 0
.][ 2 book
.lf 5 -
on your summer vacation.
```

The foregoing shows us that *refer* (a) produces a label “1”; (b) brackets that label with interpolations of the “[.” and “.]” strings; (c) calls a macro “[–”]; (d) defines strings and registers containing the label and bibliographic data for the reference; (e) calls a macro “[]”]; and (f) uses the **If** request to restore the line numbers of the original input. As discussed in subsection “Macro interface” above, it is up to the document or a macro package to employ and format this information usefully. Let us see how we might turn *groff\_ms(7)* to this task.

```
$ REFER=my-db-file groff -R -ms
.LP
Read the book
.[
friedman
.]
on your summer vacation.
Commentary is available.\{*\}
.FS \{*\}
Space reserved for penetrating insight.
.FE
```

*ms*’s automatic footnote numbering mechanism is not aware of *refer*’s label numbering, so we have manually specified a (superscripted) symbolic footnote for our non-bibliographic aside.

**See also**

“Some Applications of Inverted Indexes on the Unix System”, by M. E. Lesk, 1978, AT&T Bell Laboratories Computing Science Technical Report No. 69.

[indxbib\(1\)](#), [lookbib\(1\)](#), [lkbib\(1\)](#)

**Name**

soelim – recursively interpolate source requests in roff files

**Synopsis**

soelim [-Crt] [-I *dir*] [*input-file* ...]

soelim --help

soelim -v

soelim --version

**Description**

GNU *soelim* is a preprocessor for the *groff*(7) document formatting system. *soelim* works as a filter to eliminate source requests in *roff*(7) input files; that is, it replaces lines of the form “.so *included-file*” within each text *input-file* with the contents of *included-file*, recursively. By default, it writes **.If** requests as well to record the name and line number of each *input-file* and *included-file*, so that any diagnostics produced by later processing can be accurately traced to the original input. Options allow this information to be suppressed (**-r**) or supplied in T<sub>E</sub>X comments instead (**-t**). In the absence of *input-file* arguments, *soelim* reads the standard input stream. Output is written to the standard output stream.

To embed a backslash “\” in the name of a *macro-file*, write “\” or “\e”. To embed a space, write “\ ” (backslash followed by a space). Any other escape sequence in *macro-file*, including “[rs]”, prevents *soelim* from replacing the source request.

The dot must be at the beginning of a line and must be followed by “so” without intervening spaces or tabs for *soelim* to handle it. This convention allows source requests to be “protected” from processing by *soelim*, for instance as part of macro definitions or **.if** requests.

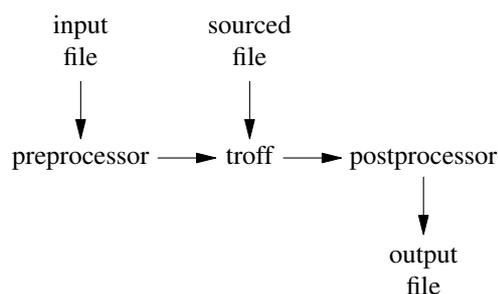
There must also be at least one space between “so” and its *macro-file* argument. The **-C** option overrides this requirement.

The foregoing is the limit of *soelim*’s understanding of *roff* languages; it does not, for example, replace the input line

```
.if 1 .so otherfile
```

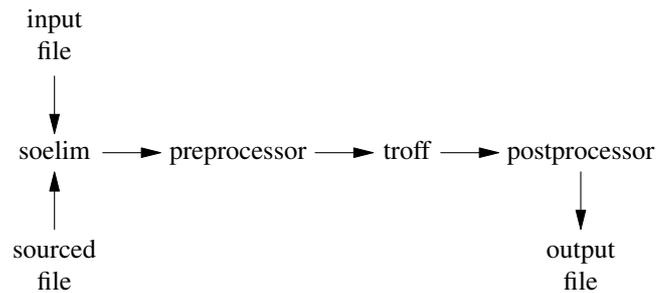
with the contents of *otherfile*. With its **-r** option, therefore, *soelim* can be used to process text files in general, to flatten a tree of input documents.

*soelim* was designed to handle situations where the target of a *roff* source request requires a preprocessor such as *eqn*(1), *pic*(1), *refer*(1), or *tbl*(1). The usual processing sequence of *groff*(1) is as follows. In the diagrams below, the traditional names for *soelim* and *troff* are used; on this system, the GNU versions are installed as *soelim* and *troff*.



That is, files sourced with **.so** are normally read *only* by *troff* (the actual formatter). *soelim* is *not* required for *troff* to source files.

If a file to be sourced should also be preprocessed, it must already be read *before* the input file passes through the preprocessor. *soelim*, normally invoked via *groff*’s **-s** option, handles this.



## Options

- help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.
- C** Recognize **.so** even when followed by a character other than space or newline.
- I dir** Search the directory *dir* path for *input-* and *included-files*. **-I** may be specified more than once; each *dir* is searched in the given order. To search the current working directory before others, add **"-I."** at the desired place; it is otherwise searched last.
- r** Write files "raw"; do not add **.If** requests.
- t** Emit  $\TeX$  comment lines starting with **"%"** indicating the current file and line number, rather than **.If** requests for the same purpose.

If both **-r** and **-t** are given, the last one specified controls.

## See also

[groff\(1\)](#)

**Name**

tbl – prepare tables for groff documents

**Synopsis**tbl [-C] [*file* ...]

tbl --help

tbl -v

tbl --version

**Description**

The GNU implementation of *tbl* is part of the *groff(1)* document formatting system. *tbl* is a *troff(1)* pre-processor that translates descriptions of tables embedded in its input into the language, *groff(7)*, understood by *troff*. It copies the contents of each *file* to the standard output stream, except that lines between **.TS** and **.TE** are interpreted as table descriptions. While GNU *tbl*'s input syntax is highly compatible with AT&T *tbl*, the output GNU *tbl* produces cannot be processed by AT&T *troff*; GNU *troff* (or a *troff* implementing any GNU extensions employed) must be used. Normally, *tbl* is not executed directly by the user, but invoked by specifying the **-t** option to *groff(1)*. If no *file* operands are given on the command line, or if *file* is “-”, the standard input stream is read.

**Overview**

*tbl* expects to find table descriptions between input lines that begin with **.TS** (table start) and **.TE** (table end). Within each such *table region*, another description can be preceded with an input line beginning with **.T&**.

(Experienced *roff* users should observe that *tbl* is not a *roff* language interpreter: the default control character must be used, and no spaces or tabs are permitted between the control character and the macro name. These *tbl* input tokens remain as-is in the output, where they become ordinary macro calls. Macro packages often define **TS**, **T&**, and **TE** macros to handle issues of table placement on the page. *tbl* produces *groff* code to define these macros as empty if their definitions do not exist when the formatter encounters a table region.)

Each table region may begin with *region options*, and must contain one or more *table definitions*; each table definition contains a *format specification* followed by one or more input lines (rows) of *entries*. These entries comprise the *table data*.

**Region options**

The line immediately following the **.TS** token may specify region options: keywords that influence the interpretation or rendering of the region as a whole or all table entries within it indiscriminately. They can be specified in any lettercase and must be separated by commas, spaces, or tabs. (AT&T *tbl* accepted only options with all characters in the same lettercase.) Some of these options require a parenthesized argument; those that do permit spaces and tabs between the option's name and the opening parenthesis. Options accumulate and cannot be unset within a region once declared; if an option that takes a parameter is repeated, the last occurrence controls. If present, the set of region options must be terminated with a semicolon (;).

Any of the **allbox**, **box**, **doublebox**, **frame**, and **doubleframe** region options makes a table “boxed” for the purpose of later discussion.

**allbox** Enclose each table entry in a box; implies **box**.

**box** Enclose the entire table region in a box. As a GNU extension, the alternative option name **frame** is also recognized.

**center** Center the table region with respect to the current indentation and line length; the default is to left-align it. As a GNU extension, the alternative option name **centre** is also recognized.

**decimalpoint(c)**

Recognize character *c* as the decimal separator in columns using the **N** (numeric) classifier (see subsection “Column classifiers” below). This is a GNU extension.

**delim**(*xy*)

Recognize characters *x* and *y* as start and end delimiters, respectively, for *eqn(1)* input, and ignore input between them. *x* and *y* need not be distinct.

**doublebox**

Enclose the entire table region in a double box; implies **box**. As a GNU extension, the alternative option name **doubleframe** is also recognized.

**expand**

Spread the table horizontally to fill the space between the current indentation and the current line length by increasing column separation. Ordinarily, a table is made only as wide as necessary to accommodate the widths of its entries and its column separations (whether specified or default). When **expand** applies to a table that exceeds the available horizontal space, column separation is reduced as far as necessary—even to zero. *tbl* produces *groff* input that issues a diagnostic if this occurs. The column modifier **x** (see below) overrides this option.

**linesize**(*n*)

Draw lines or rules (e.g., from **box**) with a thickness of *n* points. The default is the current type size when the region begins. This option is ignored on terminal devices.

**nokeep** Don't use diversions to prevent page breaks. Normally, *tbl* attempts to prevent undesirable breaks in tables by using diversions. This can sometimes interact badly with macro packages' own use of diversions—when footnotes, for example, are employed. This is a GNU extension.

**nospaces**

Ignore leading and trailing spaces in table entries. This is a GNU extension.

**nowarn**

Suppress diagnostic messages produced at document formatting time when the line or page lengths are inadequate to contain a table row. This is a GNU extension.

**tab**(*c*) Use the character *c* instead of a tab to separate entries in a row of table data.

**Table format specification**

The table format specification is mandatory: it determines the number of columns in the table and directs how the entries within it are to be typeset. The format specification is a series of column *descriptors*. Spaces, tabs, newlines, and commas are valid descriptor separators. Newlines and commas are special; they apply the descriptors following them to a subsequent row of the table. (This enables column headings to be centered or boldfaced while the table entries for the data are not, for instance.) We term the resulting group of column descriptors a *row definition*. Within a row definition, separation between column descriptors (by spaces or tabs) is often optional; only some modifiers, described below, make separation necessary. Column classifiers are letters or punctuation symbols, whereas modifiers consist of or begin with letters or numerals. Letters are recognized case-insensitively.

Each column descriptor begins with a mandatory *classifier*, a character that selects from one of several arrangements. Some determine the positioning of table entries within a rectangular cell: centered, left-aligned, numeric (aligned to a configurable decimal separator), and so on. Others perform special operations like drawing lines or spanning entries from adjacent cells in the table. Except for “|”, any classifier can be followed by one or more *modifiers*; some of these accept an argument, which in GNU *tbl* can be parenthesized. Modifiers select fonts, set the type size, and perform other tasks described below.

The format specification can occupy multiple input lines, but must conclude with a dot “.” at the end of its final column descriptor. Each row definition is applied in turn to one row of the table. The last row definition is applied to rows of table data in excess of the row definitions.

For clarity in this document's examples, we shall write classifiers in uppercase and modifiers in lowercase. Thus, “**CbCb,LR.**” defines two rows of two columns. The first row's entries are centered and boldfaced; the second and any further rows' first and second columns are left- and right-aligned, respectively.

The row definition with the most column descriptors determines the number of columns in the table; any row definition with fewer is implicitly extended on the right-hand side with **L** classifiers as many times as necessary to make the table rectangular.

### Column classifiers

The **L**, **R**, and **C** classifiers are the easiest to understand and use.

**A, a** Center longest entry in this column, left-align remaining entries in the column with respect to the centered entry, then indent all entries by one en. Such “alphabetic” entries (hence the name of the classifier) can be used in the same column as **L**-classified entries, as in “**LL,AR.**”. The **A** entries are often termed “sub-columns” due to their indentation.

**C, c** Center entry within the column.

**L, l** Left-align entry within the column.

**N, n** Numerically align entry in the column; that is, align columns of numbers vertically at the units place. If multiple decimal separators are adjacent to a digit, use the rightmost one for vertical alignment. If there is no decimal separator, use the rightmost digit for vertical alignment; otherwise, center the entry within the column. The non-printing input token **&** in an entry treats the glyph preceding it (if any) as the units place; if multiple instances occur in the data, use the leftmost one for alignment.

If **N**-classified entries share a column with **L** or **R** entries, center the widest **N** entry with respect to the widest **L** or **R** entry, preserving the alignment of all **N** entries with respect to each other.

The appearance of *eqn* equations within **N**-classified columns can be troublesome due to the foregoing textual scan for a decimal separator. Use the **delim** region option to make *tbl* ignore the data within *eqn* delimiters for that purpose.

**R, r** Right-align entry within the column.

**S, s** Span previous entry on the left into this column.

**^** Span entry in the same column from the previous row into this row.

**\_**, **-** Replace table entry with a horizontal rule. An empty table entry is expected to correspond to this classifier; if data are found there, *tbl* issues a diagnostic message.

**=** Replace table entry with a double horizontal rule. An empty table entry is expected to correspond to this classifier; if data are found there, *tbl* issues a diagnostic message.

**|** Place a vertical rule on the corresponding row of the table (if two of these are adjacent, a double vertical rule). This classifier does not contribute to the column count and no table entries correspond to it. A **|** to the left of the first column descriptor or to the right of the last one produces a line at the edge of the table.

To change the table format within a *tbl* region, use the **.T&** token at the start of a line. It is followed by a format specification and table data, but *not* region options. The quantity of columns in a new table format thus introduced cannot increase relative to the previous table format; in that case, you must end the table region and start another. If that will not serve because the region uses box options or the columns align in an undesirable manner, you must design the initial table format specification to include the maximum quantity of columns required, and use the **S** horizontal spanning classifier where necessary to achieve the desired columnar alignment.

Attempting to horizontally span in the first column or vertically span on the first row is an error. Non-rectangular span areas are also not supported.

### Column modifiers

Any number of modifiers can follow a column classifier. Arguments to modifiers, where accepted, are case-sensitive. If the same modifier is applied to a column specifier more than once, or if conflicting modifiers are applied, only the last occurrence has effect. The modifier **x** is mutually exclusive with **e** and **w**, but **e** is not mutually exclusive with **w**; if these are used in combination, **x** unsets both **e** and **w**, while either **e** or **w** overrides **x**.

- b, B** Typeset entry in bold; abbreviates **f(B)**.
- d, D** Align a vertically spanned table entry to the bottom (“down”), instead of the center, of its range. This is a GNU extension.
- e, E** Equalize the widths of columns with this modifier. The column with the largest width controls. This modifier sets the default line length used in a text block.
- f, F** Select the typeface for the table entry. This modifier must be followed by a font or style name (one or two characters not starting with a digit), font mounting position (a single digit), or a name or mounting position of any length in parentheses. The last form is a GNU extension. (The parameter corresponds to that accepted by the *troff* **ft** request.) A one-character argument not in parentheses must be separated by one or more spaces or tabs from what follows.
- i, I** Typeset entry in italics; abbreviates **f(I)**.
- m, M** Call a *groff* macro before typesetting a text block (see subsection “Text blocks” below). This is a GNU extension. This modifier must be followed by a macro name of one or two characters or a name of any length in parentheses. A one-character macro name not in parentheses must be separated by one or more spaces or tabs from what follows. The named macro must be defined before the table region containing this column modifier is encountered. The macro should contain only simple *groff* requests to change text formatting, like adjustment or hyphenation. The macro is called *after* the column modifiers **b**, **f**, **i**, **p**, and **v** take effect; it can thus override other column modifiers.
- p, P** Set the type size for the table entry. This modifier must be followed by an integer *n* with an optional leading sign. (The parameter corresponds to that accepted by the *troff* **ps** request.) If unsigned, the type size is set to *n* scaled points. Otherwise, the type size is incremented or decremented per the sign by *n* scaled points. The use of a signed multi-digit number is a GNU extension. If a type size modifier is followed by a column separation modifier (see below), they must be separated by at least one space or tab.
- t, T** Align a vertically spanned table entry to the top, instead of the center, of its range.
- u, U** Move the column up one half-line, “staggering” the rows. This is a GNU extension.
- v, V** Set the vertical spacing to be used in a text block. (This parameter corresponds to that accepted by the *troff* **vs** request.) This modifier must be followed by an integer *n* with an optional leading sign. If unsigned, the vertical spacing is set to *n* scaled points. Otherwise, the vertical spacing is incremented or decremented per the sign by *n* scaled points. The use of a signed multi-digit number is a GNU extension. If a vertical spacing modifier is followed by a column separation modifier (see below), they must be separated by at least one space or tab.
- w, W** Set the column’s minimum width. This modifier must be followed by a number, which is either a unitless integer, or a *roff* horizontal measurement in parentheses. Parentheses are required if the width is to be followed immediately by an explicit column separation (alternatively, follow the width with one or more spaces or tabs). If no unit is specified, ens are assumed. This modifier sets the default line length used in a text block.
- x, X** Expand the column. After computing the column widths, distribute any remaining line length evenly over all columns bearing this modifier. Applying the **x** modifier to more than one column is a GNU extension. This modifier sets the default line length used in a text block.
- z, Z** Ignore the table entries corresponding to this column for width calculation purposes; that is, compute the column’s width using only the information in its descriptor.
- n* A numeric suffix on a column descriptor sets the separation distance (in ens) from the succeeding column; the default separation is **3n**. This separation is proportionally multiplied if the **expand** region option is in effect; in the case of tables wider than the output line length, this separation might be zero. A negative separation cannot be specified. A separation amount after the last column in a row is nonsensical and provokes a diagnostic from *tbl*.

### Table data

The table data come after the format specification. Each input line corresponds to a table row, except that a backslash at the end of a line of table data continues an entry on the next input line. (Text blocks, discussed below, also spread table entries across multiple input lines.) Table entries within a row are separated in the input by a tab character by default; see the **tab** region option above. Excess entries in a row of table data (those that have no corresponding column descriptor, not even an implicit one arising from rectangularization of the table) are discarded with a diagnostic message. Do not use a *roff* comment escape sequence in a table entry. If you wish to visibly mark an empty table entry in the document source, populate it with the **\&** non-printing input token. The table data are interrupted by a line consisting of the **.T&** input token, and conclude with the line **.TE**.

Ordinarily, a table entry is typeset rigidly. It is not filled, broken, hyphenated, adjusted, or populated with additional inter-sentence space. *tbl* measures each table entry as it occurs in the input, updating the width required by its corresponding column. The **x** modifier makes this width a minimum, and the modifiers **w** or **z** override it entirely. In contrast to conventional *roff* input (within a paragraph, say), changes to text formatting, such as font selection or vertical spacing, do not persist between entries.

Several forms of table entry are interpreted specially.

- If a table row contains only an underscore or equals sign (**\_** or **=**), a single or double horizontal rule (line), respectively, is drawn across the table at that point.
- A table entry containing only **\_** or **=** on an otherwise populated row is replaced by a single or double horizontal rule, respectively, joining its neighbors.
- Prefixing a lone underscore or equals sign with a backslash also has meaning. If a table entry consists only of **\\_** or **\=** on an otherwise populated row, it is replaced by a single or double horizontal rule, respectively, that does *not* (quite) join its neighbors.
- A table entry consisting of **\R***x*, where *x* is any *roff* ordinary or special character, is replaced by enough repetitions of the glyph corresponding to *x* to fill the column, albeit without joining its neighbors.
- On any row but the first, a table entry of **\^** causes the entry above it to span down into the current one.

On occasion, these special tokens may be required as literal table data. To use either **\_** or **=** literally and alone in an entry, prefix or suffix it with the token **\&**. To express **\\_**, **\=**, or **\R**, use a *roff* escape sequence to interpolate the backslash (**\e** or **\[rs]**). A reliable way to emplace the **\^** glyph sequence within a table entry is to use a pair of *groff* special character escape sequences (**\[rs][ha]**).

Rows of table entries can be interleaved with *groff* control lines; these do not count as table data. On such lines the default control character (**.**) must be used (and not changed); the no-break control character is not recognized. To start the first table entry in a row with a dot, precede it with the token **\&**.

### Text blocks

An ordinary table entry's contents can make a column, and therefore the table, excessively wide; the table then exceeds the line length of the page, and becomes ugly or is exposed to truncation by the output device. When a table entry requires more conventional typesetting, breaking across more than one output line (and thereby increasing the height of its row), it can be placed within a *text block*.

*tbl* interprets a table entry beginning with **"T{"** at the end of an input line not as table data, but as a token starting a text block. Similarly, **"T}"** at the start of an input line ends a text block; it must also end the table entry. Text block tokens can share an input line with other table data (preceding **T{** and following **T}**). Input lines between these tokens are formatted in a diversion by *troff*. Text blocks cannot be nested. Multiple text blocks can occur in a table row.

Like other table entries, text blocks are formatted as was the text prior to the table, modified by applicable column descriptors. Specifically, the classifiers **A**, **C**, **L**, **N**, **R**, and **S** determine a text block's *alignment* within its cell, but not its *adjustment*. You can add **na** or **ad** requests to the beginning of a text block to alter its adjustment distinctly from other text in the document. As with other table entries, when a text block ends, any alterations to its formatting are discarded. They do not affect subsequent table entries, not even other text blocks.

If **w** or **x** modifiers are not specified for *all* columns of a text block's span, the default length of the text block (more precisely, the line length used to process the text block diversion) is computed as  $L \times C / (N + 1)$ , where  $L$  is the current line length,  $C$  the number of columns spanned by the text block, and  $N$  the number of columns in the table. If necessary, you can also control a text block's width by including an **ll** (line length) request in it prior to any text to be formatted. Because a diversion is used to format the text block, its width is subsequently available in the register **dl**.

### Miscellaneous

The register **TW** stores the width of the table region in basic units; it can't be used within the region itself, but is defined before the **.TE** token is output so that a *groff* macro named **TE** can make use of it. **T** is a Boolean-valued register indicating whether the bottom of the table is being processed. The **#T** register marks the top of the table. Avoid using these names for any other purpose.

*tbl* also defines a macro **T#** to produce the bottom and side lines of a boxed table. While *tbl* itself arranges for the output to include a call of this macro at the end of such a table, it can also be used by macro packages to create boxes for multi-page tables by calling it from a page footer macro that is itself called by a trap planted near the bottom of the page. See section "Limitations" below for more on multi-page tables.

Using *tbl* macros within conditional input (that is, contingent upon an **if**, **ie**, **el**, or **while** request) can result in misleading line numbers in subsequent diagnostics. *tbl* unconditionally injects its output into the source document, but the conditional branch containing it may not be taken, and if it is not, the **If** requests that *tbl* injects to restore the source line number cannot take effect. Consider copying the input line counter register **.c** and restoring its value at a convenient location after applicable arithmetic.

### Interaction with *eqn*

*tbl* should always be called before *eqn(1)*. (*groff(1)* automatically arranges preprocessors in the correct order.) Don't call the **EQ** and **EN** macros within tables; instead, set up delimiters in your *eqn* input and use the **delim** region option so that *tbl* will recognize them.

### GNU *tbl* enhancements

In addition to extensions noted above, GNU *tbl* removes constraints endured by users of AT&T *tbl*.

- There is no limit on the number of columns in a table, regardless of their classification, nor any limit on the number of text blocks.
- All table rows are considered when deciding column widths, not just those occurring in the first 200 input lines of a region. Similarly, table continuation (**.T&**) tokens are recognized outside a region's first 200 input lines.
- Numeric and alphabetic entries may appear in the same column.
- Numeric and alphabetic entries may span horizontally.
- GNU *tbl* internally employs register, string, macro, and diversions having names beginning with the digit **3**. A document to be preprocessed with GNU *tbl* should not use any such identifiers.

### Using GNU *tbl* within macros

You can embed a table region inside a macro definition. However, since *tbl* writes its own macro definitions at the beginning of each table region, it is necessary to call end macros instead of ending macro definitions with **..**. Additionally, the escape character must be disabled.

Not all *tbl* features can be exercised from such macros because *tbl* is a *roff* preprocessor: it sees the input earlier than *troff* does. For example, vertically aligning decimal separators fails if the numbers containing them occur as macro or string parameters; the alignment is performed by *tbl* itself, which sees only **\\$1**, **\\$2**, and so on, and therefore can't recognize a decimal separator that only appears later when *troff* interpolates a macro or string definition.

### Options

- help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.
- C** Enable AT&T compatibility mode: recognize **.TS** and **.TE** even when followed by a character other than space or newline. Furthermore, interpret the uninterpreted leader escape sequence **\a**.

## Limitations

Multi-page tables, if boxed and/or if you want their column headings repeated after page breaks, require support at the time the document is formatted. A convention for such support has arisen in macro packages such as *ms*, *mm*, and *me*. To use it, follow the **.TS** token with a space and then “**H**”; this will be interpreted by the formatter as a **TS** macro call with an **H** argument. Then, within the table data, call the **TH** macro; this informs the macro package where the headings end. If your table has no such heading rows, or you do not desire their repetition, call **TH** immediately after the table format specification. If a multi-page table is boxed or has repeating column headings, do not enclose it with keep/release macros, or divert it in any other way. Further, the **bp** request cannot be used to force a page break in a multi-page table. Define a macro to wrap **bp**: invoke it normally if there is no current diversion. Otherwise, pass the macro call to the enclosing diversion using the transparent line escape sequence **\!**; this will “bubble up” the page break to the output device. See section “Examples” below for a demonstration.

Double horizontal rules are not currently supported by *grotty(1)*; single rules are used instead. *grotty* also ignores half-line motions, so the **u** column modifier has no effect.

A text block within a table must be able to fit on one page.

Using **\a** to put leaders in table entries does not work in GNU *tbl*, except in compatibility mode. This is correct behavior: **\a** is an *uninterpreted* leader. You can still use the *roff* leader character (Control+A) or define a string to use **\a** as it was designed: to be interpreted only in copy mode.

```
.ds a \a
.TS
box center tab( );
Lw(2i)0 L.
Population\a;6,327,119
.TE
```

Population.....6,327,119
--------------------------

A leading and/or trailing **|** in a format specification, such as “[**LCR|**.”, produces an en space between the vertical rules and the content of the adjacent columns. If no such space is desired (so that the rule abuts the content), you can introduce “dummy” columns with zero separation and empty corresponding table entries before and/or after.

```
.TS
center tab( # );
R0|L C R0|L.
—
#levulose#glucose#dextrose#
—
.TE
```

These dummy columns have zero width and are therefore invisible; unfortunately they usually don’t work as intended on terminal devices.

levulose	glucose	dextrose
----------	---------	----------

## Examples

It can be easier to acquire the language of *tbl* through examples than formal description, especially at first.

```
.TS
box center tab( # );
Cb Cb
L L.
Ability#Application
Strength#crushes a tomato
Dexterity#dodges a thrown tomato
Constitution#eats a month-old tomato without becoming ill
Intelligence#knows that a tomato is a fruit
```

```
Wisdom#chooses \f[I]not\f[] to put tomato in a fruit salad
Charisma#sells obligate carnivores tomato-based fruit salads
.TE
```

Ability	Application
Strength	crushes a tomato
Dexterity	dodges a thrown tomato
Constitution	eats a month-old tomato without becoming ill
Intelligence	knows that a tomato is a fruit
Wisdom	chooses <i>not</i> to put tomato in a fruit salad
Charisma	sells obligate carnivores tomato-based fruit salads

The **A** and **N** column classifiers can be easier to grasp in visual rendering than in description.

```
.TS
center tab(,);
CbS, LN, AN.
Daily energy intake (in MJ)
Macronutrients
Carbohydrates; 4.5
Fats; 2.25
Protein; 3
.T&
LN, AN.
Mineral
Pu-239; 14.6
—
.T&
LN.
Total; \[ti]24.4
.TE
```

Daily energy intake (in MJ)	
Macronutrients	
Carbohydrates	4.5
Fats	2.25
Protein	3
Mineral	
Pu-239	14.6
<hr/>	
Total	~24.4

Next, we'll lightly adapt a compact presentation of spanning, vertical alignment, and zero-width column modifiers from the *mandoc* reference for its *tbl* interpreter. It rewards close study.

```
.TS
box center tab(:);
Lz S | Rt
Ld | Cb | ^
^ | Rz S.
left:r
l:center:
:right
.TE
```

left		center		r
l				right

Row staggering is not visually achievable on terminal devices, but a table using it can remain comprehensible nonetheless.

```
.TS
center tab(|);
Cf(BI) Cf(BI) Cf(B), C C Cu.
n|n\f[B]\[tmu]\f[]n|difference
1|1
2|4|3
3|9|5
4|16|7
5|25|9
6|36|11
.TE
```

<i>n</i>	<i>n</i> × <i>n</i>	difference
1	1	3
2	4	5
3	9	7
4	16	9
5	25	11
6	36	

Some *tbl* features cannot be illustrated in the limited environment of a portable man page.

We can define a macro outside of a *tbl* region that we can call from within it to cause a page break inside a multi-page boxed table. You can choose a different name; be sure to change both occurrences of “BP”.

```
.de BP
. ie '\\n(.z'' .bp \\$1
. el \!.BP \\$1
..
```

### See also

“Tbl—A Program to Format Tables”, by M. E. Lesk, 1976 (revised 16 January 1979), AT&T Bell Laboratories Computing Science Technical Report No. 49.

The spanning example above was taken from *mandoc*’s man page for its *tbl* implementation (<https://man.openbsd.org/tbl.7>).

[groff\(1\)](#), [troff\(1\)](#)

**Name**

tfmtoedit – adapt TeX Font Metrics files for groff –Tdv

**Synopsis**

**tfmtoedit** [-s] [-g *gf-file*] [-k *skew-char*] *tfm-file map-file font-description*

**tfmtoedit** --help

**tfmtoedit** -v

**tfmtoedit** --version

**Description**

*tfmtoedit* creates a font description file for use with the **dvi** output driver of *groff*(1). *tfm-file* is the name of the TeX font metric file for the font. *map-file* is a file giving the *groff* special character identifiers for glyphs in the font; this file should consist of a sequence of lines of the form

```
i c1 . . . cn
```

where *i* is a decimal integer giving the position of the glyph in the font, and *c1* through *cn* are *groff* special character identifiers for the glyph. If a glyph has no *groff* names but exists in *tfm-file*, it is put in the *groff* font description file as an unnamed character. Output is written in *groff\_font*(5) format to *font-description*, a file named for the intended *groff* font name.

The **-s** option should be given if the font is “special”, meaning that *groff* should search it whenever a glyph is not found in the current font. In that case, *font-description* should be listed as an argument to the **fonts** directive in the output device’s *DESC* file; if it is not special, there is no need to do so, since *troff*(1) will automatically mount it when it is first used.

To do a good job of math typesetting, *groff* requires font metric information not present in *tfm-file*. This is because TeX has separate math italic fonts, whereas *groff* uses normal italic fonts for math. The additional information required by *groff* is given by the two arguments to the **math\_fit** macro in the Metafont programs for the Computer Modern fonts. In a text font (a font for which **math\_fit** is false), Metafont normally ignores these two arguments. Metafont can be made to put this information into the GF (“generic font”) files it produces by loading the following definition after **cmbase** when creating *cm.base*.

```
def ignore_math_fit(expr left_adjustment, right_adjustment) =
  special "adjustment";
  numspecial left_adjustment*16/designsize;
  numspecial right_adjustment*16/designsize;
enddef;
```

For the EC font family, load the following definition after **exbase**—it is probably easiest to patch *exbase.mf* locally.

```
def ignore_math_fit(expr left_adjustment, right_adjustment) =
  ori_special "adjustment";
  ori_numspecial left_adjustment*16/designsize;
  ori_numspecial right_adjustment*16/designsize;
enddef;
```

The only difference from the previous example is the “ori\_” prefix to “special” and “numspecial”.

The GF file created using this modified *cm.base* or *exbase.mf* should be specified with the **-g** option, which should *not* be given for a font for which **math\_fit** is true.

**Options**

**--help** displays a usage message, while **-v** and **--version** show version information; all exit afterward.

**-g** *gf-file*

Use the *gf-file* produced by Metafont containing “**special**” and “**numspecial**” commands to obtain additional font metric information.

**-k** *skew-char*

The skew character of this font is at position *skew-char*. *skew-char* should be an integer; it may be given in decimal, with a leading 0 in octal, or with a leading 0x in hexadecimal. Any kerns whose second component is *skew-char* are ignored.

- s      Add the **special** directive to the font description file.

**Files**

*/usr/local/share/groff/1.23.0/font/devdvi/DESC*  
describes the **dvi** output device.

*/usr/local/share/groff/1.23.0/font/devdvi/F*  
describes the font known as *F* on device **dvi**.

**See also**

[groff\(1\)](#), [grodvi\(1\)](#), [groff\\_font\(5\)](#)

**Name**

troff – GNU roff typesetter and document formatter

**Synopsis**

**troff** [**-abcCEiRUz**] [**-d** *cs*] [**-d** *name=string*] [**-f** *fam*] [**-F** *dir*] [**-I** *dir*] [**-m** *name*] [**-M** *dir*] [**-n** *num*] [**-o** *list*] [**-r** *cn*] [**-r** *reg=expr*] [**-T** *dev*] [**-w** *name*] [**-W** *name*] [*file* ...]

**troff** **--help**

**troff** **-v**

**troff** **--version**

**Description**

GNU *troff* transforms *groff*(7) language input into the device-independent output format described in *groff\_out*(5); *troff* is thus the heart of the GNU *roff* document formatting system. It is functionally compatible with the AT&T *troff* typesetter and features numerous extensions. Many people prefer to use the *groff*(1) command, a front end which also runs preprocessors and output drivers in the appropriate order and with appropriate options.

**Options**

**-h** and **--help** display a usage message, while **-v** and **--version** show version information; all exit afterward.

**-a** Generate a plain text approximation of the typeset output. The read-only register **.A** is set to 1. This option produces a sort of abstract preview of the formatted output.

- Page breaks are marked by a phrase in angle brackets; for example, “<beginning of page>”.
- Lines are broken where they would be in the formatted output.
- A horizontal motion of any size is represented as one space. Adjacent horizontal motions are not combined. Inter-sentence space nodes (those arising from the second argument to the **.ss** request) are not represented.
- Vertical motions are not represented.
- Special characters are rendered in angle brackets; for example, the default soft hyphen character appears as “<hy>”.

The above description should not be considered a specification; the details of **-a** output are subject to change.

**-b** Write a backtrace reporting the state of *troff*'s input parser to the standard error stream with each diagnostic message. The line numbers given in the backtrace might not always be correct, because *troff*'s idea of line numbers can be confused by requests that append to strings or macros.

**-c** Start with color output disabled.

**-C** Enable AT&T *troff* compatibility mode; implies **-c**.

**-d** *cs*

**-d** *name=string*

Define *roff* string *c* or *name* as *s* or *string*; *c* must be a one-character name. Due to *getopt\_long*(3) limitations, *c* cannot be, and *name* cannot contain, an equals sign, even though that is a valid character in a *roff* identifier.

**-E** Inhibit *troff* error messages; implies **-Ww**. This option does *not* suppress messages sent to the standard error stream by documents or macro packages using **tm** or related requests.

**-f** *fam* Use *fam* as the default font family.

**-F** *dir* Search in directory *dir* for the selected output device's directory of device and font description files. See the description of *GROFF\_FONT\_PATH* in section “Environment” below for the default search locations and ordering.

- i** Read the standard input stream after all named input files have been processed.
- I *dir*** Search the directory *dir* for files (those named on the command line; in **psbb**, **so**, and **soquiet** requests; and in “\X'ps: import”, “\X'ps: file”, and “\X'pdf: pdfpic” device control escape sequences). **-I** may be specified more than once; each *dir* is searched in the given order. To search the current working directory before others, add “**-I .**” at the desired place; it is otherwise searched last. **-I** works similarly to, and is named for, the “include” option of Unix C compilers.
- m *name***  
Process *name.tmac* before input files. If not found, *tmac.name* is attempted. *name* (in both arrangements) is presumed to be a macro file; see the description of *GROFF\_TMAC\_PATH* in section “Environment” below for the default search locations and ordering.
- M *dir*** Search directory *dir* for macro files. See the description of *GROFF\_TMAC\_PATH* in section “Environment” below for the default search locations and ordering.
- n *num***  
Number the first page *num*.
- o *list*** Output only pages in *list*, which is a comma-separated list of inclusive page ranges; *n* means page *n*, *m-n* means every page between *m* and *n*, *-n* means every page up to *n*, and *n-* means every page from *n* on. *troff* stops processing and exits after formatting the last page enumerated in *list*.
- r *cn***  
**-r *reg=expr***  
Define *roff* register *c* or *reg* as *groff* numeric expression *n* or *expr*; *c* must be a one-character name. Due to *getopt\_long*(3) limitations, *c* cannot be, and *reg* cannot contain, an equals sign, even though that is a valid character in a *roff* identifier.
- R** Don't load *troffrc* and *troffrc-end*.
- T *dev*** Prepare output for device *dev*, rather than the default, **ps**; see *groff*(1).
- U** Operate in *unsafe mode*, enabling the **open**, **opena**, **pi**, **pso**, and **sy** requests, which are disabled by default because they allow an untrusted input document to write to arbitrary file names and run arbitrary commands. This option also adds the current directory to the macro package search path; see the **-m** option above.
- w *name***  
**-W *name***  
Enable (**-w**) or inhibit (**-W**) warnings in category *name*. See section “Warnings” below.
- z** Suppress formatted output.

## Warnings

Warning diagnostics emitted by *troff* are divided into named, numbered categories. The name associated with each warning category is used by the **-w** and **-W** options. Each category is also assigned a power of two; the sum of enabled category codes is used by the **warn** request and the **.warn** register. Warnings of each category are produced under the following circumstances.

Bit	Code	Category	Bit	Code	Category
0	1	<b>char</b>	10	1024	<b>reg</b>
1	2	<b>number</b>	11	2048	<b>tab</b>
2	4	<b>break</b>	12	4096	<b>right-brace</b>
3	8	<b>delim</b>	13	8192	<b>missing</b>
4	16	<b>el</b>	14	16384	<b>input</b>
5	32	<b>scale</b>	15	32768	<b>escape</b>
6	64	<b>range</b>	16	65536	<b>space</b>
7	128	<b>syntax</b>	17	131072	<b>font</b>
8	256	<b>di</b>	18	262144	<b>ig</b>
9	512	<b>mac</b>	19	524288	<b>color</b>
			20	1048576	<b>file</b>

<b>break</b>	4	A filled output line could not be broken such that its length was less than the output line length <code>\n[.I]</code> . This category is enabled by default.
<b>char</b>	1	No mounted font defines the glyph requested for formatting. (“ <b>char</b> ” is a misnomer since it reports missing glyphs—there are no “missing” input characters, only invalid ones.) This category is enabled by default.
<b>color</b>	524288	An undefined color name was selected, an attempt was made to define a color using an unrecognized color space, an invalid component in a color definition was encountered, or an attempt was made to redefine a default color.
<b>delim</b>	8	The closing delimiter in an escape sequence was missing or mismatched.
<b>di</b>	256	A <b>di</b> , <b>da</b> , <b>box</b> , or <b>boxa</b> request was invoked without an argument when there was no current diversion.
<b>el</b>	16	The <b>el</b> request was encountered with no prior corresponding <b>ie</b> request.
<b>escape</b>	32768	An unsupported escape sequence was encountered.
<b>file</b>	1048576	An attempt was made to load a file that does not exist. This category is enabled by default.
<b>font</b>	131072	A non-existent font was selected, or the selection was ignored because a font selection escape sequence was used after the output line continuation escape sequence on an input line. This category is enabled by default.
<b>ig</b>	262144	An invalid escape sequence occurred in input ignored using the <b>ig</b> request. This warning category diagnoses a condition that is an error when it occurs in non-ignored input.
<b>input</b>	16384	An invalid character occurred on the input stream.
<b>mac</b>	512	An undefined string, macro, or diversion was used. When such an object is dereferenced, an empty one of that name is automatically created. So, in most cases, at most one warning is given for each name.  This warning is also emitted upon an attempt to move an unplanted trap macro. In such cases, the unplanted macro is <i>not</i> dereferenced, so it is not created if it does not exist.
<b>missing</b>	8192	A request was invoked with a mandatory argument absent.
<b>number</b>	2	An invalid numeric expression was encountered. This category is enabled by default.
<b>range</b>	64	A numeric expression was out of range for its context.
<b>reg</b>	1024	An undefined register was used. When an undefined register is dereferenced, it is automatically defined with a value of 0. So, in most cases, at most one warning is given for each name.

<b>right-brace</b>	4096	A right brace escape sequence <code>\}</code> was encountered where a number was expected.
<b>scale</b>	32	An inappropriate scaling unit was used in a numeric expression.
<b>space</b>	65536	A space was missing between a request or macro and its argument. This warning is produced when an undefined name longer than two characters is encountered and the first two characters of the name constitute a defined name. No request is invoked, no macro called, and an empty macro is not defined. This category is enabled by default. It never occurs in compatibility mode.
<b>syntax</b>	128	A self-contradictory hyphenation mode was requested; an empty or incomplete numeric expression was encountered; an operand to a numeric operator was missing; an attempt was made to define a recursive, empty, or nonsensical character class; or a <i>groff</i> extension conditional expression operator was used while in compatibility mode.
<b>tab</b>	2048	A tab character was encountered where a number was expected, or appeared in an unquoted macro argument.

Two warning names group other warning categories for convenience.

<b>all</b>	All warning categories except <b>di</b> , <b>mac</b> , and <b>reg</b> . This shorthand is intended to produce all warnings that are useful with macro packages and documents written for AT&T <i>troff</i> and its descendants, which have less fastidious diagnostics than GNU <i>troff</i> .
<b>w</b>	All warning categories. Authors of documents and macro packages targeting <i>groff</i> are encouraged to use this setting.

## Environment

*GROFF\_FONT\_PATH* and *GROFF\_TMAC\_PATH* each accept a search path of directories; that is, a list of directory names separated by the system's path component separator character. On Unix systems, this character is a colon (:); on Windows systems, it is a semicolon (;).

### *GROFF\_FONT\_PATH*

A list of directories in which to seek the selected output device's directory of device and font description files. *troff* will scan directories given as arguments to any specified **-F** options before these, then in a site-specific directory (*/usr/local/share/groff/site-font*), a standard location (*/usr/local/share/groff/1.23.0/font*), and a compatibility directory (*/usr/lib/font*) after them.

### *GROFF\_TMAC\_PATH*

A list of directories in which to search for macro files. *troff* will scan directories given as arguments to any specified **-M** options before these, then the current directory (only if in unsafe mode), the user's home directory, a platform-specific directory (*/usr/local/lib/groff/site-tmac*), a site-specific directory (*/usr/local/share/groff/site-tmac*), and a standard location (*/usr/local/share/groff/1.23.0/tmac*) after them.

### *GROFF\_TYPESETTER*

Set the default output device. If empty or not set, **ps** is used. The **-T** option overrides *GROFF\_TYPESETTER*.

### *SOURCE\_DATE\_EPOCH*

A timestamp (expressed as seconds since the Unix epoch) to use as the output creation timestamp in place of the current time. The time is converted to human-readable form using *ctime(3)* when the formatter starts up and stored in registers usable by documents and macro packages.

**TZ** The timezone to use when converting the current time (or value of *SOURCE\_DATE\_EPOCH*) to human-readable form; see *tzset(3)*.

## Files

*/usr/local/share/groff/1.23.0/tmac/troffrc*

is an initialization macro file loaded before any macro packages specified with **-m** options.

*/usr/local/share/groff/1.23.0/tmac/troffrc-end*  
is an initialization macro file loaded after all macro packages specified with **-m** options.

*/usr/local/share/groff/1.23.0/tmac/name.tmac*  
are macro files distributed with *groff*.

*/usr/local/share/groff/1.23.0/font/devname/DESC*  
describes the output device *name*.

*/usr/local/share/groff/1.23.0/font/devname/F*  
describes the font *F* of device *name*.

*troffrc* and *troffrc-end* are sought neither in the current nor the home directory by default for security reasons, even if the **-U** option is specified. Use the **-M** command-line option or the *GROFF\_TMAC\_PATH* environment variable to add these directories to the search path if necessary.

### Authors

The GNU version of *troff* was originally written by James Clark; he also wrote the original version of this document, which was updated by Werner Lemberg ([w1@gnu.org](mailto:w1@gnu.org)), Bernd Warken ([groff-bernd.warken-72@web.de](mailto:groff-bernd.warken-72@web.de)), and G. Branden Robinson ([g.branden.robinson@gmail.com](mailto:g.branden.robinson@gmail.com)).

### See also

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “*info groff*”.

[groff\(1\)](#) offers an overview of the GNU *roff* system and describes its front end executable.

[groff\(7\)](#) details the *groff* language, including a short but complete reference of all predefined requests, registers, and escape sequences.

[groff\\_char\(7\)](#)  
explains the syntax of *groff* special character escape sequences, and lists all special characters predefined by the language.

[groff\\_diff\(7\)](#)  
enumerates the differences between AT&T device-independent *troff* and *groff*.

[groff\\_font\(5\)](#)  
covers the format of *groff* device and font description files.

[groff\\_out\(5\)](#)  
describes the format of *troff*'s output.

[groff\\_tmac\(5\)](#)  
includes information about macro files that ship with *groff*.

[roff\(7\)](#) supplies background on *roff* systems in general, including pointers to further related documentation.

**Name**

groff\_filenames – filename conventions used in roff systems

**Description**

Since the evolution of *roff* in the 1970s, a whole bunch of filename extensions for *roff* files were used.

The *roff* extensions refer to preprocessors or macro packages. These extensions are fixed in all *Unix*-like operating systems.

Later on, **groff** added some more extensions. This *man page* is about these filename extensions.

**Compression of roff files**

Each *roff* file can be optionally *compressed*. That means that the *total filename* ends with a *compressor name*. So the whole filename has the structure `<name>.<extension>[.<compression>]`.

Best-known are the *compressor extensions* **.Z**, **.gz**, and **.bzip2**. Relatively new is **.xz**.

From now on, we will ignore the *compressions* and only comment the structure `<name>.<extension>`.

**Man pages**

The *Unix manual pages* are widely called *man pages*. The *man page* style is the best-known part of the *roff* language.

The extensions for *man* should be better documented. So this is documented here.

Files written in the *man* language use the following extension: `*.<section>[<group>]`.

**Man page sections**

The traditional *man page* `<section>` is a digit from **1** to **8**.

`<name>.1`

`<name>.2`

`<name>.3`

`<name>.4`

`<name>.5`

`<name>.6`

`<name>.7`

`<name>.8`

Classic *man page sections*.

In older commercial *Unix* systems, the 3 characters **l**, **n**, and **o** were also used as *section* names. This is to-day *deprecated*, but there are still documents in this format.

`<name>.l`

`<name>.n`

`<name>.o`

*Deprecated* *man page sections*, which stood for “local”, “new”, and “old”, respectively.

**Man page group extensions**

The `<group>` extension in `.<section>[<group>]` is optional, but it can be any string of word characters. Usually programmers use a group name that is already used, e.g., **x** for X Window System documents or **tcl** to refer to the *Tcl* programming language.

Examples:

**groff.1** is the *man page* for **groff** in *section 1* without a *group*

**xargs.1posix.gz**

is the *man page* for the program **xargs** in *section 1* and *group* **posix**; moreover it is *compressed* with **gz** (**gzip**).

**config.5ssl**

*OpenSSL CONF* library configuration files from *section 5* with *group* **ssl**.

**dpkg-reconfigure.&scdebconf**

man page for the program **dpkg-reconfigure** in *section 8* and *group cdebconf*.

**Source of man pages**

There are 2 *roff* languages for writing man pages: **man** and **mdoc**.

The names of these 2 styles are taken as *extensions* for the source code files of man pages in the *groff* package.

**<name>.man**

*traditional* Unix-like man page format within groff source files.

**<name>.n**

A temporary man page file produced from a *name.man* man page by a run of **make** within the **groff** source package.

**<name>.mdoc**

Man page format in BSD.

**Traditional troff extensions****Files using macro packages**

The *classical roff* languages were interpreted by the traditional **troff** and **nroff** programs.

The *roff* language has been extended by a variety of macro packages, each producing a sort of dialect of the common language. Documents written using such packages tend to bear a characteristic file name extension.

**<name>.me**

*roff* file using the **me** macro package.

**<name>.mm**

*roff* file using the **mm** macro package

**<name>.ms**

*roff* file using the **ms** macro package

All of these classical *roff* languages and their extensions are still very active in **groff**.

**Source code for macro packages (tmac files)**

In traditional *roff* the source code for the macro packages was stored in *TMAC* files. Their file names have the form:

**tmac.<package>**,

*<package>* is the name of the macro package without the leading **m** character, which is reintegrated by the option **-m**.

For example, **tmac.an** is the source for the **man** macro package.

In the **groff** source, more suitable file names were integrated; see later on.

**Preprocessors**

Moreover, the following *preprocessors* were used as filename extension:

**<name>.chem**

for the integration of chemical formulas

**<name>.eqn**

for the mathematical use of equations

**<name>.pic**

graphical tool

**<name>.tbl**

for tables with *tbl*

**<name>.ref**  
for files using the **prefer** *preprocessor*

#### **roff files**

**<name>.t**  
**<name>.tr**  
for files using the *roff* language of any kind

#### **New groff extensions**

*GNU roff groff* is the actual *roff* standard, both for classical *roff* and new extensions. So even the used new extensions in the source code should be regarded as actual standard. The following extensions are used instead of classical **.t** or **.tr**:

**<name>.groff**  
**<name>.roff**  
general ending for files using the *groff language*

#### **Source code for macro packages (*tmac* files)**

As the classical form **tmac.<package\_without\_m>**, of the *TMAC* file names is quite strange, *groff* added the following structures:

**<package\_without\_m>.tmac**  
**m<package>.tmac**  
**groff\_m<package>.tmac**

#### **Files using new macro packages**

*Groff* uses the following new macro packages:

**<name>.mmse**  
file with swedish **mm** *macros* for **groff**

**<name>.mom**  
files written in the *groff macro package* **mom**

**<name>.www**  
files written in HTML-like *groff macros*.

#### **Preprocessors and postprocessors**

**<name>.hdtbl**  
Heidelberger tables, an alternative to the preprocessor *tbl*. See [groff\\_hdtbl\(7\)](#).

**<name>.grap**  
files written for the graphical **grap** processor.

**<name>.grn**  
for including *gremlin*(1), pictures, see [grn](#)(1).

**<name>.pdfroff**  
transform this file with **pdfroff** of the *groff* system

#### **Authors**

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#### **See also**

History and future  
[roff\(7\)](#), [man-pages\(7\)](#), [groff\\_diff\(7\)](#), [groff\(7\)](#)

Compression  
[uncompress\(1posix\)](#), [gzip2\(1\)](#), [bzip2\(1\)](#), [xz\(1\)](#)

**Name**

groff\_font – GNU roff device and font description files

**Description**

The *groff* font and output device description formats are slight extensions of those used by AT&T device-independent *troff*. In distinction to the AT&T implementation, *groff* lacks a binary format; all files are text files. (Plan 9 *troff* has also abandoned the binary format.) The device and font description files for a device *name* are stored in a *devname* directory. The device description file is called *DESC*, and, for each font supported by the device, a font description file is called *f*, where *f* is usually an abbreviation of a font's name and/or style. For example, the **ps** (PostScript) device has *groff* font description files for Times roman (**TR**) and Zapf Chancery Medium italic (**ZCMI**), among many others, while the **utf8** device (for terminal emulators) has only font descriptions for the roman, italic, bold, and bold-italic styles (**R**, **I**, **B**, and **BI**, respectively).

Device and font description files are read by the formatter, *troff*, and by output drivers. The programs typically delegate these files' processing to an internal library, *libgroff*, ensuring their consistent interpretation.

**DESC file format**

The *DESC* file contains a series of directives; each begins a line. Their order is not important, with two exceptions: (1) the **res** directive must precede any **papersize** directive; and (2) the **charset** directive must come last (if at all). If a directive name is repeated, later entries in the file override previous ones (except that the paper dimensions are computed based on the **res** directive last seen when **papersize** is encountered). Spaces and/or tabs separate words and are ignored at line boundaries. Comments start with the “#” character and extend to the end of a line. Empty lines are ignored.

**family** *fam*

The default font family is *fam*.

**fonts** *n F1 ... Fn*

Fonts *F1*, ..., *Fn* are mounted at font positions  $m + 1$ , ...,  $m + n$  where *m* is the number of **styles** (see below). This directive may extend over more than one line. A font name of **0** causes no font to be mounted at the corresponding position.

**hor** *n* The horizontal motion quantum is *n* basic units. Horizontal quantities are rounded to multiples of *n*.

**image\_generator** *program*

Use *program* to generate PNG images from PostScript input. Under GNU/Linux, this is usually *gs(1)*, but under other systems (notably Cygwin) it might be set to another name. The *grohtml(1)* driver uses this directive.

**paperlength** *n*

The vertical dimension of the output medium is *n* basic units (deprecated: use **papersize** instead).

**papersize** *format-or-dimension-pair-or-file-name ...*

The dimensions of the output medium are as according to the argument, which is either a standard paper format, a pair of dimensions, or the name of a plain text file containing either of the foregoing. Recognized paper formats are the ISO and DIN formats **A0–A7**, **B0–B7**, **C0–C7**, and **D0–D7**; the U.S. formats **letter**, **legal**, **tabloid**, **ledger**, **statement**, and **executive**; and the envelope formats **com10**, **monarch**, and **DL**. Matching is performed without regard for lettercase.

Alternatively, the argument can be a custom paper size in the format *length,width* (with no spaces before or after the comma). Both *length* and *width* must have a unit appended; valid units are “**I**” for inches, “**c**” for centimeters, “**p**” for points, and “**P**” for picas. Example: “**12c,235p**”. An argument that starts with a digit is always treated as a custom paper format.

Finally, the argument can be a file name (e.g., */etc/papersize*); if the file can be opened, the first line is read and a match attempted against each other form. No comment syntax is supported.

More than one argument can be specified; each is scanned in turn and the first valid paper specification used.

**paperwidth** *n*

The horizontal dimension of the output medium is *n* basic units (deprecated: use **papersize** instead).

**pass\_filenames**

Direct *troff* to emit the name of the source file being processed. This is achieved with the intermediate output command “**x F**”, which *grohtml* interprets.

**postpro** *program*

Use *program* as the postprocessor.

**prepro** *program*

Use *program* as a preprocessor. The **html** and **xhtml** output devices use this directive.

**print** *program*

Use *program* as the print spooler. If omitted, *groff*'s **-I** and **-L** options are ignored.

**res** *n* The device resolution is *n* basic units per inch.

**sizes** *s1* ... *sn* **0**

The device has fonts at *s1*, ..., *sn* scaled points (see below). The list of sizes must be terminated by a **0**. Each *si* can also be a range of sizes *m*–*n*. The list can extend over more than one line.

**sizescale** *n*

Set the scale factor for type sizes to one divided by *n*. The default is **1**.

**styles** *S1* ... *Sm*

The first *m* font mounting positions are associated with styles *S1*, ..., *Sm*.

**tcommand**

The postprocessor can handle the **t** and **u** intermediate output commands.

**unicode**

The output device supports the complete Unicode repertoire. This directive is useful only for devices which produce character entities instead of glyphs.

If **unicode** is present, no **charset** section is required in the font description files since the Unicode handling built into *groff* is used. However, if there are entries in a font description file's **charset** section, they either override the default mappings for those particular characters or add new mappings (normally for composite characters).

The **utf8**, **html**, and **xhtml** output devices use this directive.

**unitwidth** *n*

Quantities in the font description files are in basic units for fonts whose type size is *n* scaled points.

**unscaled\_charwidths**

Make the font handling module always return unscaled glyph widths. The *grohtml* driver uses this directive.

**use\_charnames\_in\_special**

*troff* should encode named glyphs inside device control commands. The *grohtml* driver uses this directive.

**vert** *n* The vertical motion quantum is *n* basic units. Vertical quantities are rounded to multiples of *n*.

**charset**

This directive and the rest of the file are ignored. It is recognized for compatibility with other *troff* implementations. In GNU *troff*, character set repertoire is described on a per-font basis.

*troff* recognizes but ignores the directives **spare1**, **spare2**, and **biggestfont**.

The **res**, **unitwidth**, **fonts**, and **sizes** lines are mandatory. Directives not listed above are ignored by *troff* but may be used by postprocessors to obtain further information about the device.

## Font description file format

On typesetting output devices, each font is typically available at multiple sizes. While paper size measurements in the device description file are in absolute units, measurements applicable to fonts must be proportional to the type size. *groff* achieves this using the precedent set by AT&T device-independent *troff*: one font size is chosen as a norm, and all others are scaled linearly relative to that basis. The “unit width” is the number of basic units per point when the font is rendered at this nominal size.

For instance, *groff*’s **lbp** device uses a **unitwidth** of 800. Its Times roman font (“**TR**”) has a **spacewidth** of 833; this is also the width of its comma, period, centered period, and mathematical asterisk, while its “**M**” is 2,963 basic units. Thus, an “**M**” on the **lbp** device is 2,963 basic units wide at a notional type size of 800 points. (800-point type is not practical for most purposes, but using it enables the quantities in the font description files to be expressed as integers.)

A font description file has two sections. The first is a sequence of directives, and is parsed similarly to the *DESC* file described above. Except for the directive names that begin the second section, their ordering is immaterial. Later directives of the same name override earlier ones, spaces and tabs are handled in the same way, and the same comment syntax is supported. Empty lines are ignored throughout.

### **name** *F*

The name of the font is *F*. “**DESC**” is an invalid font name. Simple integers are valid, but their use is discouraged. (*groff* requests and escape sequences interpret non-negative font names as mounting positions instead. Further, a font named “**0**” cannot be automatically mounted by the **fonts** directive of a *DESC* file.)

### **spacewidth** *n*

The width of an unadjusted inter-word space is *n* basic units.

The directives above must appear in the first section; those below are optional.

**slant** *n* The font’s glyphs have a slant of *n* degrees; a positive *n* slants in the direction of text flow.

### **ligatures** *ligl ... lign* [**0**]

Glyphs *ligl*, ..., *lign* are ligatures; possible ligatures are **ff**, **fi**, **fl**, **ffi**, and **ffl**. For compatibility with other *troff* implementations, the list of ligatures may be terminated with a **0**. The list of ligatures must not extend over more than one line.

**special** The font is *special*: when a glyph is requested that is not present in the current font, it is sought in any mounted fonts that bear this property.

Other directives in this section are ignored by *troff*, but may be used by postprocessors to obtain further information about the font.

The second section contains one or two subsections. These can appear in either order; the first one encountered commences the second section. Each starts with a directive on a line by itself. A **charset** subsection is mandatory unless the associated *DESC* file contains the **unicode** directive. Another subsection, **kernpairs**, is optional.

The directive **charset** starts the character set subsection. (For typesetter devices, this directive is misnamed since it starts a list of glyphs, not characters.) It precedes a series of glyph descriptions, one per line. Each such glyph description comprises a set of fields separated by spaces or tabs and organized as follows.

```
name metrics type code [entity-name] [-- comment]
```

*name* identifies the glyph: if *name* is a printable character *c*, it corresponds to the *troff* ordinary character *c*. If *name* is a multi-character sequence not beginning with \, it corresponds to the GNU *troff* special character escape sequence “[*name*]”. A name consisting of three minus signs, “---”, indicates that the glyph is unnamed: such glyphs can be accessed only by the \N escape sequence in *troff*. A special character named “---” can still be defined using **.char** and similar requests. The *name* “\–” defines the minus sign glyph. Finally, *name* can be the horizontal motion escape sequences, \j and \^ (“thin” and “hair” spaces, respectively), in which case only the width metric described below is applied; a font can thus customize the widths of these spaces.

The form of the *metrics* field is as follows (on one line; it may be broken here for readability).

```
width[,height[,depth[,italic-correction[,left-italic-correction[,subscript-correction]]]]]]]]]
```

There must not be any spaces, tabs, or newlines between these *subfields*, which are in basic units expressed as decimal integers. Unspecified subfields default to be **0**. Since there is no associated binary format, these values are not required to fit into the C language data type **char** as they are in AT&T device-independent *troff*.

The *width* subfield gives the width of the glyph. The *height* subfield gives the height of the glyph (upwards is positive); if a glyph does not extend above the baseline, it should be given a zero height, rather than a negative height. The *depth* subfield gives the depth of the glyph, that is, the distance below the baseline to which the glyph extends (downwards is positive); if a glyph does not extend below the baseline, it should be given a zero depth, rather than a negative depth. Italic corrections are relevant to glyphs in italic or oblique styles. The *italic-correction* is the amount of space that should be added after an oblique glyph to be followed immediately by an upright glyph. The *left-italic-correction* is the amount of space that should be added before an oblique glyph to be preceded immediately by an upright glyph. The *subscript-correction* is the amount of space that should be added after an oblique glyph to be followed by a subscript; it should be less than the italic correction.

For fonts used with typesetting devices, the *type* field gives a featural description of the glyph: it is a bit mask recording whether the glyph is an ascender, descender, both, or neither. When a `\w` escape sequence is interpolated, these values are bitwise or-ed together for each glyph and stored in the **ct** register. In font descriptions for *nroff*-mode output devices (terminals), all glyphs might have a type of zero.

- 0 means the glyph lies entirely between the baseline and a horizontal line at the “x-height” of the font, as with “a”, “c”, and “x”;
- 1 means the glyph descends below the baseline, like “p”;
- 2 means the glyph ascends above the font’s x-height, like “A” or “b”); and
- 3 means the glyph is both an ascender and a descender—this is true of parentheses in some fonts.

The *code* field gives a numeric identifier that the postprocessor uses to render the glyph. The glyph can be specified to *troff* using this code by means of the `\N` escape sequence. The code can be any integer (that is, any integer parsable by the C standard library’s *strtol*(3) function).

The *entity-name* field defines an identifier for the glyph that the postprocessor uses to print the *troff* glyph *name*. This field is optional; it was introduced so that the *grohtml* output driver could encode its character set. For example, the glyph `\[Po]` is represented by “&pound;” in HTML 4.0. For efficiency, these data are now compiled directly into *grohtml*. *grops* uses the field to build sub-encoding arrays for PostScript fonts containing more than 256 glyphs. Anything on the line after the *entity-name* field or “—” is ignored.

A line in the **charset** section can also have the following format.

```
name "
```

This notation indicates that *name* is another name for the glyph mentioned in the preceding line. Such aliases can be chained.

The word **kernpairs** starts a list of kerning adjustments to be made to adjacent glyph pairs from this font. It contains a sequence of lines formatted as follows.

```
g1 g2 n
```

The foregoing means that when glyph *g1* is typeset immediately before *g2*, the space between them should be increased by *n*. Most kerning pairs should have a negative value for *n*.

## Files

```
/usr/local/share/groff/1.23.0/font/devname/DESC
```

describes the output device *name*.

`/usr/local/share/groff/1.23.0/font/devname/F`  
describes the font known as *F* on device *name*.

**See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “`info groff`”.

“Troff User’s Manual” by Joseph F. Ossanna, 1976 (revised by Brian W. Kernighan, 1992), AT&T Bell Laboratories Computing Science Technical Report No. 54, widely called simply “CSTR #54”, documents the language, device and font description file formats, and device-independent output format referred to collectively in *groff* documentation as “AT&T *troff*”.

“A Typesetter-independent TROFF” by Brian W. Kernighan, 1982, AT&T Bell Laboratories Computing Science Technical Report No. 97, provides additional insights into the device and font description file formats and device-independent output format.

[groff\(1\)](#), subsection “Utilities”, lists programs available for describing fonts in a variety of formats such that *groff* output drivers can use them.

[groff\\_out\(5\)](#), [troff\(1\)](#), [addftinfo\(1\)](#)

**Name**

groff\_out – GNU roff intermediate output format

**Description**

The fundamental operation of the *troff*(1) formatter is the translation of the *groff*(7) input language into a device-independent form, described here, primarily concerned with what has to be written or drawn at specific positions on the output device. This language is simple and imperative. In the following discussion, the term *command* always refers to this intermediate output language, and never to the *groff*(7) language intended for direct use by document authors. Intermediate output commands comprise several categories: glyph output; font, color, and text size selection; motion of the printing position; page advancement; drawing of geometric primitives; and device control commands, a catch-all for operations not easily classified as any of the foregoing, such as directives to start and stop output, identify the intended output device, or place URL hyperlinks in supported output formats.

As the GNU *roff* processor *groff*(1) is a wrapper program around *troff* that automatically calls a postprocessor, this output does not show up normally. This is why it is called *intermediate* within the *groff* system. The *groff* program provides the option `-Z` to inhibit postprocessing, such that the produced *intermediate output* is sent to standard output just like calling *troff* manually.

In this document, the term *troff output* describes what is output by the GNU *troff* program, while *intermediate output* refers to the language that is accepted by the parser that prepares this output for the postprocessors. This parser is smarter on whitespace and implements obsolete elements for compatibility, otherwise both formats are the same. Both formats can be viewed directly with *gxditview*(1).

The main purpose of the *intermediate output* concept is to facilitate the development of postprocessors by providing a common programming interface for all devices. It has a language of its own that is completely different from the *groff*(7) language. While the *groff* language is a high-level programming language for text processing, the *intermediate output* language is a kind of low-level assembler language by specifying all positions on the page for writing and drawing.

The pre-*groff* *roff* versions are denoted as *classical troff*. The *intermediate output* produced by *groff* is fairly readable, while *classical troff* output was hard to understand because of strange habits that are still supported, but not used any longer by GNU *troff*.

**Language concepts**

During the run of *troff*, the *roff* input is cracked down to the information on what has to be printed at what position on the intended device. So the language of the *intermediate output* format can be quite small. Its only elements are commands with or without arguments. In this document, the term “command” always refers to the *intermediate output* language, never to the *roff* language used for document formatting. There are commands for positioning and text writing, for drawing, and for device controlling.

**Separation**

*Classical troff output* had strange requirements on whitespace. The *groff* output parser, however, is smart about whitespace by making it maximally optional. The whitespace characters, i.e., the *tab*, *space*, and *newline* characters, always have a syntactical meaning. They are never printable because spacing within the output is always done by positioning commands.

Any sequence of *space* or *tab* characters is treated as a single *syntactical space*. It separates commands and arguments, but is only required when there would occur a clashing between the command code and the arguments without the space. Most often, this happens when variable length command names, arguments, argument lists, or command clusters meet. Commands and arguments with a known, fixed length need not be separated by *syntactical space*.

A line break is a syntactical element, too. Every command argument can be followed by whitespace, a comment, or a newline character. Thus a *syntactical line break* is defined to consist of optional *syntactical space* that is optionally followed by a comment, and a newline character.

The normal commands, those for positioning and text, consist of a single letter taking a fixed number of arguments. For historical reasons, the parser allows stacking of such commands on the same line, but fortunately, in *groff intermediate output*, every command with at least one argument is followed by a line break,

thus providing excellent readability.

The other commands — those for drawing and device controlling — have a more complicated structure; some recognize long command names, and some take a variable number of arguments. So all **D** and **x** commands were designed to request a *syntactical line break* after their last argument. Only one command, ‘**x X**’ has an argument that can stretch over several lines, all other commands must have all of their arguments on the same line as the command, i.e., the arguments may not be split by a line break.

Empty lines, i.e., lines containing only space and/or a comment, can occur everywhere. They are just ignored.

### Argument units

Some commands take integer arguments that are assumed to represent values in a measurement unit, but the letter for the corresponding *scaling indicator* is not written with the output command arguments; see [groff\(7\)](#) and *Groff: The GNU Implementation of troff*, the *groff* Texinfo manual, for more on this topic. Most commands assume the scaling indicator “**u**”, the basic unit of the device, some use “**z**”, the *scaled point unit* of the device, while others, such as the color commands, expect plain integers. Note that these scaling indicators are relative to the chosen device. They are defined by the parameters specified in the device’s *DESC* file; see [groff\\_font\(5\)](#).

Note that single characters can have the eighth bit set, as can the names of fonts and special characters (this is, glyphs). The names of glyphs and fonts can be of arbitrary length. A glyph that is to be printed will always be in the current font.

A string argument is always terminated by the next whitespace character (space, tab, or newline); an embedded **#** character is regarded as part of the argument, not as the beginning of a comment command. An integer argument is already terminated by the next non-digit character, which then is regarded as the first character of the next argument or command.

### Document parts

A correct *intermediate output* document consists of two parts, the *prologue* and the *body*.

The task of the *prologue* is to set the general device parameters using three exactly specified commands. The *groff prologue* is guaranteed to consist of the following three lines (in that order):

```
x T device
x res n h v
x init
```

with the arguments set as outlined in subsection “Device Control Commands” below. However, the parser for the *intermediate output* format is able to swallow additional whitespace and comments as well.

The *body* is the main section for processing the document data. Syntactically, it is a sequence of any commands different from the ones used in the *prologue*. Processing is terminated as soon as the first **x stop** command is encountered; the last line of any *groff intermediate output* always contains such a command.

Semantically, the *body* is page oriented. A new page is started by a **p** command. Positioning, writing, and drawing commands are always done within the current page, so they cannot occur before the first **p** command. Absolute positioning (by the **H** and **V** commands) is done relative to the current page, all other positioning is done relative to the current location within this page.

### Command reference

This section describes all *intermediate output* commands, the classical commands as well as the *groff* extensions.

#### Comment command

```
#anything(line-break)
```

A comment. Ignore any characters from the **#** character up to the next newline. Each comment can be preceded by arbitrary *syntactical space*; every command can be terminated by a comment.

#### Simple commands

The commands in this subsection have a command code consisting of a single character, taking a fixed number of arguments. Most of them are commands for positioning and text writing. These commands are

smart about whitespace. Optionally, *syntactical space* can be inserted before, after, and between the command letter and its arguments. All of these commands are stackable, i.e., they can be preceded by other simple commands or followed by arbitrary other commands on the same line. A separating *syntactical space* is only necessary when two integer arguments would clash or if the preceding argument ends with a string argument.

**C** *xxx*<white-space>

Print a glyph (special character) named *xxx*. The trailing *syntactical space* or *line break* is necessary to allow glyph names of arbitrary length. The glyph is printed at the current print position; its size is read from the font description file. The print position is not changed.

**c** *c* Print glyph with single-letter name *c* at the current print position; its size is read from the font description file. The print position is not changed.

**f** *n* Set font to font number *n* (a non-negative integer).

**H** *n* Move right to the absolute vertical position *n* (a non-negative integer in basic units **u**) relative to left edge of current page.

**h** *n* Move *n* (a non-negative integer) basic units **u** horizontally to the right. AT&T *troff* allowed negative *n*; GNU *troff* does not produce such values, but *groff*'s output driver library handles them.

**m** *color-scheme* [*component*] . . .

Set the color for text (glyphs), line drawing, and the outline of graphic objects using different color schemes; the analogous command for the filling color of graphic objects is **DF**. The color components are specified as integer arguments between 0 and 65536. The number of color components and their meaning vary for the different color schemes. These commands are generated by the *groff* escape sequence **\m**. They are *groff* extensions.

**mc** *cyan magenta yellow*

Set color using the CMY color scheme, having the 3 color components cyan, magenta, and yellow.

**md** Set color to the default color value (black in most cases). No component arguments.

**mg** *gray*

Set color to the shade of gray given by the argument, an integer between 0 (black) and 65536 (white).

**mk** *cyan magenta yellow black*

Set color using the CMYK color scheme, having the 4 color components cyan, magenta, yellow, and black.

**mr** *red green blue*

Set color using the RGB color scheme, having the 3 color components red, green, and blue.

**N** *n* Print glyph with index *n* (an integer, normally non-negative) of the current font. The print position is not changed. If **-T html** or **-T xhtml** is used, negative values are emitted also to indicate an unbreakable space with given width. For example, **N -193** represents an unbreakable space which has a width of 193 u.

**n** *b a* Inform the device about a line break, but no positioning is done by this command. In *classical troff*, the integer arguments *b* and *a* informed about the space before and after the current line to make the *intermediate output* more human readable without performing any action. In *groff*, they are just ignored, but they must be provided for compatibility reasons.

**p** *n* Begin a new page in the outprint. The page number is set to *n*. This page is completely independent of pages formerly processed even if those have the same page number. The vertical position on the outprint is automatically set to 0. All positioning, writing, and drawing is always done relative to a page, so a **p** command must be issued before any of these commands.

- s** *n* Set type size to *n* scaled points (unit **z** in GNU *troff*). AT&T *troff* used unscaled points (**p**) instead; see section “Compatibility” below.
- t** *xyz*...*<white-space>*  
**t** *xyz*... *dummy-arg**<white-space>*  
 Typeset a word *xyz*; that is, set a sequence of ordinary glyphs named *x*, *y*, *z*, ..., terminated by a space character or a line break; an optional second integer argument is ignored (this allows the formatter to generate an even number of arguments). Each glyph is set at the current drawing position, and the position is then advanced horizontally by the glyph’s width. A glyph’s width is read from its metrics in the font description file, scaled to the current type size, and rounded to a multiple of the horizontal motion quantum. Only ordinary characters can be set using this command; use the **C** command to emplace special characters. The **t** command is a *groff* extension and is output only for devices whose *DESC* file contains the **tcommand** directive; see [groff\\_font\(5\)](#).
- u** *n xyz*...*<white-space>*  
 Typeset word *xyz* with track kerning. As **t**, but after placing each glyph, the drawing position is further advanced horizontally by *n* basic units (**u**). The **u** command is a *groff* extension and is output only for devices whose *DESC* file contains the **tcommand** directive; see [groff\\_font\(5\)](#).
- V** *n* Move down to the absolute vertical position *n* (a non-negative integer in basic units **u**) relative to upper edge of current page.
- v** *n* Move *n* basic units **u** down (*n* is a non-negative integer). AT&T *troff* allowed negative *n*; GNU *troff* does not produce such values, but *groff*’s output driver library handles them.
- w** Describe an adjustable space. This performs no action; it is present for documentary purposes. The spacing itself must be performed explicitly by a move command.

### Graphics commands

Each graphics or drawing command in the *intermediate output* starts with the letter **D** followed by one or two characters that specify a subcommand; this is followed by a fixed or variable number of integer arguments that are separated by a single space character. A **D** command may not be followed by another command on the same line (apart from a comment), so each **D** command is terminated by a *syntactical line break*.

*troff* output follows the classical spacing rules (no space between command and subcommand, all arguments are preceded by a single space character), but the parser allows optional space between the command letters and makes the space before the first argument optional. As usual, each space can be any sequence of tab and space characters.

Some graphics commands can take a variable number of arguments. In this case, they are integers representing a size measured in basic units **u**. The *h* arguments stand for horizontal distances where positive means right, negative left. The *v* arguments stand for vertical distances where positive means down, negative up. All these distances are offsets relative to the current location.

Unless indicated otherwise, each graphics command directly corresponds to a similar *groff* **\D** escape sequence; see [groff\(7\)](#).

Unknown **D** commands are assumed to be device-specific. Its arguments are parsed as strings; the whole information is then sent to the postprocessor.

In the following command reference, the syntax element *<line-break>* means a *syntactical line break* as defined in subsection “Separation” above.

**D~** *h<sub>1</sub> v<sub>1</sub> h<sub>2</sub> v<sub>2</sub> ... h<sub>n</sub> v<sub>n</sub>* *<line-break>*

Draw B-spline from current position to offset (*h<sub>1</sub>*, *v<sub>1</sub>*), then to offset (*h<sub>2</sub>*, *v<sub>2</sub>*) if given, etc., up to (*h<sub>n</sub>*, *v<sub>n</sub>*). This command takes a variable number of argument pairs; the current position is moved to the terminal point of the drawn curve.

**Da** *h<sub>1</sub> v<sub>1</sub> h<sub>2</sub> v<sub>2</sub>* *<line-break>*

Draw arc from current position to (*h<sub>1</sub>*, *v<sub>1</sub>*) + (*h<sub>2</sub>*, *v<sub>2</sub>*) with center at (*h<sub>1</sub>*, *v<sub>1</sub>*); then move the current

position to the final point of the arc.

**DC** *d* <line-break>

**DC** *d dummy-arg* <line-break>

Draw a solid circle using the current fill color with diameter *d* (integer in basic units **u**) with leftmost point at the current position; then move the current position to the rightmost point of the circle. An optional second integer argument is ignored (this allows the formatter to generate an even number of arguments). This command is a *groff* extension.

**Dc** *d* <line-break>

Draw circle line with diameter *d* (integer in basic units **u**) with leftmost point at the current position; then move the current position to the rightmost point of the circle.

**DE** *h v* <line-break>

Draw a solid ellipse in the current fill color with a horizontal diameter of *h* and a vertical diameter of *v* (both integers in basic units **u**) with the leftmost point at the current position; then move to the rightmost point of the ellipse. This command is a *groff* extension.

**De** *h v* <line-break>

Draw an outlined ellipse with a horizontal diameter of *h* and a vertical diameter of *v* (both integers in basic units **u**) with the leftmost point at current position; then move to the rightmost point of the ellipse.

**DF** *color-scheme* [*component . . .*] <line-break>

Set fill color for solid drawing objects using different color schemes; the analogous command for setting the color of text, line graphics, and the outline of graphic objects is **m**. The color components are specified as integer arguments between 0 and 65536. The number of color components and their meaning vary for the different color schemes. These commands are generated by the *groff* escape sequences **\D'F . . .** and **\M** (with no other corresponding graphics commands). This command is a *groff* extension.

**DFc** *cyan magenta yellow* <line-break>

Set fill color for solid drawing objects using the CMY color scheme, having the 3 color components cyan, magenta, and yellow.

**DFd** <line-break>

Set fill color for solid drawing objects to the default fill color value (black in most cases). No component arguments.

**DFg** *gray* <line-break>

Set fill color for solid drawing objects to the shade of gray given by the argument, an integer between 0 (black) and 65536 (white).

**DFk** *cyan magenta yellow black* <line-break>

Set fill color for solid drawing objects using the CMYK color scheme, having the 4 color components cyan, magenta, yellow, and black.

**DFr** *red green blue* <line-break>

Set fill color for solid drawing objects using the RGB color scheme, having the 3 color components red, green, and blue.

**Df** *n* <line-break>

The argument *n* must be an integer in the range  $-32767$  to  $32767$ .

$0 \leq n \leq 1000$

Set the color for filling solid drawing objects to a shade of gray, where 0 corresponds to solid white, 1000 (the default) to solid black, and values in between to intermediate shades of gray; this is obsoleted by command **DFg**.

$n < 0$  or  $n > 1000$

Set the filling color to the color that is currently being used for the text and the outline, see command **m**. For example, the command sequence

```
mg 0 0 65536
Df -1
```

sets all colors to blue.

This command is a *groff* extension.

**DI** *h v* <line-break>

Draw line from current position to offset (*h*, *v*) (integers in basic units **u**); then set current position to the end of the drawn line.

**Dp** *h<sub>1</sub> v<sub>1</sub> h<sub>2</sub> v<sub>2</sub> ... h<sub>n</sub> v<sub>n</sub>* <line-break>

Draw a polygon line from current position to offset (*h<sub>1</sub>*, *v<sub>1</sub>*), from there to offset (*h<sub>2</sub>*, *v<sub>2</sub>*), etc., up to offset (*h<sub>n</sub>*, *v<sub>n</sub>*), and from there back to the starting position. For historical reasons, the position is changed by adding the sum of all arguments with odd index to the current horizontal position and the even ones to the vertical position. Although this doesn't make sense it is kept for compatibility. This command is a *groff* extension.

**DP** *h<sub>1</sub> v<sub>1</sub> h<sub>2</sub> v<sub>2</sub> ... h<sub>n</sub> v<sub>n</sub>* <line-break>

The same macro as the corresponding **Dp** command with the same arguments, but draws a solid polygon in the current fill color rather than an outlined polygon. The position is changed in the same way as with **Dp**. This command is a *groff* extension.

**Dt** *n* <line-break>

Set the current line thickness to *n* (an integer in basic units **u**) if *n* > 0; if *n* = 0 select the smallest available line thickness; otherwise, the line thickness is made proportional to the type size, which is the default. For historical reasons, the horizontal position is changed by adding the argument to the current horizontal position, while the vertical position is not changed. Although this doesn't make sense, it is kept for compatibility. This command is a *groff* extension.

### Device control commands

Each device control command starts with the letter **x** followed by a space character (optional or arbitrary space/tab in *groff*) and a subcommand letter or word; each argument (if any) must be preceded by a *syntactical space*. All **x** commands are terminated by a *syntactical line break*; no device control command can be followed by another command on the same line (except a comment).

The subcommand is basically a single letter, but to increase readability, it can be written as a word, i.e., an arbitrary sequence of characters terminated by the next tab, space, or newline character. All characters of the subcommand word but the first are simply ignored. For example, *troff* outputs the initialization command **x i** as **x init** and the resolution command **x r** as **x res**. But writings like **x i\_like\_groff** and **x roff\_is\_groff** are accepted as well to mean the same commands.

In the following, the syntax element <line-break> means a *syntactical line break* as defined in subsection "Separation" above.

**xF** *name* <line-break>

(*Filename* control command)

Use *name* as the intended name for the current file in error reports. This is useful for remembering the original file name when *groff* uses an internal piping mechanism. The input file is not changed by this command. This command is a *groff* extension.

**xf** *n s* <line-break>

(*font* control command)

Mount font position *n* (a non-negative integer) with font named *s* (a text word); see [groff\\_font\(5\)](#).

**xH** *n* <line-break>

(*Height* control command)

Set character height to *n* (a positive integer in scaled points **z**). *Classical troff* used the unit points (**p**) instead; see section "Compatibility" below.

- xi** <line-break>  
(*init* control command)  
Initialize device. This is the third command of the *prologue*.
- xp** <line-break>  
(*pause* control command)  
Parsed but ignored. The classical documentation reads *pause device, can be restarted*.
- xr** *n h v* <line-break>  
(*resolution* control command)  
Resolution is *n*, while *h* is the minimal horizontal motion, and *v* the minimal vertical motion possible with this device; all arguments are positive integers in basic units **u** per inch. This is the second command of the *prologue*.
- xS** *n* <line-break>  
(*Slant* control command)  
Set slant to *n* degrees (an integer in basic units **u**).
- xs** <line-break>  
(*stop* control command)  
Terminates the processing of the current file; issued as the last command of any *intermediate troff output*.
- xt** <line-break>  
(*trailer* control command)  
Generate trailer information, if any. In **groff**, this is currently ignored.
- xT** *xxx* <line-break>  
(*Typesetter* control command)  
Set the name of the output driver to *xxx*, a sequence of non-whitespace characters terminated by whitespace. The possible names correspond to those of *groff*'s **-T** option. This is the first command of the *prologue*.
- xu** *n* <line-break>  
(*underline* control command)  
Configure underlining of spaces. If *n* is 1, start underlining of spaces; if *n* is 0, stop underlining of spaces. This is needed for the **cu** request in **nroff** mode and is ignored otherwise. This command is a *groff* extension.
- xX** *anything* <line-break>  
(*X-escape* control command)  
Send string *anything* uninterpreted to the device. If the line following this command starts with a **+** character this line is interpreted as a continuation line in the following sense. The **+** is ignored, but a newline character is sent instead to the device, the rest of the line is sent uninterpreted. The same applies to all following lines until the first character of a line is not a **+** character. This command is generated by the *groff* escape sequence **\X**. The line-continuing feature is a *groff* extension.

### Obsolete command

In *classical troff* output, emitting a single glyph was mostly done by a very strange command that combined a horizontal move and the printing of a glyph. It didn't have a command code, but is represented by a 3-character argument consisting of exactly 2 digits and a character.

*ddc* Move right *dd* (exactly two decimal digits) basic units **u**, then print glyph with single-letter name *c*.

In *groff*, arbitrary *syntactical space* around and within this command is allowed to be added. Only when a preceding command on the same line ends with an argument of variable length a separating space is obligatory. In *classical troff*, large clusters of these and other commands were used, mostly without spaces; this made such output almost unreadable.

For modern high-resolution devices, this command does not make sense because the width of the glyphs

can become much larger than two decimal digits. In *groff*, it is used only for output to the **X75**, **X75-12**, **X100**, and **X100-12** devices. For others, the commands **t** and **u** provide greater functionality and superior troubleshooting capacity.

### Postprocessing

The *roff* postprocessors are programs that have the task to translate the *intermediate output* into actions that are sent to a device. A device can be some piece of hardware such as a printer, or a software file format suitable for graphical or text processing. The *groff* system provides powerful means that make the programming of such postprocessors an easy task.

There is a library function that parses the *intermediate output* and sends the information obtained to the device via methods of a class with a common interface for each device. So a *groff* postprocessor must only redefine the methods of this class. For details, see the reference in section “Files” below.

### Example

This section presents the *intermediate output* generated from the same input for three different devices. The input is the sentence *hell world* fed into *groff* on the command line.

- High-resolution device *ps*

```
shell> echo "hell world" | groff -Z -T ps

x T ps
x res 72000 1 1
x init
p1
x font 5 TR
f5
s10000
V12000
H72000
thell
wh2500
tw
H96620
torld
n12000 0
x trailer
V792000
x stop
```

This output can be fed into the postprocessor [grops\(1\)](#) to get its representation as a PostScript file, or [gropdf\(1\)](#) to output directly to PDF.

- Low-resolution device *latin1*

This is similar to the high-resolution device except that the positioning is done at a minor scale. Some comments (lines starting with #) were added for clarification; they were not generated by the formatter.

```
shell> "hell world" | groff -Z -T latin1

# prologue
x T latin1
x res 240 24 40
x init
# begin a new page
p1
# font setup
x font 1 R
f1
```

```

s10
# initial positioning on the page
V40
H0
# write text 'hell'
thell
# inform about a space, and do it by a horizontal jump
wh24
# write text 'world'
tworld
# announce line break, but do nothing because ...
n40 0
# ... the end of the document has been reached
x trailer
V2640
x stop

```

This output can be fed into the postprocessor *grotty*(1) to get a formatted text document.

- Classical style output

As a computer monitor has a very low resolution compared to modern printers the *intermediate output* for the X devices can use the jump-and-write command with its 2-digit displacements.

```

shell> "hell world" | groff -Z -T X100
x T X100
x res 100 1 1
x init
p1
x font 5 TR
f5
s10
V16
H100
# write text with old-style jump-and-write command
ch07e07103lw06w11o07r05l03dh7
n16 0
x trailer
V1100
x stop

```

This output can be fed into the postprocessor *xditview*(1x) or *gxditview*(1) for displaying in X.

Due to the obsolete jump-and-write command, the text clusters in the classical output are almost unreadable.

## Compatibility

The *intermediate output* language of the *classical troff* was first documented in [CSTR #97]. The *groff intermediate output* format is compatible with this specification except for the following features.

- The classical quasi device independence is not yet implemented.
- The old hardware was very different from what we use today. So the *groff* devices are also fundamentally different from the ones in *classical troff*. For example, the classical PostScript device was called *post* and had a resolution of 720 units per inch, while *groff*'s *ps* device has a resolution of 72000 units per inch. Maybe, by implementing some rescaling mechanism similar to the classical quasi device independence, these could be integrated into modern *groff*.

- The B-spline command **D~** is correctly handled by the *intermediate output* parser, but the drawing routines aren't implemented in some of the postprocessor programs.
- The argument of the commands **s** and **x H** has the implicit unit scaled point **z** in *groff*, while *classical troff* had point (**p**). This isn't an incompatibility, but a compatible extension, for both units coincide for all devices without a *sizescale* parameter, including all classical and the *groff* text devices. The few *groff* devices with a *sizescale* parameter either did not exist, had a different name, or seem to have had a different resolution. So conflicts with classical devices are very unlikely.
- The position changing after the commands **Dp**, **DP**, and **Dt** is illogical, but as old versions of *groff* used this feature it is kept for compatibility reasons.

The differences between *groff* and *classical troff* are documented in [groff\\_diff\(7\)](#).

## Files

[/usr/local/share/groff/1.23.0/font/devname/DESC](#)  
describes the output device *name*.

## Authors

James Clark wrote an early version of this document, which described only the differences between AT&T device-independent *troff*'s output format and that of GNU *roff*. The present version was completely rewritten in 2001 by Bernd Warken ([groff-bernd.warken-72@web.de](mailto:groff-bernd.warken-72@web.de)).

## See also

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “`info groff`”.

“Troff User's Manual” by Joseph F. Ossanna, 1976 (revised by Brian W. Kernighan, 1992), AT&T Bell Laboratories Computing Science Technical Report No. 54, widely called simply “CSTR #54”, documents the language, device and font description file formats, and device-independent output format referred to collectively in *groff* documentation as “AT&T *troff*”.

“A Typesetter-independent TROFF” by Brian W. Kernighan, 1982, AT&T Bell Laboratories Computing Science Technical Report No. 97, provides additional insights into the device and font description file formats and device-independent output format.

[groff\(1\)](#) documents the **-Z** option and contains pointers to further *groff* documentation.

[groff\(7\)](#) describes the *groff* language, including its escape sequences and system of units.

[groff\\_font\(5\)](#)

details the device scaling parameters of device *DESC* files.

[troff\(1\)](#) generates the device-independent intermediate output documented here.

[roff\(7\)](#) presents historical aspects and the general structure of *roff* systems.

[groff\\_diff\(7\)](#)

enumerates differences between the intermediate output produced by AT&T *troff* and that of *groff*.

[gxditview\(1\)](#)

is a viewer for intermediate output.

*Roff.js* (<https://github.com/Alhadis/Roff.js/>) is a viewer for intermediate output written in JavaScript.

[grodvi\(1\)](#), [grohtml\(1\)](#), [grolbp\(1\)](#), [grolj4\(1\)](#), [gropdf\(1\)](#), [grops\(1\)](#), and [grotty\(1\)](#) are *groff* postprocessors.

**Name**

groff\_tmac – macro files in the GNU roff typesetting system

**Description**

Definitions of macros, strings, and registers for use in a *roff*(7) document can be collected into *macro files*, *roff* input files designed to produce no output themselves but instead ease the preparation of other *roff* documents. There is no syntactical difference between a macro file and any other *roff* document; only its purpose distinguishes it. When a macro file is installed at a standard location, named according to a certain convention, and suitable for use by a general audience, it is termed a *macro package*. Macro packages can be loaded by supplying the **-m** option to *troff*(1) or a *groff* front end.

Each macro package stores its macro, string, and register definitions in one or more *tmac* files. This name originated in early Unix culture as an abbreviation of “*troff* macros”.

A macro package must be named *name.tmac* and be placed in a “*tmac* directory” to be loadable with the **-m** option. Section “Environment” of *troff*(1) lists these directories. Alternatively, a *groff* document wishing to use a macro file can load it with the **mso** (“macro source”) request.

Like any other *roff* document, a macro file can use the “**so**” request (“source”) to load further files relative to its own location.

Macro files are named for their most noteworthy application, but a macro file need not define any macros. It can restrict itself to defining registers and strings or invoking other *groff* requests. It can even be empty.

**Macro packages**

Macro packages come in two varieties; those which assume responsibility for page layout and other critical functions (“major” or “full-service”) and those which do not (“supplemental” or “auxiliary”). GNU *roff* provides most major macro packages found in AT&T and BSD Unix systems, an additional full-service package, and many supplemental packages. Multiple full-service macro packages cannot be used by the same document. Auxiliary packages can generally be freely combined, though attention to their use of the *groff* language name spaces for identifiers (particularly registers, macros, strings, and diversions) should be paid. Name space management was a significant challenge in AT&T *troff*; *groff*’s support for arbitrarily long identifiers affords few excuses for name collisions, apart from attempts at compatibility with the demands of historical documents.

**Man pages**

*an*

*man* *an* is used to compose man pages in the format originating in Version 7 Unix (1979). It has a small macro interface and is widely used; see *groff\_man*(7).

*doc*

*mdoc* *doc* is used to compose man pages in the format originating in 4.3BSD-Reno (1990). It provides many more features than *an*, but is also larger, more complex, and not as widely adopted; see *groff\_mdoc*(7).

Because readers of man pages often do not know in advance which macros are used to format a given document, a wrapper is available.

*andoc*

*mandoc*

This macro file, specific to *groff*, recognizes whether a document uses *man* or *mdoc* format and loads the corresponding macro package. Multiple man pages, in either format, can be handled; *andoc* reloads each macro package as necessary.

**Full-service packages**

The packages in this section provide a complete set of macros for writing documents of any kind, up to whole books. They are similar in functionality; it is a matter of taste which one to use.

*me* The classical *me* macro package; see *groff\_me*(7).

- mm* The semi-classical *mm* macro package; see [groff\\_mm\(7\)](#).
- mom* The *mom* macro package, only available in groff. As this was not based on other packages, it was freely designed as quite a nice, modern macro package. See [groff\\_mom\(7\)](#).
- ms* The classical *ms* macro package; see [groff\\_ms\(7\)](#).

### Localization packages

For Western languages, the localization file sets the hyphenation mode and loads hyphenation patterns and exceptions. Localization files can also adjust the date format and provide translations of strings used by some of the full-service macro packages; alter the input encoding (see the next section); and change the amount of additional inter-sentence space. For Eastern languages, the localization file defines character classes and sets flags on them. By default, *troffrc* loads the localization file for English.

*trans* loads localized strings used by various macro packages after their localized forms have been prepared by a localization macro file.

As of *groff* 1.23.0, the following localization files exist.

- cs* Czech; localizes *man*, *me*, *mm*, *mom*, and *ms*. Sets the input encoding to Latin-2 by loading *latin2.tmac*.
- de*
- den* German; localizes *man*, *me*, *mm*, *mom*, and *ms*. Sets the input encoding to Latin-1 by loading *latin1.tmac*.  
*de.tmac* selects hyphenation patterns for traditional orthography, and *den.tmac* does the same for the new orthography (“Rechtschreibreform”).
- en* English.
- fr* French; localizes *man*, *me*, *mm*, *mom*, and *ms*. Sets the input encoding to Latin-9 by loading *latin9.tmac*.
- it* Italian; localizes *man*, *me*, *mm*, *mom*, and *ms*.
- ja* Japanese.
- sv* Swedish; localizes *man*, *me*, *mm*, *mom*, and *ms*. Sets the input encoding to Latin-1 by loading *latin1.tmac*. Some of the localization of the *mm* package is handled separately; see [groff\\_mmse\(7\)](#).
- zh* Chinese.

### Input encodings

*latin1*

*latin2*

*latin5*

*latin9* Various input encodings supported directly by groff. Normally, this macro is loaded at the very beginning of a document or specified as the first macro argument on the command line. *groff* loads *latin1* by default at startup. These macro packages don’t work on EBCDIC hosts.

*cp1047* Encoding support for EBCDIC. On those platforms it is loaded automatically at startup. Due to different character ranges used in *groff* it doesn’t work on architectures which are based on ASCII.

Some input encoding characters may not be available for a particular output device. For example, saying

```
groff -Tlatin1 -mlatin9 ...
```

fails if you use the Euro character in the input. Usually, this limitation is present only for drivers which have a limited set of output glyphs (**ascii**, **latin1**); for other drivers it is usually sufficient to install proper fonts which contain the necessary glyphs.

### Auxiliary packages

The macro packages in this section are not intended for stand-alone use, but can add functionality to any other macro package or to plain (“raw”) *groff* documents.

- 62bit* provides macros for addition, multiplication, and division of 62-bit integers (allowing safe multiplication of signed 31-bit integers, for example).
- hdtbl* allows the generation of tables using a syntax similar to the HTML table model. This Heidelberg table macro package is not a preprocessor, which can be useful if the contents of table entries are determined by macro calls or string interpolations. Compare to *tbl(1)*. It works only with the **ps** and **pdf** output devices. See *groff\_hdtbl(7)*.
- papersize* enables the paper size to be set on the command line by giving a **-d paper=size** option to *troff*. Possible values for *size* are the ISO and DIN formats “A0–A6”, “B0–B6”, “C0–C6”, and “D0–D6”; the U.S. formats “letter”, “legal”, “tabloid”, “ledger”, “statement”, and “executive”; and the envelope formats “com10”, “monarch”, and “DL”. All formats, even those for envelopes, are in portrait orientation: the length measurement is vertical. Appending “l” (ell) to any of these denotes landscape orientation instead. An output device typically requires command-line options **-p** and **-l** to override the paper dimensions and orientation, respectively, defined in its *DESC* file; see subsection “Paper sizes” of *groff(1)*. This macro file is normally loaded at startup by the *troffrc* file.
- pdfpic* provides a single macro, **PDFPIC**, to include a PDF graphic in a document using features of the **pdf** output driver. For other output devices, **PDFPIC** calls **PSPIC**, with which it shares an interface (see below). This macro file is normally loaded at startup by the *troffrc* file.
- pic* supplies definitions of the macros **PS**, **PE**, and **PF**, usable with the *pic(1)* preprocessor. They center each picture. Use it if your document does not use a full-service macro package, or that package does not supply working *pic* macro definitions. Except for *man* and *mdoc*, those provided with *groff* already do so (exception: *mm* employs the name **PF** for a different purpose).
- pspic* provides a macro, **PSPIC**, that includes a PostScript graphic in a document. The **ps**, **dvi**, **html**, and **xhtml** output devices support such inclusions; for all other drivers, the image is replaced with a rectangular border of the same size. This macro file is automatically loaded at startup by the *troffrc* file.

Its syntax is as follows.

```
.PSPIC [-L|-R|-C|-I n] file [width [height]]
```

*file* is the name of the PostScript file; *width* and *height* give the desired width and height of the image. If neither a *width* nor a *height* argument is specified, the image’s natural width (as given in the file’s bounding box) or the current line length is used as the width, whatever is smaller. The *width* and *height* arguments may have scaling units attached; the default scaling unit is **i**. **PSPIC** scales the graphic uniformly in the horizontal and vertical directions so that it is no more than *width* wide and *height* high. Option **-C** centers the graphic horizontally; this is the default. **-L** and **-R** left- and right-align the graphic, respectively. **-I** indents the graphic by *n* (with a default scaling unit of **m**).

To use **PSPIC** within a diversion, we recommend extending it with the following code, assuring that the diversion’s width completely covers the image’s width.

```
.am PSPIC
. vpt 0
\h' (\n[ps-offset]u + \n[ps-deswid]u) '
. sp -1
. vpt 1
..
```

Failure to load **PSPIC**’s image argument is not an error. (The **psbb** request does issue an error diagnostic.) To make such a failure fatal, append to the **pspic\*error-hook** macro.

```
.am pspic*error-hook
. ab
..
```

- ptx* provides a single macro, **xx**, to format permuted index entries as produced by the GNU *ptx*(1) program. If you need different formatting, copy the macro into your document and adapt it to your needs.
- rfc1345* defines special character escape sequences named for the glyph mnemonics specified in RFC 1345 and the digraph table of the Vim text editor. See [groff\\_rfc1345\(7\)](#).
- sboxes* offers a simple interface to the “**pdf: background**” device control command supported by [gropdf\(1\)](#). Using this package, *groff ms* documents can draw colored rectangles beneath any output.

**.BOXSTART SHADED *color* OUTLINED *color* INDENT *size* WEIGHT *size***

begins a box, where the argument after **SHADED** gives the fill color and that after **OUTLINED** the border color. Omit the former to get a borderless filled box and the latter for a border with no fill. The specified **WEIGHT** is used if the box is **OUTLINED**.

**INDENT** precedes a value which leaves a gap between the border and the contents inside the box.

Each *color* must be a defined *groff* color name, and each *size* a valid *groff* numeric expression. The keyword/value pairs can be specified in any order.

Boxes can be stacked, so you can start a box within another box; usually the later boxes would be smaller than the containing box, but this is not enforced. When using **BOXSTART**, the left position is the current indent minus the **INDENT** in the command, and the right position is the left position (calculated above) plus the current line length and twice the indent.

**.BOXSTOP**

takes no parameters. It closes the most recently started box at the current vertical position after adding its **INDENT** spacing.

Your *groff* documents can conditionally exercise the *sboxes* macros. The register **GSBOX** is defined if the package is loaded, and interpolates a true value if the **pdf** output device is in use.

*sboxes* furthermore hooks into the [groff\\_ms\(7\)](#) package to receive notifications when footnotes are growing, so that it can close boxes on a page before footnotes are printed. When that condition obtains, *sboxes* will close open boxes two points above the footnote separator and re-open them on the next page. (This amount probably will not match the box’s **INDENT**.)

See “Using PDF boxes with *groff* and the *ms* macros” (<file:///usr/local/share/doc/groff-1.23.0/msboxes.pdf>) for a demonstration.

- trace* aids the debugging of *groff* documents by tracing macro calls. See [groff\\_trace\(7\)](#).
- www* defines macros corresponding to HTML elements. See [groff\\_www\(7\)](#).

## Naming

AT&T *nroff* and *troff* were implemented before the conventions of the modern C *getopt*(3) call evolved, and used a naming scheme for macro packages that looks odd to modern eyes. Macro packages were typically loaded using the **-m** option to the formatter; when directly followed by its argument without an intervening space, this looked like a long option preceded by a single minus—a sensation in the computer stone age. Macro packages therefore came to be known by names that started with the letter “m”, which was omitted from the name of the macro file as stored on disk. For example, the manuscript macro package was stored as *tmac.s* and loaded with the option **-ms**.

*groff* commands permit space between an option and its argument. The syntax “**groff -m s**” makes the macro file name more clear but may be jarring to users familiar with the original convention, unaware that the package’s “real” name was “s” all along. For such packages of long pedigree, *groff* accommodates dif-

ferent users' expectations by supplying wrapper macro files that load the desired file with **mso** requests. Thus, all of “**groff -m s**”, “**groff -m ms**”, “**groff -ms**”, and “**groff -mms**” serve to load the manuscript macros.

Wrappers are not provided for packages of more recent vintage. For example, the *www* package may be requested at the command line only with “**groff -m www**” or “**groff -mwww**”.

As noted in passing above, AT&T *troff* named macro files in the form *tmac.name*. It has since become conventional in operating systems to use a suffixed file name extension to suggest a file type or format. *troff*'s **-m** option and **mso** request attempt to load a macro package using either naming convention; if one fails, the other is tried.

## Inclusion

There are several ways to use a macro package in a document. The classical way is to specify the troff/groff option **-m name** at run time; this makes the contents of the macro package *name* available. In groff, the file name *tmac* is searched within the tmac path; if not found, *tmac.name* is searched for instead.

Alternatively, it is also possible to include a macro file by adding the request **.so filename** to the document; the argument must be the full file name of an existing file, possibly with the directory where it is kept. In groff, this was improved by the similar request **.mso package**, which added searching in the tmac path, just like option **-m** does.

In order to resolve the **.so** and **.mso** requests, the roff preprocessor *soelim(1)* must be called if the files to be included need preprocessing. This can be done either directly by a pipeline on the command line or by giving the formatter the **-s** option. *man(1)* calls *soelim* automatically.

For example, suppose a macro file is stored as

```
/usr/local/share/groff/1.23.0/tmac/macros.tmac
```

and is used in some document called *docu.roff*.

At run time, the formatter call for this is

```
sh# groff -m macros docu.roff
```

To include the macro file directly in the document, use either

```
.mso macros.tmac
```

or

```
.so /usr/local/share/groff/1.23.0/tmac/macros.tmac
```

In both cases, the formatter should be called with option **-s** to invoke *soelim*.

```
sh# groff -s docu.roff
```

## Writing macros

A *roff(7)* document is a text file that is enriched by predefined formatting constructs, such as requests, escape sequences, strings, numeric registers, and macros from a macro package. These elements are described in *roff(7)*.

To give a document a personal style, it is most useful to extend the existing elements by defining some macros for repeating tasks; the best place for this is near the beginning of the document or in a separate file.

Macros without arguments are just like strings. But the full power of macros occurs when arguments are passed with a macro call. Within the macro definition, the arguments are available as the escape sequences **\\$1**, ..., **\\$9**, **\\$[. ..]**, **\\$\***, and **\\$@**, the name under which the macro was called is in **\\$0**, and the number of arguments is in register **\n[. \$]**; see *groff(7)*.

### Draft mode

Writing groff macros is easy when the escaping mechanism is temporarily disabled. In groff, this is done by enclosing the macro definition(s) within a pair of **.eo** and **.ec** requests. Then the body in the macro definition is just like a normal part of the document — text enhanced by calls of requests, macros, strings, registers, etc. For example, the code above can be written in a simpler way by

```
.eo
.ds midpart was called with the following
.de print_args
\f[I]\$0\f[] \*[midpart] \n[.] arguments:
\$*
..
.ec
```

Unfortunately, draft mode cannot be used universally. Although it is good enough for defining normal macros, draft mode fails with advanced applications, such as indirectly defined strings, registers, etc. An optimal way is to define and test all macros in draft mode and then do the backslash doubling as a final step; do not forget to remove the `.eo` request.

### Tips for macro definitions

- Start every line with a dot, for example, by using the groff request `.nop` for text lines, or write your own macro that handles also text lines with a leading dot.

```
.de Text
.  if (\\n[.] == 0) \
.    return
.  nop \\$*\
..
```

- Write a comment macro that works both for copy and draft modes; since the escape character is off in draft mode, trouble might occur when comment escape sequences are used. For example, the following macro just ignores its arguments, so it acts like a comment line:

```
.de c
..
.c This is like a comment line.
```

- In long macro definitions, make ample use of comment lines or almost-empty lines (this is, lines which have a leading dot and nothing else) for a better structuring.
- To increase readability, use groff's indentation facility for requests and macro calls (arbitrary whitespace after the leading dot).

### Diversions

Diversions can be used to implement quite advanced programming constructs. They are comparable to pointers to large data structures in the C programming language, but their usage is quite different.

In their simplest form, diversions are multi-line strings, but diversions get their power when used dynamically within macros. The (formatted) information stored in a diversion can be retrieved by calling the diversion just like a macro.

Most of the problems arising with diversions can be avoided if you remember that diversions always store complete lines. Using diversions when the line buffer has not been flushed produces strange results; not knowing this, many people get desperate about diversions. To ensure that a diversion works, add line breaks at the right places. To be safe, enclose everything that has to do with diversions within a pair of line breaks; for example, by explicitly using `.br` requests. This rule should be applied to diversion definition, both inside and outside, and to all calls of diversions. This is a bit of overkill, but it works nicely.

(If you really need diversions which should ignore the current partial line, use environments to save the current partial line and/or use the `.box` request.)

The most powerful feature using diversions is to start a diversion within a macro definition and end it within another macro. Then everything between each call of this macro pair is stored within the diversion and can be manipulated from within the macros.

### Authors

This document was written by Bernd Warken <groff-bernd.warcken-72@web.de>, Werner Lemberg <wl@gnu.org>, and G. Branden Robinson <g.branden.robinson@gmail.com>.

**See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

The Filesystem Hierarchy Standard (<https://wiki.linuxfoundation.org/lsh/fhs>) is maintained by the Linux Foundation.

*groff(1)* is an overview of the *groff* system.

*groff\_man(7)*,

*groff\_mdoc(7)*,

*groff\_me(7)*,

*groff\_mm(7)*,

*groff\_mom(7)*,

*groff\_ms(7)*,

*groff\_rfc1345(7)*,

*groff\_trace(7)*,

and

*groff\_www(7)*

are *groff* macro packages.

*groff(7)* summarizes the language recognized by GNU *troff*.

**Name**

lj4\_font – groff fonts for use with devlj4

**Description**

Nominally, all Hewlett-Packard LaserJet 4-series and newer printers have the same internal fonts: 45 scalable fonts and one bitmapped Lineprinter font. The scalable fonts are available in sizes between 0.25 points and 999.75 points, in 0.25-point increments; the Lineprinter font is available only in 8.5-point size.

The LaserJet font files included with *groff* assume that all printers since the LaserJet 4 are identical. There are some differences between fonts in the earlier and more recent printers, however. The LaserJet 4 printer used Agfa Intellifont technology for 35 of the internal scalable fonts; the remaining 10 scalable fonts were TrueType. Beginning with the LaserJet 4000-series printers introduced in 1997, all scalable internal fonts have been TrueType. The number of printable glyphs differs slightly between Intellifont and TrueType fonts (generally, the TrueType fonts include more glyphs), and there are some minor differences in glyph metrics. Differences among printer models are described in the *PCL 5 Comparison Guide* and the *PCL 5 Comparison Guide Addendum* (for printers introduced since approximately 2001).

LaserJet printers reference a glyph by a combination of a 256-glyph symbol set and an index within that symbol set. Many glyphs appear in more than one symbol set; all combinations of symbol set and index that reference the same glyph are equivalent. For each glyph, *hpfodit(1)* searches a list of symbol sets, and selects the first set that contains the glyph. The printing code generated by *hpfodit* is an integer that encodes a numerical value for the symbol set in the high byte(s), and the index in the low byte. See [groff\\_font\(5\)](#) for a complete description of the font file format; symbol sets are described in greater detail in the *PCL 5 Printer Language Technical Reference Manual*.

Two of the scalable fonts, Symbol and Wingdings, are bound to 256-glyph symbol sets; the remaining scalable fonts, as well as the Lineprinter font, support numerous symbol sets, sufficient to enable printing of more than 600 glyphs.

The metrics generated by *hpfodit* assume that the *DESC* file contains values of 1200 for *res* and 6350 for *unitwidth*, or any combination (e.g., 2400 and 3175) for which  $res \times unitwidth = 7\,620\,000$ . Although HP PCL 5 LaserJet printers support an internal resolution of 7200 units per inch, they use a 16-bit signed integer for cursor positioning; if **devlj4** is to support U.S. ledger paper (11 in  $\times$  17 in; in = inch), the maximum usable resolution is  $32\,767 \div 17$ , or 1927 units per inch, which rounds down to 1200 units per inch. If the largest required paper size is less (e.g., 8.5 in  $\times$  11 in, or A5), a greater *res* (and lesser *unitwidth*) can be specified.

**Limitations**

Font metrics for Intellifont fonts were provided by Tagged Font Metric (TFM) files originally developed by Agfa/Compugraphic. The TFM files provided for these fonts supported 600+ glyphs and contained extensive lists of kerning pairs.

To accommodate developers who had become accustomed to TFM files, HP also provided TFM files for the 10 TrueType fonts included in the LaserJet 4. The TFM files for TrueType fonts generally included less information than the Intellifont TFMs, supporting fewer glyphs, and in most cases, providing no kerning information. By the time the LaserJet 4000 printer was introduced, most developers had migrated to other means of obtaining font metrics, and support for new TFM files was very limited. The TFM files provided for the TrueType fonts in the LaserJet 4000 support only the Latin 2 (ISO 8859-2) symbol set, and include no kerning information; consequently, they are of little value for any but the most rudimentary documents.

Because the Intellifont TFM files contain considerably more information, they generally are preferable to the TrueType TFM files even for use with the TrueType fonts in the newer printers. The metrics for the TrueType fonts are very close, though not identical, to those for the earlier Intellifont fonts of the same names. Although most output using the Intellifont metrics with the newer printers is quite acceptable, a few glyphs may fail to print as expected. The differences in glyph metrics may be particularly noticeable with composite parentheses, brackets, and braces used by [eqn\(1\)](#). A script, located in `/usr/local/share/groff/1.23.0/font/devlj4/generate`, can be used to adjust the metrics for these glyphs in the special font “S” for use with printers that have all TrueType fonts.

At the time HP last supported TFM files, only version 1.0 of the Unicode standard was available. Conse-

quently, many glyphs lacking assigned code points were assigned by HP to the Private Use Area (PUA). Later versions of the Unicode standard included code points outside the PUA for many of these glyphs. The HP-supplied TrueType TFM files use the PUA assignments; TFM files generated from more recent TrueType font files require the later Unicode values to access the same glyphs. Consequently, two different mapping files may be required: one for the HP-supplied TFM files, and one for more recent TFM files.

## Files

*/usr/local/share/groff/1.23.0/font/devlj4/DESC*

describes the **lj4** output device.

*/usr/local/share/groff/1.23.0/font/devlj4/F*

describes the font known as *F* on device **lj4**.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/Makefile*

is a *make(1)* script that uses *hpftodit(1)* to prepare the foregoing font description files from HP TFM data; it can be used to regenerate the *groff* font descriptions in the event the TFM files are updated.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/special.awk*

is an *awk(1)* script that corrects the Intellifont-based height metrics for several glyphs in the **S** (special) font for TrueType CG Times used in the HP LaserJet 4000 and later.

*/usr/local/share/groff/1.23.0/font/devlj4/generate/special.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/symbol.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/text.map*

*/usr/local/share/groff/1.23.0/font/devlj4/generate/wingdings.map*

map MSL indices and HP Unicode Private Use Area assignments to *groff* special character identifiers.

## See also

*groff(1)*, *hpftodit(1)*, *grolj4(1)*, *groff\_font(5)*

**Name**

groff – GNU roff language reference

**Description**

*groff* is short for GNU *roff*, a free reimplemention of the AT&T device-independent *troff* typesetting system. See [roff\(7\)](#) for a survey of and background on *roff* systems.

This document is intended as a reference. The primary *groff* manual, *Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is a better resource for learners, containing many examples and much discussion. It is written in Texinfo; you can browse it interactively with “info groff”. Additional formats, including plain text, HTML, DVI, and PDF, may be available in `/usr/local/share/doc/groff-1.23.0`.

*groff* is also a name for an extended dialect of the *roff* language. We use “roff” to denote features that are universal, or nearly so, among implementations of this family. We apply the term “groff” to the language documented here, the GNU implementation of the overall system, the project that develops that system, and the command of that name.

GNU *troff*, installed on this system as [troff\(1\)](#), is the *formatter*: a program that reads device and font descriptions ([groff\\_font\(5\)](#)), interprets the *groff* language expressed in text input files, and translates that input into a device-independent output format ([groff\\_out\(5\)](#)) that is usually then post-processed by an output driver to produce PostScript, PDF, HTML, DVI, or terminal output.

**Input format**

Input to *troff* must be in one of two character encodings it can recognize: IBM code page 1047 on EBCDIC systems, and ISO Latin-1 (8859-1) otherwise. Use of ISO 646-1991:IRV (“US-ASCII”) or (equivalently) the “Basic Latin” subset of ISO 10646 (“Unicode”) is recommended; see [groff\\_char\(7\)](#). [groff\(1\)](#) and the [preconv\(1\)](#) preprocessor can transform other encodings, including UTF-8, to satisfy *troff*’s requirements.

*groff* input is organized into lines separated by the Unix newline character (U+000A).

**Syntax characters**

Several input characters are syntactically significant to *groff*.

- A dot at the beginning of an input line marks it as a *control line*. It can also follow the **.el** and **.nop** requests, and the condition in **.if**, **.ie**, and **.while** requests. The control character invokes requests and calls macros by the name that follows it. The **.cc** request can change the control character.
- ' The neutral apostrophe is recognized where the control character is; it is the *no-break control character*. It works as the control character does, but suppresses the break implied by the **.bp**, **.cf**, **.fi**, **.fl**, **.in**, **.nf**, **.rj**, **.sp**, **.ti**, **.trf**, requests. If the no-break control character is used with any of these requests, *troff* suppresses the break; instead the requested operation takes effect at the next break. It makes **.br** nilpotent. The no-break control character can be changed with the **.c2** request. When formatted, “'” may be typeset as a typographical quotation mark; use the `\[aq]` special character escape sequence to format a neutral apostrophe glyph.
- " The neutral double quote can be used to enclose arguments to macros and strings, and is required if those arguments contain space or tab characters. In the **.ds**, **.ds1**, **.as**, and **.as1** requests, a leading double quote in the second argument is stripped off, enabling the inclusion of leading space characters in the string definition or appendment. To include a double quote inside a quoted argument, use the `\[dq]` special character escape sequence (which also serves to typeset the glyph in text).
- \ A backslash introduces an escape sequence. The escape character can be changed with the **.ec** request; **.eo** disables escape sequence recognition. Use the `\[rs]` special character escape sequence to format a backslash glyph, and `\e` to typeset the glyph of the current escape character.
- ( An opening parenthesis is special only in certain escape sequences; when recognized, it introduces an argument of exactly two characters. *groff* offers the more flexible square bracket syntax.
- [ An opening bracket is special only in certain escape sequences; when recognized, it introduces an argument (list) of any length, not including a closing bracket.

- ] A closing bracket is special only when an escape sequence using an opening bracket as an argument delimiter is being interpreted. It ends the argument (list).

Horizontal white space characters are significant to *groff*, but trailing spaces on text lines are ignored.

*space* Space characters separate arguments in request invocations, macro calls, and string interpolations. In text, they separate words. Multiple adjacent space characters in text cause *groff* to attempt end-of-sentence detection on the preceding word (and trailing punctuation). The amount of space between words and sentences is controlled by the `.ss` request. When filling is enabled (the default), a line may be broken at a space. When adjustment is enabled and set to both margins (the default), inter-word spaces may be expanded to justify the line. An adjustable but non-breaking space is available with `\~`. To get a space of fixed width, use one of the escape sequences `'\ '` (the escape character followed by a space), `\0`, `\|`, `\^`, or `\h`; see section “Escape sequences” below.

*newline* In text, a newline puts an inter-word space onto the output and, if filling is enabled, triggers end-of-sentence recognition on the preceding text. See section “Line continuation” below.

*tab* A tab character in text causes the drawing position to advance to the next defined tab stop.

### Line continuation

The *roff* language distinguishes input and output line continuation.

A backslash `\` immediately followed by a newline, sometimes discussed as *newline*, suppresses the effects of that newline on the input. The next input line thus retains the classification of its predecessor as a control or text line. *newline* is useful for managing line lengths in the input during document maintenance; you can break an input line in the middle of a request invocation, macro call, or escape sequence. Input line continuation is invisible to the formatter, with two exceptions: the `|` operator recognizes the new input line, and the input line counter register `.c` is incremented.

The `\c` escape sequence continues an *output* line. Nothing on the input line after it is formatted. In contrast to *newline*, a line after `\c` is treated as a new input line, so a control character is recognized at its beginning. The visual results depend on whether filling is enabled. An intervening control line that causes a break overrides `\c`, flushing out the pending output line in the usual way. The register `.int` contains a positive value if the last output line was continued with `\c`; this datum is associated with the environment.

### Colors

*groff* supports color output with a variety of color spaces and up to 16 bits per channel. Some devices, particularly terminals, may be more limited. When color support is enabled, two colors are current at any given time: the *stroke color*, with which glyphs, rules (lines), and geometric objects like circles and polygons are drawn, and the *fill color*, which can be used to paint the interior of a closed geometric figure. The `color`, `defcolor`, `gcolor`, and `fgcolor` requests; `\m` and `\M` escape sequences; and `.color`, `.m`, and `.M` registers exercise color support.

Each output device has a color named “**default**”, which cannot be redefined. A device’s default stroke and fill colors are not necessarily the same. For the `dvi`, `html`, `pdf`, `ps`, and `xhtml` output devices, *troff* automatically loads a macro file defining many color names at startup. By the same mechanism, the devices supported by *grotty*(1) recognize the eight standard ISO 6429/ECMA-48 color names (also known vulgarly as “ANSI colors”).

### Measurements

A *numerical value* is an integer or decimal fraction with an optional scaling unit appended. They are used to express measurements or dimensionless quantities. A *scaling unit* is a one-letter abbreviation for a unit of measurement.

The *groff* language defines the following scaling units.

<b>c</b>	centimeter
<b>i</b>	inch
<b>P</b>	pica = 1/6 inch
<b>p</b>	point = 1/72 inch

<b>m</b>	em = the font size in points (approx. width of letter ‘m’)
<b>M</b>	100th of an em
<b>n</b>	en = em/2
<b>u</b>	Basic unit for output device
<b>v</b>	vee (vertical line space)
<b>s</b>	scaled point = 1/ <i>sizescale</i> of a point (defined in font <i>DESC</i> file)
<b>f</b>	multiply by 65,536 (used with color components)

## Numeric expressions

A *numeric expression* is a syntactic structure, recognized only in specific contexts, that evaluates to an integer: it can be as simple as a literal “0” or it can be a complex sequence of register and string interpolations interleaved with operators.

+	addition
–	subtraction
*	multiplication
/	truncating division
%	modulo
<hr/>	
unary +	assertion, motion, incrementation
unary –	negation, motion, decrementation
<hr/>	
( <i>c</i> ; <i>e</i> )	scaling
>?	maximum
<?	minimum
<hr/>	
<	less than
>	greater than
<=	less than or equal
>=	greater than or equal
=	equal
==	equal
<hr/>	
&	logical conjunction (“and”)
:	logical disjunction (“or”)
!	logical complementation (“not”)
<hr/>	
( )	precedence
<hr/>	
	boundary-relative motion

*troff* provides a set of mathematical and logical operators familiar to programmers—as well as some unusual ones—but supports only integer arithmetic. (Provision is made for interpreting and reporting decimal fractions in certain cases.) The internal data type used for computing results is usually a 32-bit signed integer, which suffices to represent magnitudes within a range of  $\pm 2$  billion. (If that’s not enough, see [groff\\_tmac\(5\)](#) for the *62bit.tmac* macro package.)

Arithmetic infix operators perform a function on the numeric expressions to their left and right; they are + (addition), – (subtraction), \* (multiplication), / (truncating division), and % (modulo). *Truncating division* rounds to the integer nearer to zero, no matter how large the fractional portion. Overflow and division (or modulo) by zero are errors and abort evaluation of a numeric expression.

Arithmetic unary operators operate on the numeric expression to their right; they are – (negation) and + (assertion—for completeness; it does nothing). The unary minus must often be used with parentheses to avoid confusion with the decrementation operator, discussed below.

The sign of the modulo of operands of mixed signs is determined by the sign of the first. Division and modulo operators satisfy the following property: given a dividend *a* and a divisor *b*, a quotient *q* formed by “**(a / b)**” and a remainder *r* by “**(a % b)**”, then  $qb + r = a$ .

GNU *troff*’s scaling operator (*c*; *e*) evaluates a numeric expression *e* using *c* as the default scaling unit. If *c* is omitted, scaling units are ignored in the evaluation of *e*. GNU *troff* also provides a pair of operators to compute the extrema of two operands: >? (maximum) and <? (minimum).

Comparison operators comprise < (less than), > (greater than), <= (less than or equal), >= (greater than or equal), and = (equal). == is a synonym for =. When evaluated, a comparison is replaced with “0” if it is false and “1” if true. In the *roff* language, positive values are true, others false.

We can operate on truth values with the logical operators & (logical conjunction or “and”) and : (logical disjunction or “or”). They evaluate as comparison operators do. A logical complementation (“not”) operator, !, works only within “if”, “ie”, and “while” requests. Furthermore, ! is recognized only at the beginning of a numeric expression not contained by another numeric expression. In other words, it must be the “outermost” operator. Including it elsewhere in the expression produces a warning in the “number” category (see *troff(1)*), and its expression evaluates false. This unfortunate limitation maintains compatibility with AT&T *troff*. You can test a numeric expression for falsity by comparing it to a false value.

The *roff* language has no operator precedence: expressions are evaluated strictly from left to right, in contrast to schoolhouse arithmetic. Use parentheses ( ) to impose a desired precedence upon subexpressions.

For many requests and escape sequences that cause motion on the page, the unary operators + and – work differently when leading a numeric expression. They then indicate a motion relative to the drawing position: positive is down in vertical contexts, right in horizontal ones.

+ and – are also treated differently by the following requests and escape sequences: **bp**, **in**, **ll**, **pl**, **pn**, **po**, **ps**, **pvs**, **rt**, **ti**, **\H**, **\R**, and **\s**. Here, leading plus and minus signs serve as incrementation and decrementation operators, respectively. To negate an expression, subtract it from zero or include the unary minus in parentheses with its argument.

A leading | operator indicates a motion relative not to the drawing position but to a boundary. For horizontal motions, the measurement specifies a distance relative to a drawing position corresponding to the beginning of the *input* line. By default, tab stops reckon movements in this way. Most escape sequences do not; | tells them to do so. For vertical movements, the | operator specifies a distance from the first text baseline on the page or in the current diversion, using the current vertical spacing.

The **\B** escape sequence tests its argument for validity as a numeric expression.

A register interpolated as an operand in a numeric expression must have an Arabic format; luckily, this is the default.

Due to the way arguments are parsed, spaces are not allowed in numeric expressions unless the (sub)expression containing them is surrounded by parentheses.

## Control structures

*groff* has “if” and “while” control structures like other languages. However, the syntax for grouping multiple input lines in the branches or bodies of these structures is unusual.

They have a common form: the request name is (except for **.el** “else”) followed by a conditional expression *cond-expr*; the remainder of the line, *anything*, is interpreted as if it were an input line. Any quantity of spaces between arguments to requests serves only to separate them; leading spaces in *anything* are therefore not seen. *anything* effectively *cannot* be omitted; if *cond-expr* is true and *anything* is empty, the new-line at the end of the control line is interpreted as a blank line (and therefore a blank text line).

It is frequently desirable for a control structure to govern more than one request, macro call, or text line, or a combination of the foregoing. The opening and closing brace escape sequences \{ and \} perform such grouping. Brace escape sequences outside of control structures have no meaning and produce no output.

\{ should appear (after optional spaces and tabs) immediately subsequent to the request’s conditional expression. \} should appear on a line with other occurrences of itself as necessary to match \{ sequences. It can be preceded by a control character, spaces, and tabs. Input after any quantity of \} sequences on the same line is only processed if all the preceding conditions to which they correspond are true. Furthermore, a \} closing the body of a **.while** request must be the last such escape sequence on an input line.

## Conditional expressions

The **.if**, **.ie**, and **.while** requests test the truth values of numeric expressions. They also support several additional Boolean operators; the members of this expanded class are termed *conditional expressions*; their truth values are as shown below.

**cond-expr... ..is true if..**


---

's1's2'	s1 produces the same formatted output as s2.
<b>c</b> g	a glyph g is available.
<b>d</b> m	a string, macro, diversion, or request m is defined.
<b>e</b>	the current page number is even.
<b>F</b> f	a font named f is available.
<b>m</b> c	a color named c is defined.
<b>n</b>	the formatter is in <i>nroff</i> mode.
<b>o</b>	the current page number is odd.
<b>r</b> n	a register named n is defined.
<b>S</b> s	a font style named s is available.
<b>t</b>	the formatter is in <i>troff</i> mode.
<b>v</b>	n/a (historical artifact; always false).

The first of the above, the *output comparison operator*, interpolates a true value if formatting its comparands *s1* and *s2* produces the same output commands. Other delimiters can be used in place of the neutral apostrophes. *troff* formats *s1* and *s2* in separate environments; after the comparison, the resulting data are discarded. The resulting glyph properties, including font family, style, size, and slant, must match, but not necessarily the requests and/or escape sequences used to obtain them. Motions must match in orientation and magnitude to within the applicable horizontal or vertical motion quantum of the device, after rounding.

Surround the comparands with `\?` to avoid formatting them; this causes them to be compared character by character, as with string comparisons in other programming languages. Since comparands protected with `\?` are read in copy mode, they need not even be valid *groff* syntax. The escape character is still lexically recognized, however, and consumes the next character.

The above operators can't be combined with most others, but a leading `!`, not followed immediately by spaces or tabs, complements an expression. Spaces and tabs are optional immediately after the `"c"`, `"d"`, `"F"`, `"m"`, `"r"`, and `"S"` operators, but right after `!`, they end the predicate and the conditional evaluates true. (This bizarre behavior maintains compatibility with AT&T *troff*.)

**Syntax reference conventions**

In the following request and escape sequence specifications, most argument names were chosen to be descriptive. A few denotations may require introduction.

<i>c</i>	denotes a single input character.
<i>font</i>	a font either specified as a font name or a numeric mounting position.
<i>anything</i>	all characters up to the end of the line, to the ending delimiter for the escape sequence, or within <code>\{</code> and <code>\}</code> . Escape sequences may generally be used freely in <i>anything</i> , except when it is read in copy mode.
<i>n</i>	is a numerical expression that evaluates to an integer value.
<i>N</i>	is an optionally-signed numerical expression.
$\pm N$	has three meanings, depending on its sign.

If a numerical expression presented as  $\pm N$  starts with a `+` sign, an increment in the amount of of *N* is applied to the value applicable to the request or escape sequence. If it starts with a `-` sign, a decrement of magnitude *N* is applied instead. Without a sign, *N* replaces any existing value. A leading minus sign in *N* is always interpreted as a decrementation operator, not an algebraic sign. To assign a register a negative value or the negated value of another register, enclose it with its operand in parentheses or subtract it from zero. If a prior value does not exist (the register was undefined), an increment or decrement is applied as if to 0.

**Requests**

In *groff*, identifier names, including those of requests, can be arbitrarily long. No bracketing or marking of long names is needed in request invocation syntax.

Most requests take one or more arguments. Tabs are permitted after a request name, before its first argument (if any), but arguments themselves must be separated only by space characters. There is no inherent limit on argument length or quantity.

Not all details of request behavior are outlined here. Refer to the *groff* Texinfo manual or *groff\_diff(7)*.

### Request short reference

- .ab** [*message*]  
Abort processing; write any *message* to the standard error stream and exit with failure status.
- .ad**  
Enable output line adjustment using mode stored in  $\backslash\mathbf{n}[\mathbf{j}]$ .
- .ad** *c*  
Enable output line adjustment in mode *c* (*c*=**b,c,l,n,r**). Sets  $\backslash\mathbf{n}[\mathbf{j}]$ .
- .af** *register c*  
Assign format *c* to *register*, where *c* is “**I**”, “**T**”, “**a**”, “**A**”, or a sequence of decimal digits whose quantity denotes the minimum width in digits to be used when the register is interpolated. “**I**” and “**a**” indicate Roman numerals and basic Latin alphabets, respectively, in the lowercase specified. The default is “0”.
- .aln** *new old*  
Create alias (additional name) *new* for existing register named *old*.
- .als** *new old*  
Create alias (additional name) *new* for existing request, string, macro, or diversion *old*.
- .am** *macro*  
Append to *macro* until **..** is encountered.
- .am** *macro end*  
Append to *macro* until *.end* is called.
- .am1** *macro*  
Same as **.am** but with compatibility mode switched off during macro expansion.
- .am1** *macro end*  
Same as **.am** but with compatibility mode switched off during macro expansion.
- .ami** *macro*  
Append to a macro whose name is contained in the string *macro* until **..** is encountered.
- .ami** *macro end*  
Append to a macro indirectly. *macro* and *end* are strings whose contents are interpolated for the macro name and the end macro, respectively.
- .ami1** *macro*  
Same as **.ami** but with compatibility mode switched off during macro expansion.
- .ami1** *macro end*  
Same as **.ami** but with compatibility mode switched off during macro expansion.
- .as** *name* [*string*]  
Append *string* to the string *name*; no operation if *string* is omitted.
- .as1** *name* [*string*]  
Same as **.as** but with compatibility mode switched off during string expansion.
- .asciify** *diversion*  
Unformat ASCII characters, spaces, and some escape sequences in *diversion*.
- .backtrace**  
Write a backtrace of the input stack to the standard error stream. Also see the **-b** option of *groff(1)*.
- .bd** *font N*  
Embolden *font* by *N*-1 units.
- .bd** *S font N*  
Embolden Special Font *S* when current font is *font*.
- .blm**  
Unset blank line macro (trap). Restore default handling of blank lines.
- .blm** *name*  
Set blank line macro (trap) to *name*.
- .box**  
Stop directing output to current diversion; any pending output line is discarded.
- .box** *name*  
Direct output to diversion *name*, omitting a partially collected line.
- .boxa**  
Stop appending output to current diversion; any pending output line is discarded.

- .boxa** *name*  
Append output to diversion *name*, omitting a partially collected line.
- .bp**  
Eject current page and begin new page.
- .bp ±N**  
Eject current page; next page number ±N.
- .br**  
Line break.
- .brp**  
Break output line; adjust if applicable.
- .break**  
Break out of a while loop.
- .c2**  
Reset no-break control character to “**r**”.
- .c2 c**  
Set no-break control character to *c*.
- .cc**  
Reset control character to ‘.’.
- .cc c**  
Set control character to *c*.
- .ce**  
Center the next input line.
- .ce N**  
Center following *N* input lines.
- .cf filename**  
Copy contents of file *filename* unprocessed to stdout or to the diversion.
- .cflags n c1 c2 ...**  
Assign properties encoded by the number *n* to characters *c1*, *c2*, and so on.
- .ch name [N]**  
Change a planted page location trap *name* by moving its location to *N*, or by unplanted it altogether if *N* is absent.
- .char c anything**  
Define entity *c* as string *anything*.
- .chop object**  
Remove the last character from the macro, string, or diversion named *object*.
- .class name c1 c2 ...**  
Define a (character) class *name* comprising the characters or range expressions *c1*, *c2*, and so on.
- .close stream**  
Close the *stream*.
- .color**  
Enable output of color-related device-independent output commands.
- .color N**  
If *N* is zero, disable output of color-related device-independent output commands; otherwise, enable them.
- .composite from to**  
Map glyph name *from* to glyph name *to* while constructing a composite glyph name.
- .continue**  
Finish the current iteration of a while loop.
- .cp**  
Enable compatibility mode.
- .cp N**  
If *N* is zero disable compatibility mode, otherwise enable it.
- .cs font N M**  
Set constant character width mode for *font* to *N*/36 ems with em *M*.
- .cu N**  
Continuous underline in nroff, like **.ul** in troff.
- .da**  
Stop appending output to current diversion.
- .da name**  
Append output to diversion *name*.
- .de macro**  
Define or redefine *macro* until “**..**” occurs at the start of a control line in the current conditional block.
- .de macro end**  
Define or redefine *macro* until *.end* is called at the start of a control line in the current conditional block.
- .del macro**  
As **.de**, but disable compatibility mode during macro expansion.

- .del** *macro end*  
As **.de** *macro end*, but disable compatibility mode during macro expansion.
- .defcolor** *ident scheme color-component ...*  
Define a color named *ident*. *scheme* identifies a color space and determines the number of required *color-components*; it must be one of “**rgb**” (three components), “**cmj**” (three), “**cmjk**” (four), or “**gray**” (one). “**grey**” is accepted as a synonym of “**gray**”. The color components can be encoded as a single hexadecimal value starting with # or ##. The former indicates that each component is in the range 0–255 (0–FF), the latter the range 0–65,535 (0–FFFF). Alternatively, each color component can be specified as a decimal fraction in the range 0–1, interpreted using a default scaling unit of “**F**”, which multiplies its value by 65,536 (but clamps it at 65,535). Each output device has a color named “**default**”, which cannot be redefined. A device’s default stroke and fill colors are not necessarily the same.
- .dei** *macro*  
Define macro indirectly. As **.de**, but use interpolation of string *macro* as the name of the defined macro.
- .dei** *macro end*  
Define macro indirectly. As **.de**, but use interpolations of strings *macro* and *end* as the names of the defined and end macros.
- .deil** *macro*  
As **.dei**, but disable compatibility mode during macro expansion.
- .deil** *macro end*  
As **.dei** *macro end*, but disable compatibility mode during macro expansion.
- .device** *anything*  
Write *anything*, read in copy mode, to the intermediate output as a device control command.
- .devicem** *name*  
Write contents of macro or string *name* to the intermediate output as a device control command.
- .di**  
Stop directing output to current diversion.
- .di** *name*  
Direct output to diversion *name*.
- .do** *name ...*  
Interpret the string, request, diversion, or macro *name* (along with any arguments) with compatibility mode disabled. Compatibility mode is restored (only if it was active) when the *expansion* of *name* is interpreted.
- .ds** *name* [*string*]  
Define a string variable *name* with contents *string*, or as empty if *string* is omitted.
- .ds1** *name* [*string*]  
Same as **.ds** but with compatibility mode switched off during string expansion.
- .dt**  
Clear diversion trap.
- .dt** *N name*  
Set diversion trap to macro *name* at position *N* (default scaling indicator ▼).
- .ec**  
Set escape character to ‘\’.
- .ec** *c*  
Set escape character to *c*.
- .ecr**  
Restore escape character saved with **.ecs**.
- .ecs**  
Save current escape character.
- .el** *anything*  
Interpret *anything* as if it were an input line if the conditional expression of the corresponding **.ie** request was false.
- .em** *name*  
Call macro *name* after the end of input.
- .eo**  
Unset escape character, turning off escape sequence interpretation.
- .ev**  
Pop environment stack, returning to previous one.

- .ev** *env* Push current environment onto stack and switch to *env*.
- .evc** *env* Copy environment *env* to the current one.
- .ex** Exit with successful status.
- .fam** Return to previous font family.
- .fam** *name*  
Set the current font family to *name*.
- .fc** Disable field mechanism.
- .fc** *a* Set field delimiter to *a* and pad glyph to space.
- .fc** *a b* Set field delimiter to *a* and pad glyph to *b*.
- .fchar** *c anything*  
Define fallback character (or glyph) *c* as string *anything*.
- .fcolor** Restore previous fill color.
- .fcolor** *c*  
Set fill color to *c*.
- .fi** Enable filling of output lines; a pending output line is broken. Sets **\n[u]**.
- .fl** Flush output buffer.
- .fp** *n font*  
Mount *font* at position *n*.
- .fp** *n internal external*  
Mount font with description file *external* under the name *internal* at position *n*.
- .fschar** *f c anything*  
Define fallback character (or glyph) *c* for font *f* as string *anything*.
- .fspecial** *font*  
Reset list of special fonts for *font* to be empty.
- .fspecial** *font s1 s2 ...*  
When the current font is *font*, then the fonts *s1*, *s2*, ... are special.
- .ft** Select previous style or font; same as **\f[]** or **\FP**.
- .ft** *font* Select style, font name, or mounting position *font*; same as **\f[font]** escape sequence.
- .ftr** *font1 font2*  
Translate *font1* to *font2*.
- .fzoom** *font*  
Don't magnify *font*.
- .fzoom** *font zoom*  
Set zoom factor for *font* (in multiples of 1/1000th).
- .gcolor** Restore previous stroke color.
- .gcolor** *c*  
Set stroke color to *c*.
- .hc** Reset the hyphenation character to **\%** (the default).
- .hc** *char* Change the hyphenation character to *char*.
- .hcode** *c1 code1 [c2 code2] ...*  
Set the hyphenation code of character *c1* to *code1*, that of *c2* to *code2*, and so on.
- .hla** *lang*  
Set the hyphenation language to *lang*.
- .hlm** *n* Set the maximum quantity of consecutive hyphenated lines to *n*.
- .hpf** *pattern-file*  
Read hyphenation patterns from *pattern-file*.
- .hpfa** *pattern-file*  
Append hyphenation patterns from *pattern-file*.
- .hpfcodes** *a b [c d] ...*  
Define mapping values for character codes in pattern files read with the **.hpf** and **.hpfa** requests.
- .hw** *word ...*  
Define how each *word* is to be hyphenated, with each hyphen “-” indicating a hyphenation point.

- .hy** Set automatic hyphenation mode to **1**.
- .hy 0** Disable automatic hyphenation; same as **.nh**.
- .hy mode** Set automatic hyphenation mode to *mode*; see section “Hyphenation” below.
- .hym** Set the (right) hyphenation margin to **0** (the default).
- .hym length** Set the (right) hyphenation margin to *length* (default scaling indicator **m**).
- .hys** Set the hyphenation space to **0** (the default).
- .hys hyphenation-space** Suppress hyphenation of the line in adjustment modes “**b**” or “**n**” if it can be justified by adding no more than *hyphenation-space* extra space to each inter-word space (default scaling indicator **m**).
- .ie cond-expr anything** If *cond-expr* is true, interpret *anything* as if it were an input line, otherwise skip to a corresponding **.el** request.
- .if cond-expr anything** If *cond-expr* is true, then interpret *anything* as if it were an input line.
- .ig** Ignore input (except for side effects of **\R** on auto-incrementing registers) until “**..**” occurs at the start of a control line in the current conditional block.
- .ig end** Ignore input (except for side effects of **\R** on auto-incrementing registers) until *.end* is called at the start of a control line in the current conditional block.
- .in** Change to previous indentation value.
- .in ±N** Change indentation according to  $\pm N$  (default scaling indicator **m**).
- .it n name** Set an input trap, calling macro *name*, after the next *n* lines of input that directly produce formatted output have been read.
- .itc n name** As **.it**, but lines interrupted with the **\c** escape sequence are not applied to the line count.
- .kern** Enable pairwise kerning.
- .kern n** If *n* is zero, disable pairwise kerning, otherwise enable it.
- .lc** Remove leader repetition glyph.
- .lc c** Set leader repetition glyph to *c* (default: “.”).
- .length reg anything** Compute the number of characters of *anything* and store the count in the register *reg*.
- .linetabs** Enable line-tabs mode (calculate tab positions relative to beginning of output line).
- .linetabs 0** Disable line-tabs mode.
- .lf N** Set input line number to *N*.
- .lf N file** Set input line number to *N* and filename to *file*.
- .lg N** Ligature mode on if  $N > 0$ .
- .ll** Change to previous line length.
- .ll ±N** Set line length according to  $\pm N$  (default length 6.5 **i**, default scaling indicator **m**).
- .lsm** Unset the leading space macro (trap). Restore default handling of lines with leading spaces.
- .lsm name** Set the leading space macro (trap) to *name*.
- .ls** Change to the previous value of additional intra-line skip.
- .ls N** Set additional intra-line skip value to *N*, i.e.,  $N-1$  blank lines are inserted after each text output line.
- .lt ±N** Length of title (default scaling indicator **m**).
- .mc** Margin glyph off.

- .mc** *c* Print glyph *c* after each text line at actual distance from right margin.
- .mc** *c N* Set margin glyph to *c* and distance to *N* from right margin (default scaling indicator **m**).
- .mk** [*register*] Mark current vertical position in *register*, or in an internal register used by **.rt** if no argument.
- .mso** *file* As **.so**, except that *file* is sought in the *tmac* directories.
- .msoquiet** *file* As **.mso**, but no warning is emitted if *file* does not exist.
- .na** Disable output line adjustment.
- .ne** Need a one-line vertical space.
- .ne** *N* Need *N* vertical space (default scaling indicator **v**).
- .nf** Disable filling of output lines; a pending output line is broken. Clears **\n[u]**.
- .nh** Disable automatic hyphenation; same as "**.hy 0**".
- .nm** Number mode off.
- .nm**  $\pm N$  [*M* [*S* [*I*]]] In line number mode, set number, multiple, spacing, and indentation.
- .nn** Do not number next line.
- .nn** *N* Do not number next *N* lines.
- .nop** *anything* Interpret *anything* as if it were an input line.
- .nr** *register*  $\pm N$  [*M*] Define or modify *register* using  $\pm N$  with auto-increment *M*.
- .nroff** Make the built-in conditions **n** true and **t** false.
- .ns** Turn on no-space mode.
- .nx** Immediately jump to end of current file.
- .nx** *filename* Immediately continue processing with file *file*.
- .open** *stream filename* Open *filename* for writing and associate the stream named *stream* with it.
- .opena** *stream filename* Like **.open** but append to it.
- .os** Output vertical distance that was saved by the **.sv** request.
- .output** *string* Emit *string* directly to intermediate output, allowing leading whitespace if *string* starts with " (which is stripped off).
- .pc** Reset page number character to ‘%’.
- .pc** *c* Page number character.
- .pev** Report the state of the current environment followed by that of all other environments to the standard error stream.
- .pi** *program* Pipe output to *program* (**nroff** only).
- .pl** Set page length to default 11 **i**. The current page length is stored in register **.p**.
- .pl**  $\pm N$  Change page length to  $\pm N$  (default scaling indicator **v**).
- .pm** Report, to the standard error stream, the names and sizes in bytes of defined macros, strings, and diversions.
- .pn**  $\pm N$  Next page number *N*.
- .pnr** Print the names and contents of all currently defined registers on stderr.
- .po** Change to previous page offset. The current page offset is available in register **.o**.
- .po**  $\pm N$  Page offset *N*.
- .ps** Return to previous type size.
- .ps**  $\pm N$  Set/increase/decrease the type size to/by *N* scaled points (a non-positive resulting type size is set to 1 u); also see **\s [ $\pm N$ ]**.
- .psbb** *filename* Get the bounding box of a PostScript image *filename*.

- .pso** *command*  
This behaves like the **.so** request except that input comes from the standard output of *command*.
- .ptr** Report names and positions of all page location traps to the standard error stream.
- .pvs** Change to previous post-vertical line spacing.
- .pvs ±N** Change post-vertical line spacing according to ±N (default scaling indicator **p**).
- .rchar** *c1 c2 ...*  
Remove the definitions of entities *c1*, *c2*, ...
- .rd** *prompt*  
Read insertion.
- .return** Return from a macro.
- .return** *anything*  
Return twice, namely from the macro at the current level and from the macro one level higher.
- .rfschar** *f c1 c2 ...*  
Remove the font-specific definitions of glyphs *c1*, *c2*, ... for font *f*.
- .rj** *n* Right justify the next *n* input lines.
- .rm** *name*  
Remove request, macro, diversion, or string *name*.
- .rn** *old new*  
Rename request, macro, diversion, or string *old* to *new*.
- .rnn** *reg1 reg2*  
Rename register *reg1* to *reg2*.
- .rr** *ident* Remove register *ident*.
- .rs** Restore spacing; turn no-space mode off.
- .rt** Return (*upward only*) to vertical position marked by **.mk** on the current page.
- .rt ±N** Return (*upward only*) to specified distance from the top of the page (default scaling indicator **v**).
- .schar** *c anything*  
Define global fallback character (or glyph) *c* as string *anything*.
- .shc** Reset the soft hyphen glyph to **\[hy]**.
- .shc** *c* Set the soft hyphen glyph to *c*.
- .shift** *n*  
In a macro, shift the arguments by *n* positions.
- .sizes** *s1 s2 ... sn [0]*  
Set available type sizes similarly to the **sizes** directive in a *DESC* file. Each *si* is interpreted in units of scaled points (**z**).
- .so** *file* Replace the request's control line with the contents of *file*, "sourcing" it.
- .soquiet** *file*  
As **.so**, but no warning is emitted if *file* does not exist.
- .sp** Move the drawing position down one vee.
- .sp** *N* Move the drawing position vertically by *N* (default scaling indicator **v**). Positive values are downwards. Prefixing *N* with the | operator moves to a position relative to the page top for positive *N*, and the bottom if *N* is negative; in all cases, one line height (vee) is added to *N*. *N* is ignored inside a diversion.
- .special**  
Reset global list of special fonts to be empty.
- .special** *s1 s2 ...*  
Fonts *s1*, *s2*, etc. are special and are searched for glyphs not in the current font.
- .spreadwarn**  
Toggle the spread warning on and off (the default) without changing its value.
- .spreadwarn** *N*  
Emit a **break** warning if the additional space inserted for each space between words in an output line adjusted to both margins is larger than or equal to *N*. A negative *N* is treated as 0. The default scaling indicator is **m**. At startup, **.spreadwarn** is inactive and *N* is 3 m.

- .ss** *N* Set minimal inter-word spacing to *N* 12ths of the space width of the current font.
- .ss** *NM* As **.ss** *N*, and set additional inter-sentence space to *M* 12ths of the space width of the current font.
- .stringdown** *stringvar*  
Replace each byte in the string named *stringvar* with its lowercase version.
- .stringup** *stringvar*  
Replace each byte in the string named *stringvar* with its uppercase version.
- .sty** *n style*  
Associate *style* with font position *n*.
- .substring** *str start [end]*  
Replace the string named *str* with its substring bounded by the indices *start* and *end*, inclusive. Negative indices count backwards from the end of the string.
- .sv** Save 1 *v* of vertical space.
- .sv** *N* Save the vertical distance *N* for later output with **.os** request (default scaling indicator **v**).
- .sy** *command-line*  
Execute program *command-line*.
- .ta** *n1 n2 ... nn T r1 r2 ... rn*  
Set tabs at positions *n1*, *n2*, ..., *nn*, then set tabs at *nn+m×rn+r1* through *nn+m×rn+rn*, where *m* increments from 0, 1, 2, ... to the output line length. Each *n* argument can be prefixed with a “+” to place the tab stop *ni* at a distance relative to the previous, *n(i-1)*. Each argument *ni* or *ri* can be suffixed with a letter to align text within the tab column bounded by tab stops *i* and *i+1*; “**L**” for left-aligned (the default), “**C**” for centered, and “**R**” for right-aligned.
- .tc** Remove tab repetition glyph.
- .tc** *c* Set tab repetition glyph to *c* (default: none).
- .ti**  $\pm N$  Temporary indent next line (default scaling indicator **m**).
- .tkf** *font s1 n1 s2 n2*  
Enable track kerning for *font*.
- .tl** 'left' center 'right'  
Three-part title.
- .tm** *anything*  
Print *anything* on stderr.
- .tm1** *anything*  
Print *anything* on stderr, allowing leading whitespace if *anything* starts with " (which is stripped off).
- .tmc** *anything*  
Similar to **.tm1** without emitting a final newline.
- .tr** *abcd...*  
Translate *a* to *b*, *c* to *d*, etc. on output.
- .trf** *filename*  
Transparently output the contents of file *filename*.
- .trin** *abcd...*  
This is the same as the **.tr** request except that the **asciify** request uses the character code (if any) before the character translation.
- .trnt** *abcd...*  
This is the same as the **.tr** request except that the translations do not apply to text that is transparently throughput into a diversion with **!**.
- .troff** Make the built-in conditions **t** true and **n** false.
- .uf** *font* Set underline font to *font* (to be switched to by **.ul**).
- .ul** *N* Underline (italicize in *troff* mode) *N* input lines.
- .unformat** *diversion*  
Unformat space characters and tabs in *diversion*, preserving font information.
- .vpt** Enable vertical position traps.

- .vpt 0** Disable vertical position traps.
- .vs** Change to previous vertical spacing.
- .vs  $\pm N$**  Set vertical spacing to  $\pm N$  (default scaling indicator **p**).
- .warn** Enable all warning categories.
- .warn 0** Disable all warning categories.
- .warn *n*** Enable warnings in categories whose codes sum to *n*; see [troff\(1\)](#).
- .warnscale *si***  
Set scaling indicator used in warnings to *si*.
- .wh *N*** Remove active trap at vertical position *N*; a negative value is measured upward from page bottom.
- .wh *N name***  
Plant trap, calling macro *name* when page location *N* is reached or passed; a negative value is measured upward from page bottom. Any active trap already present at *N* is replaced.
- .while *cond-expr anything***  
Evaluate *cond-expr*, and repeatedly execute *anything* unless and until *cond-expr* evaluates false.
- .write *stream anything***  
Write *anything* to the stream named *stream*.
- .writec *stream anything***  
Similar to **.write** without emitting a final newline.
- .writem *stream xx***  
Write contents of macro or string *xx* to the stream named *stream*.

Besides these standard groff requests, there might be further macro calls. They can originate from a macro package (see [roff\(7\)](#) for an overview) or from a preprocessor.

Preprocessor macros are easy to recognize. They enclose their code between a pair of characteristic macros.

preprocessor	start macro	end macro
<b>chem</b>	<b>.cstart</b>	<b>.cend</b>
<b>eqn</b>	<b>.EQ</b>	<b>.EN</b>
<b>grap</b>	<b>.G1</b>	<b>.G2</b>
<b>grn</b>	<b>.GS</b>	<b>.GE</b>
<b>ideal</b>	<b>.IS</b>	<b>.IE</b>
		<b>.IF</b>
<b>pic</b>	<b>.PS</b>	<b>.PE</b>
		<b>.PF</b>
<b>refer</b>	<b>.R1</b>	<b>.R2</b>
<b>soelim</b>	<i>none</i>	<i>none</i>
<b>tbl</b>	<b>.TS</b>	<b>.TE</b>
<b>glilypond</b>	<b>.lilypond start</b>	<b>.lilypond stop</b>
<b>gperl</b>	<b>.Perl start</b>	<b>.Perl stop</b>
<b>gpinyin</b>	<b>.pinyin start</b>	<b>.pinyin stop</b>

The ‘ideal’ preprocessor is not available in *groff* yet.

## Escape sequences

Whereas requests must occur on control lines, escape sequences can occur intermixed with text and appear in arguments to requests and macros (and sometimes other escape sequences). An escape sequence is introduced by the escape character, a backslash “\” (but see the **.ec** request). The next character identifies the escape’s function. Escape sequences vary in length. Some take an argument, and of those, some have different syntactical forms for a one-character, two-character, or arbitrary-length argument. Others accept only an arbitrary-length argument. In the former convention, a one-character argument follows the function character immediately, an opening parenthesis “(” introduces a two-character argument (no closing parenthesis is used), and an argument of arbitrary length is enclosed in brackets “[ ]”. In the latter convention, the user selects a delimiter character; the neutral apostrophe “’” is a popular choice and shown in this docu-

ment. Some characters cannot be used as delimiters; see subsection “Escape Sequences” in the *groff* Texinfo manual for details. A few escape sequences are idiosyncratic, and support both of the foregoing conventions (“\s”), designate their own terminating character (“\?”), consume input until the next newline (“\!”, “\!””, “\#”), or support an additional modifier character (“\s” again).

Escape sequences serve a variety of purposes. Widespread uses include commenting the source document; changing the font style; setting the type size; interpolating special characters, registers, and strings into the text; and placing or suppressing break and hyphenation points. As with requests, use of escape sequences in source documents may interact poorly with a macro package you use; consult its documentation to learn of “safe” sequences or alternative facilities it provides to achieve the desired result.

If the escape character is followed by a character that does not identify a defined operation, the escape character is ignored (producing a diagnostic of the “escape” warning type, which is not enabled by default) and the following character is processed normally.

### Escape sequence short reference

The escape sequences \", \#, \\$, \\*, \?, \a, \e, \n, \t, \g, \V, and \newline are interpreted even in copy mode.

\"	Comment. Everything up to the end of the line is ignored.
\#	Comment. Everything up to and including the next newline is ignored.
\* <i>s</i>	Interpolate string with one-character name <i>s</i> .
\*( <i>st</i>	Interpolate string with two-character name <i>st</i> .
\*[ <i>string</i> ]	Interpolate string with name <i>string</i> (of arbitrary length).
\*[ <i>string arg1 arg2 . . .</i> ]	Interpolate string with name <i>string</i> (of arbitrary length), taking <i>arg1</i> , <i>arg2</i> , . . . as arguments.
\\$0	Interpolate name by which currently-executing macro was invoked.
\\$ <i>n</i>	Interpolate macro or string parameter numbered <i>n</i> ( $1 \leq n \leq 9$ ).
\\$( <i>nn</i>	Interpolate macro or string parameter numbered <i>nn</i> ( $01 \leq nn \leq 99$ ).
\\$[ <i>nnn</i> ]	Interpolate macro or string parameter numbered <i>nnn</i> ( $nnn \geq 1$ ).
\\$*	Interpolate concatenation of all macro or string parameters, separated by spaces.
\\$@	Interpolate concatenation of all macro or string parameters, with each surrounded by double quotes and separated by spaces.
\\$^	Interpolate concatenation of all macro or string parameters as if they were arguments to the <b>.ds</b> request.
\'	is a synonym for \[aa], the acute accent special character.
\`	is a synonym for \[ga], the grave accent special character.
\-	is a synonym for \[-], the minus sign special character.
\_	is a synonym for \[ul], the underrule special character.
\%	Control hyphenation.
\!	Transparent line. The remainder of the input line is interpreted (1) when the current diversion is read; or (2) if in the top-level diversion, by the postprocessor (if any).
\?anything\?	Transparently embed <i>anything</i> , read in copy mode, in a diversion.
\space	Move right one word space.
\~	Insert an unbreakable, adjustable space.
\0	Move right by the width of a numeral in the current font.
\	Move one-sixth em to the right on typesetters.
\^	Move one-twelfth em to the right on typesetters.
\&	Non-printing input break.
\)	Non-printing input break, transparent to end-of-sentence recognition.
\/	Apply italic correction. Use between an immediately adjacent oblique glyph on the left and an upright glyph on the right.
\,	Apply left italic correction. Use between an immediately adjacent upright glyph on the left and an oblique glyph on the right.

- \:** Non-printing break point (similar to `\%`, but never produces a hyphen glyph).
- \newline**  
Continue current input line on the next.
- \{** Begin conditional input.
- \}** End conditional input.
- \(gl** Interpolate glyph with two-character name *gl*.
- \[glyph]**  
Interpolate glyph with name *glyph* (of arbitrary length).
- \[base-glyph comp1 comp2 ...]**  
Interpolate composite glyph constructed from *base-glyph* and components *comp1*, *comp2*, and so on.
- \[charnnn]**  
Interpolate glyph of eight-bit encoded character *nnn*, where  $0 \leq nnn \leq 255$ .
- \[unnnn[n[n]]]**  
Interpolate glyph of Unicode character with code point *nnnn[n[n]]* in uppercase hexadecimal.
- \[ubase-glyph[\_combining-component]...]**  
Interpolate composite glyph from Unicode character *base-glyph* and *combining-components*.
- \a** In copy mode, interpolate leader character.
- \A'anything'**  
Interpolate 1 if *anything* is an acceptable identifier for a string, macro, diversion, register, environment, or font, and 0 otherwise.
- \b'string'**  
Build bracket: pile a sequence of glyphs corresponding to each character in *string* vertically, and center it vertically on the output line.
- \B'anything'**  
Interpolate 1 if *anything* is a valid numerical expression, and 0 otherwise.
- \c** Continue output line at next input line.
- \C'glyph'**  
As `\[glyph]`, but compatible with other *troff* implementations.
- \d** Move downward 1/2 em on typesetters.
- \D'anything'**  
Send *anything* to the output device as a drawing command; see [groff\\_out\(5\)](#).
- \e** Interpolate escape character.
- \E** As `\e`, but not interpreted in copy mode.
- \fF** Change to font or style with one-character name or one-digit position *F*.
- \fP** Switch to previous font or style.
- \f(ft** Change to font with two-character name or two-digit position *ft*.
- \f[font]**  
Change to font with arbitrarily long name or position *font*.
- \f[]** Switch to previous font or style.
- \Ff** Change to font family with one-character name *f*.
- \F(fm** Change to font family with two-character name *fm*.
- \F[fam]**  
Change to font family with arbitrarily long name *fam*.
- \F[]** Switch to previous font family.
- \gr** Interpolate format of register with one-character name *r*.
- \g(rg** Interpolate format of register with two-character name *rg*.
- \g[reg]**  
Interpolate format of register with arbitrarily long name *reg*.
- \h'N'**  
Horizontally move the drawing position by *N* ems (or specified units); | may be used. Positive motion is rightward.

- \H'N'**  
Set height of current font to *N* scaled points (or specified units).
- \kr** Mark horizontal position in one-character register name *r*.
- \k (rg)** Mark horizontal position in two-character register name *rg*.
- \k[reg]**  
Mark horizontal position in register with arbitrarily long name *reg*.
- \l'N[g]'**  
Draw horizontal line of length *N* ems (or specified units), optionally using glyph *g*.
- \L'N[g]'**  
Draw vertical line of length *N* vees (or specified units), optionally using glyph *g*.
- \mc** Set stroke color to that with one-character name *c*.
- \m (cl)** Set stroke color to that with two-character name *cl*.
- \m[color]**  
Set stroke color to that with arbitrarily long name *color*.
- \m[]** Restore previous stroke color.
- \Mc** Set fill color to that with one-character name *c*.
- \M (cl)** Set fill color to that with two-character name *cl*.
- \M[color]**  
Set fill color to that with arbitrarily long name *color*.
- \M[]** Restore previous fill color.
- \nr** Interpolate contents of register with one-character name *r*.
- \n (rg)** Interpolate contents of register with two-character name *rg*.
- \n[reg]**  
Interpolate contents of register with arbitrarily long name *reg*.
- \N' n'** Interpolate glyph with index *n* in the current font.
- \o'abc...'**  
Overstrike glyphs *a*, *b*, *c*, and so on.
- \O0** At the outermost suppression level, disable emission of glyphs and geometric primitives to the output driver.
- \O1** At the outermost suppression level, enable emission of glyphs and geometric primitives to the output driver.
- \O2** At the outermost suppression level, enable glyph and geometric primitive emission to the output driver and write to the standard error stream the page number, four bounding box registers enclosing glyphs written since the previous **\O** escape sequence, the page offset, line length, image file name (if any), horizontal and vertical device motion quanta, and input file name.
- \O3** Begin a nested suppression level.
- \O4** End a nested suppression level.
- \O[5Pfile]**  
At the outermost suppression level, write the name *file* to the standard error stream at position *P*, which must be one of **l**, **r**, **c**, or **i**.
- \p** Break output line at next word boundary; adjust if applicable.
- \r** Move “in reverse” (upward) 1 em.
- \R' name ±N'**  
Set, increment, or decrement register *name* by *N*.
- \s±N** Set/increase/decrease the type size to/by *N* scaled points. *N* must be a single digit; 0 restores the previous type size. (In compatibility mode only, a non-zero *N* must be in the range 4–39.) Otherwise, as **.ps** request.
- \s (±N**  
**\s± (N**  
Set/increase/decrease the type size to/by *N* scaled points; *N* is a two-digit number ≥1. As **.ps** request.
- \s [±N]**

<code>\s±[N]</code>	
<code>\s'±N'</code>	
<code>\s±'N'</code>	Set/increase/decrease the type size to/by <i>N</i> scaled points. As <code>.ps</code> request.
<code>\S'N'</code>	Slant output glyphs by <i>N</i> degrees; the direction of text flow is positive.
<code>\t</code>	In copy mode, interpolate tab character.
<code>\u</code>	Move upward ½ em on typesetters.
<code>\v'N'</code>	Vertically move the drawing position by <i>N</i> vees (or specified units);   may be used. Positive motion is downward.
<code>\Ve</code>	Interpolate contents of environment variable with one-character name <i>e</i> .
<code>\V(ev</code>	Interpolate contents of environment variable with two-character name <i>ev</i> .
<code>\V[env]</code>	Interpolate contents of environment variable with arbitrarily long name <i>env</i> .
<code>\w'anything'</code>	Interpolate width of <i>anything</i> , formatted in a dummy environment.
<code>\x'N'</code>	Increase required line space by <i>N</i> vees (or specified units; negative before, positive after).
<code>\X'anything'</code>	Write <i>anything</i> , read in copy mode, to the intermediate output as a device control command.
<code>\Yn</code>	Write contents of macro or string <i>n</i> to the intermediate output as a device control command.
<code>\Y(nm</code>	Write contents of macro or string <i>nm</i> to the intermediate output as a device control command.
<code>\Y[name]</code>	Write contents of macro or string <i>name</i> to the intermediate output as a device control command.
<code>\zc</code>	Output glyph <i>c</i> without advancing the print position, as if it were zero-width.
<code>\z'anything'</code>	Print <i>anything</i> and then restore the horizontal and vertical position; <i>anything</i> must not contain tabs or leaders.

## Identifiers

An identifier is a label for an object of syntactical importance like a register, a name (macro, string, or diversion), an environment, a font, a style, a character class, a glyph, or a stream, comprising a sequence of one or more characters with the following exceptions.

- Spaces, tabs, or newlines.
- Invalid input characters; these are certain control characters (from the sets “C0 Controls” and “C1 Controls” as Unicode describes them). When *troff* encounters one in an identifier, it produces a warning in category “**input**” (see section “Warnings” in *troff(1)*).

On a machine using the ISO 646, 8859, or 10646 character encodings, invalid input characters are **0x00**, **0x08**, **0x0B**, **0x0D–0x1F**, and **0x80–0x9F**.

On an EBCDIC host, they are **0x00–0x01**, **0x08**, **0x09**, **0x0B**, **0x0D–0x14**, **0x17–0x1F**, and **0x30–0x3F**.

Some of these code points are used by *troff* internally, making it non-trivial to extend the program to accept UTF-8 or other encodings that use characters from these ranges. (Consider what happens when a C1 control **0x80–0x9F** is necessary as a continuation byte in a UTF-8 sequence.)

Invalid characters are removed during interpretation; an identifier “**foo**”, followed by an invalid character and then “**bar**”, is processed as “**foobar**”.

## Strings

*groff* has string variables primarily for user convenience. Only one string is predefined by the language.

`\*[.T]` Contains the name of the output device (for example, “**utf8**” or “**pdf**”).

The `.ds` request creates a string with a specified name and contents and the `\*` escape sequence dereferences

its name, retrieving the contents. Dereferencing an undefined string name defines it as empty.

The **.as** request is similar to **.ds** but appends to a string instead of redefining it. If **.as** is called with only one argument, no operation is performed (beyond dereferencing it).

The **.ds1** request defines a string such that compatibility mode is off when the string is later interpolated. Likewise, the **.as1** request is similar to **.as**, but compatibility mode is switched off when the appended portion of the string is later interpolated.

**Caution:** Unlike other requests, the second argument to these requests consumes the remainder of the input line, including trailing spaces. It is good style to end string definitions (and appendments) with a comment, even an empty one, to prevent unwanted space from creeping into them during source document maintenance.

To store leading space in a string, start it with a double quote. A double quote is special only in that position; double quotes in any other location are included in the string (the effects of escape sequences notwithstanding).

Macros, strings, and diversions share a name space; see section “Identifiers” above. Internally, the same mechanism is used to store them. You can thus call a macro with string interpolation syntax and vice versa. Interpolating a string does not hide existing macro arguments. The sequence `\` can be placed at the end of a line in a macro definition or, within a macro definition, immediately after the interpolation of a macro as a string to suppress the effect of a newline.

Several requests exist to perform rudimentary string operations. Strings can be queried (**.length**) and modified (**.chop**, **.substring**, **.stringup**, **.stringdown**), and their names can be manipulated through renaming, removal, and aliasing (**.rn**, **.rm**, **.als**).

## Registers

Most registers store numerical values (see section “Numerical Expressions” above), but some (predefined, read-only ones) interpolate text. Each register has a name. A register is defined and assigned with the **.nr** request or the `\R` escape sequence; its value is interpolated with the `\n` escape sequence.

Registers can also be incremented or decremented by a configured amount at the time they are interpolated. The value of the increment is specified with a third argument to the **.nr** request, and a special interpolation syntax, `\n±` is used to alter and then retrieve the register’s value. Together, these features are called *auto-increment*. (A negative auto-increment can be considered an “auto-decrement”.)

Many predefined registers are available. In the following presentation, the register interpolation syntax `\n[name]` is used to refer to a register *name* to clearly distinguish it from a string or request *name*. The register name space is separate from that used for requests, macros, strings, and diversions. Bear in mind that the symbols `\n[]` are *not* part of the register name.

### Read-only registers

The following registers have predefined values that should not be modified by the user (usually, registers starting with a dot are read-only). Mostly, they provide information on the current settings or store results from request calls.

<code>\n[\$\$]</code>	The process ID of <b>troff</b> .
<code>\n[. \$]</code>	Number of arguments in the current macro or string.
<code>\n[. a]</code>	Post-line extra line-space most recently utilized using <code>\x</code> .
<code>\n[. A]</code>	Set to 1 in <b>troff</b> if option <b>-A</b> is used; always 1 in <b>nroff</b> .
<code>\n[. b]</code>	The emboldening offset while <b>.bd</b> is active.
<code>\n[. br]</code>	Within a macro, set to 1 if macro called with the ‘normal’ control character, and to 0 otherwise.
<code>\n[. c]</code>	Current input line number.
<code>\n[. C]</code>	1 if compatibility mode is in effect, 0 otherwise. Always 0 in a <b>.do</b> request; see register <b>.cp</b> below.
<code>\n[. cdp]</code>	The depth of the last glyph added to the current environment. It is positive if the glyph extends below the baseline.

- `\n[.ce]` The count of lines remaining to be centered.
- `\n[.cht]` The height of the last glyph added to the current environment. It is positive if the glyph extends above the baseline.
- `\n[.color]`  
1 if colors are enabled, 0 otherwise.
- `\n[.cp]` Within a `.do` request, the saved value of compatibility mode (see register `.C` above).
- `\n[.csk]` The skew of the last glyph added to the current environment. The skew of a glyph is how far to the right of the center of a glyph the center of an accent over that glyph should be placed.
- `\n[.d]` Current vertical place in current diversion; equal to register `nl`.
- `\n[.ev]` The name of the current environment (string-valued).
- `\n[.f]` Mounting position index of the current font.
- `\n[.F]` The name of the current input file (string-valued).
- `\n[.fam]` The current font family (string-valued).
- `\n[.fn]` The current (internal) real font name (string-valued).
- `\n[.fp]` The next free font mounting position index.
- `\n[.g]` Always 1 in GNU *troff*. Use to test if running under *groff*.
- `\n[.h]` Text baseline high-water mark on page or in diversion.
- `\n[.H]` Number of basic units per horizontal unit of output device resolution.
- `\n[.height]`  
The current font height as set with `\H`.
- `\n[.hla]` The hyphenation language in the current environment.
- `\n[.hlc]` The count of immediately preceding consecutive hyphenated lines in the current environment.
- `\n[.hlm]` The maximum quantity of consecutive hyphenated lines allowed in the current environment.
- `\n[.hy]` The automatic hyphenation mode in the current environment.
- `\n[.hym]` The hyphenation margin in the current environment.
- `\n[.hys]` The hyphenation space adjustment threshold in the current environment.
- `\n[.i]` Current indentation.
- `\n[.in]` The indentation that applies to the current output line.
- `\n[.int]` Positive if last output line contains `\c`.
- `\n[.j]` Adjustment mode encoded as an integer. Do not interpret or perform arithmetic on its value.
- `\n[.k]` The current horizontal output position (relative to the current indentation).
- `\n[.kern]` 1 if pairwise kerning is enabled, 0 otherwise.
- `\n[.l]` Current line length.
- `\n[.L]` The current line spacing setting as set by `.ls`.
- `\n[.lg]` The current ligature mode (as set by the `.lg` request).
- `\n[.linetabs]`  
The current line-tabs mode (as set by the `.linetabs` request).
- `\n[.ll]` The line length that applies to the current output line.
- `\n[.lt]` The title length (as set by the `.lt` request).
- `\n[.m]` Stroke color (string-valued).
- `\n[.M]` Fill color (string-valued).
- `\n[.n]` Length of text portion on previous output line.
- `\n[.ne]` The amount of space that was needed in the last `.ne` request that caused a trap to be sprung. Useful in conjunction with register `.trunc`.
- `\n[.nm]` 1 if output line numbering is enabled (even if temporarily suppressed), 0 otherwise.
- `\n[.ns]` 1 if in no-space mode, 0 otherwise.
- `\n[.o]` Current page offset.
- `\n[.O]` The suppression nesting level (see `\O`).
- `\n[.p]` Current page length.
- `\n[.P]` 1 if the current page is being printed, 0 otherwise (as determined by the `-o` command-line option).
- `\n[.pe]` 1 during page ejection, 0 otherwise.

<code>\n[.pn]</code>	The number of the next page: either the value set by a <code>.pn</code> request, or the number of the current page plus 1.
<code>\n[.ps]</code>	The current type size in scaled points.
<code>\n[.psr]</code>	The last-requested type size in scaled points.
<code>\n[.pvs]</code>	The current post-vertical line spacing.
<code>\n[.R]</code>	The count of available unused registers; always 10000 in GNU <i>troff</i> .
<code>\n[.rj]</code>	The count of lines remaining to be right-aligned.
<code>\n[.s]</code>	Current type size in points as a decimal fraction (string-valued).
<code>\n[.slant]</code>	The slant of the current font as set with <code>\S</code> .
<code>\n[.sr]</code>	The last requested type size in points as a decimal fraction (string-valued).
<code>\n[.ss]</code>	Size of minimal inter-word spacing in twelfths of the space width of the current font.
<code>\n[.sss]</code>	Size of additional inter-sentence space in twelfths of the space width of the current font.
<code>\n[.sty]</code>	The current font style (string-valued).
<code>\n[.t]</code>	Distance to the next vertical position trap.
<code>\n[.T]</code>	Set to 1 if option <code>-T</code> is used.
<code>\n[.tabs]</code>	A string representation of the current tab settings suitable for use as an argument to the <code>.ta</code> request.
<code>\n[.trunc]</code>	The amount of vertical space truncated by the most recently sprung vertical position trap, or, if the trap was sprung by an <code>.ne</code> request, minus the amount of vertical motion produced by <code>.ne</code> . Useful in conjunction with the register <code>.ne</code> .
<code>\n[.u]</code>	Equal to 1 if filling is enabled, 0 otherwise.
<code>\n[.U]</code>	1 in unsafe mode and 0 otherwise.
<code>\n[.v]</code>	Current vertical line spacing.
<code>\n[.V]</code>	Number of basic units per vertical unit of output device resolution.
<code>\n[.vpt]</code>	1 if vertical position traps are enabled, 0 otherwise.
<code>\n[.w]</code>	Width of previous glyph.
<code>\n[.warn]</code>	The sum of the numeric codes of currently enabled warning categories.
<code>\n[.x]</code>	The major version number of the running <i>troff</i> formatter.
<code>\n[.y]</code>	The minor version number of the running <i>troff</i> formatter.
<code>\n[.Y]</code>	The revision number of the running <i>troff</i> formatter.
<code>\n[.z]</code>	Name of current diversion.
<code>\n[.zoom]</code>	Zoom factor for current font (in multiples of 1/1000th; zero if no magnification).

### Writable registers

The following registers can be read and written by the user. They have predefined default values, but these can be modified for customizing a document.

<code>\n[%]</code>	Current page number.
<code>\n[c.]</code>	Current input line number.
<code>\n[ct]</code>	Character type (set by width function <code>\w</code> ).
<code>\n[dl]</code>	Maximal width of last completed diversion.
<code>\n[dn]</code>	Height of last completed diversion.
<code>\n[dw]</code>	Current day of week (1–7).
<code>\n[dy]</code>	Current day of month (1–31).
<code>\n[hours]</code>	The number of hours past midnight. Initialized at startup.
<code>\n[hp]</code>	Current horizontal position at input line.
<code>\n[llx]</code>	Lower left x-coordinate (in PostScript units) of a given PostScript image (set by <code>.psbb</code> ).
<code>\n[lly]</code>	Lower left y-coordinate (in PostScript units) of a given PostScript image (set by <code>.psbb</code> ).
<code>\n[ln]</code>	Output line number.
<code>\n[lsn]</code>	The count of leading spaces on an input line.
<code>\n[lss]</code>	The amount of horizontal space corresponding to the leading spaces on an input line.
<code>\n[minutes]</code>	The number of minutes after the hour. Initialized at startup.

<code>\n[mo]</code>	Current month (1–12).
<code>\n[nl]</code>	Current vertical position.
<code>\n[opmaxx]</code>	
<code>\n[opmaxy]</code>	
<code>\n[opminx]</code>	
<code>\n[opminy]</code>	These four registers mark the top left and bottom right hand corners of a box which encompasses all written glyphs. They are reset to <code>-1</code> by <code>\O0</code> or <code>\O1</code> .
<code>\n[rsb]</code>	Like register <code>sb</code> , but takes account of the heights and depths of glyphs.
<code>\n[rst]</code>	Like register <code>st</code> , but takes account of the heights and depths of glyphs.
<code>\n[sb]</code>	Depth of string below baseline (generated by width function <code>\w</code> ).
<code>\n[seconds]</code>	The number of seconds after the minute. Initialized at startup.
<code>\n[skw]</code>	Right skip width from the center of the last glyph in the <code>\w</code> argument.
<code>\n[slimit]</code>	If $>0$ , sets the maximum quantity of objects on <i>troff</i> 's internal input stack. If $\leq 0$ , there is no limit: recursion can continue until program memory is exhausted. The default is 1,000.
<code>\n[ssc]</code>	The amount of horizontal space (possibly negative) that should be added to the last glyph before a subscript (generated by width function <code>\w</code> ).
<code>\n[st]</code>	Height of string above baseline (generated by width function <code>\w</code> ).
<code>\n[systat]</code>	The return value of the <i>system()</i> function executed by the last <code>.sy</code> request.
<code>\n[urx]</code>	Upper right x-coordinate (in PostScript units) of a given PostScript image (set by <code>.psbb</code> ).
<code>\n[ury]</code>	Upper right y-coordinate (in PostScript units) of a given PostScript image (set by <code>.psbb</code> ).
<code>\n[year]</code>	The current year.
<code>\n[yr]</code>	The current year minus 1900.

## Hyphenation

When filling, *groff* hyphenates words as needed at user-specified and automatically determined hyphenation points. Explicitly hyphenated words such as “mother-in-law” are always eligible for breaking after each of their hyphens. The hyphenation character `\%` and non-printing break point `\:` escape sequences may be used to control the hyphenation and breaking of individual words. The `.hw` request sets user-defined hyphenation points for specified words at any subsequent occurrence. Otherwise, *groff* determines hyphenation points automatically by default.

Several requests influence automatic hyphenation. Because conventions vary, a variety of hyphenation modes is available to the `.hy` request; these determine whether hyphenation will apply to a word prior to breaking a line at the end of a page (more or less; see below for details), and at which positions within that word automatically determined hyphenation points are permissible. The default is “**1**” for historical reasons, but this is not an appropriate value for the English hyphenation patterns used by *groff*; localization macro files loaded by *troffrc* and macro packages often override it.

**0** disables hyphenation.

**1** enables hyphenation except after the first and before the last character of a word.

The remaining values “imply” **1**; that is, they enable hyphenation under the same conditions as “`.hy 1`”, and then apply or lift restrictions relative to that basis.

**2** disables hyphenation of the last word on a page. (Hyphenation is prevented if the next page location trap is closer to the vertical drawing position than the next text baseline would be. *groff* automatically inserts an implicit page location trap at the end of each page to cause a page transition. Users or macro packages can set such traps explicitly to prevent hyphenation of the last word in a column in multi-column page layouts or before floating figures or tables. See section “Traps” below.)

**4** disables hyphenation before the last two characters of a word.

- 8**       disables hyphenation after the first two characters of a word.
- 16**       enables hyphenation before the last character of a word.
- 32**       enables hyphenation after the first character of a word.

Apart from value 2, restrictions imposed by the hyphenation mode are *not* respected for words whose hyphenations have been explicitly specified with the hyphenation character (“%” by default) or the **.hw** request.

The nonzero values above are additive. For example, value 12 causes *groff* to hyphenate neither the last two nor the first two characters of a word. Some values cannot be used together because they contradict; for instance, values 4 and 16, and values 8 and 32. As noted, it is superfluous to add 1 to any nonzero even mode.

The places within a word that are eligible for hyphenation are determined by language-specific data (**.hla**, **.hpf**, and **.hpfa**) and lettercase relationships (**.hcode** and **.hpfcodes**). Furthermore, hyphenation of a word might be suppressed because too many previous lines have been hyphenated (**.hlm**), the line has not reached a certain minimum length (**.hym**), or the line can instead be adjusted with up to a certain amount of additional inter-word space (**.hys**).

### Localization

The set of hyphenation patterns is associated with the hyphenation language set by the **.hla** request. The **.hpf** request is usually invoked by a localization file loaded by the *troffrc* file. By default, *troffrc* loads the localization file for English. (As of *groff* 1.23.0, localization files for Czech (*cs*), German (*de*), English (*en*), French (*fr*), Japanese (*ja*), Swedish (*sv*), and Chinese (*zh*) exist.) For Western languages, the localization file sets the hyphenation mode and loads hyphenation patterns and exceptions. It also (re-)defines translatable strings and macros that packages use to handle localization tasks, such as formatting the calendar date.

### Writing macros

The **.de** request defines a macro replacing the definition of any existing request, macro, string, or diversion of the same name. *troff* enters “copy mode” (see below), storing subsequent input lines as the definition. If the optional second argument is not specified, the definition ends with the control line “..” (two dots). Alternatively, a second argument names a macro whose call syntax ends the definition; this “end macro” is then called normally. Spaces or tabs are permitted after the first control character in the line containing this ending token, but a tab immediately after the token prevents its recognition as the end of a macro definition. Macro definitions can be nested; this requires use of unique end macros for each nested definition or escaping of the line with the ending token. An end macro need not be defined until it is called. This fact enables a nested macro definition to begin inside one macro and end inside another.

Variants of **.de** that disable compatibility mode and/or indirect the names of the macros being defined or ending the definition through strings are available as **.dei**, **.dei1**, and **.dei1**. Existing macro definitions can be appended to with **.am**, **.am1**, **.ami**, and **.ami1**. The **.als**, **.rm**, and **.rn** requests create an alias of, remove, and rename a macro, respectively. **.return** stops the execution of a macro immediately, returning to the enclosing context.

### Parameters

Macro call and string interpolation parameters can be accessed using escape sequences starting with “\$”. The **\n[\$]** read-only register stores the count of parameters available to a macro or string; its value can be changed by the **.shift** request, which dequeues parameters from the current list. The **\\$0** escape sequence interpolates the name by which a macro was called. Applying string interpolation to a macro does not change this name.

### Copy mode

When *troff* processes certain requests, most importantly those which define or append to a macro or string, it does so in *copy mode*: it copies the characters of the definition into a dedicated storage region, interpolating the escape sequences **\n**, **\g**, **\\$**, **\\***, **\V**, and **\?** normally; interpreting *\newline* immediately; discarding comments **\'** and **\#**; interpolating the current leader, escape, or tab character with **\a**, **\e**, and **\t**, respectively; and storing all other escape sequences in an encoded form. The complement of copy mode—a *roff*

formatter’s behavior when not defining or appending to a macro, string, or diversion—where all macros are interpolated, requests invoked, and valid escape sequences processed immediately upon recognition, can be termed *interpretation mode*.

The escape character, `\` by default, can escape a backslash. This enables you to control whether a given `\n`, `\g`, `\$`, `\*`, `\W`, or `\?` escape sequence is interpreted at the time the macro containing it is defined, or later when the macro is called.

You can think of `\` as a “delayed” backslash; it is the escape character followed by a backslash from which the escape character has removed its special meaning. Consequently, `\` is not an escape sequence in the usual sense. In any escape sequence `\X` that *troff* does not recognize, the escape character is ignored and `X` is output, with two exceptions, `\` being one. The other is `\`, which escapes the control character. It is used to permit nested macro definitions to end without a named macro call to conclude them. Without a syntax for escaping the control character, this would not be possible. *roff* documents should not use the `\` or `\` character sequences outside of copy mode; they serve only to obfuscate the input. Use `\e` to represent the escape character, `\[rs]` to obtain a backslash glyph, and `\&` before “.” and “” where *troff* expects them as control characters if you mean to use them literally.

Macro definitions can be nested to arbitrary depth. In “`\`”, each escape character is interpreted twice—once in copy mode, when the macro is defined, and once outside of it, when the macro is called. This fact leads to exponential growth in the quantity of escape characters required to delay interpolation of `\n`, `\g`, `\$`, `\*`, `\W`, and `\?` at each nesting level. An alternative is to use `\E`, which represents an escape character that is not interpreted in copy mode. Because `\` is not a true escape sequence, we can’t use `\E` to keep “.” from ending a macro definition prematurely. If the multiplicity of backslashes complicates maintenance, use end macros.

## Traps

*Traps* are locations in the output, or conditions on the input that, when reached or fulfilled, cause a specified macro to be called. These traps can occur at a given location on the page (`.wh`, `.ch`); at a given location in the current diversion (`.dt`)—together, these are known as vertical position traps, which can be disabled and re-enabled (`.vpt`); at a blank line (`.blm`); at a line with leading space characters (`.lsm`); after a certain number of input lines (`.it`, `.itc`); or at the end of input (`.em`). Macros called by traps are passed no arguments. Setting a trap is also called *planting* one. It is said that a trap is *sprung* if its condition is fulfilled.

Registers associated with trap management include vertical position trap enablement status (`\n[vpt]`), distance to the next trap (`\n[t]`), amount of needed (`.ne`-requested) space that caused the most recent vertical position trap to be sprung (`\n[ne]`), amount of needed space truncated from the amount requested (`\n[trunc]`), page ejection status (`\n[pe]`), and leading space count (`\n[lsn]`) with its corresponding amount of motion (`\n[iss]`).

## Environments

Environments store most of the parameters that control text processing. A default environment named “`0`” exists when *troff* starts up; it is modified by formatting-related requests and escape sequences.

You can create new environments and switch among them. Only one is current at any given time. Active environments are managed using a *stack*, a data structure supporting “push” and “pop” operations. The current environment is at the top of the stack. The same environment name can be pushed onto the stack multiple times, possibly interleaved with others.

Popping the environment stack does not destroy the current environment; it remains accessible by name and can be made current again by pushing it at any time. Environments cannot be renamed or deleted, and can only be modified when current. To inspect the environment stack, use the `pev` request; see section “Debugging” below.

Environments store the following information.

- typeface parameters (size, family, style, glyph height and slant, inter-word and inter-sentence space sizes)
- page parameters (line length, title length, vertical spacing, line spacing, indentation, line numbering, centering, right-justifying, underlining, hyphenation data)

- filling enablement, adjustment enablement and mode
- tab stops; tab and leader characters; escape, control, no-break control, hyphenation control, and margin characters
- partially collected lines
- input traps
- stroke and fill colors

The **ev** request pushes to and pops from the environment stack, while **evc** copies a named environment's contents to the current one.

## Underlining

In the *RUNOFF* language, the underlining was quite easy. But in *roff* this is much more difficult.

### Underlining with .ul

There exists a *groff* request **.ul** (see above) that can underline the next or further source lines in **nroff**, but in **troff** it produces only a font change into *italic*. So this request is not really useful.

### Underlining with .UL from ms

In the 'ms' macro package in tmac/s.tmac [groff\\_ms\(7\)](#), there is the macro **.UL**. But this works only in **troff**, not in **nroff**.

### Underlining macro definitions

So one can use the *italic nroff* idea from **.ul** and the **troff** definition in *ms* for writing a useful new macro, something like

```
.de UNDERLINE
. ie n \\$1\\f[I]\\$2\\f[P]\\$3
. el \\$1\\Z'\\$2'\\v'.25m'\\D'l \\w'\\$2'u 0'\\v'-.25m'\\$3
..
```

If *doclifter*(1) makes trouble, change the macro name **UNDERLINE** into some 2-letter word, like **UL**. Moreover, change the form of the font selection escape sequence from **\f[P]** to **\fP**.

### Underlining without macro definitions

If one does not want to use macro definitions, e.g., when **doclifter** gets lost, use the following:

```
.ds u1 before
.ds u2 in
.ds u3 after
. ie n *[u1]\\f[I]*[u2]\\f[P]*[u3]
. el *[u1]\\Z'*[u2]'\\v'.25m'\\D'l \\w'*[u2]'u 0'\\v'-.25m'*[u3]
```

When using **doclifter**, it might be necessary to change syntax forms such as **\[xy]** and **\\*[xy]** to those supported by AT&T *troff*: **\\*(xy)** and **\(xy)**, and so on.

Then these lines could look like

```
.ds u1 before
.ds u2 in
.ds u3 after
. ie n *[u1]\\fI*(u2\\fP*(u3
. el *(u1\\Z'*(u2'\\v'.25m'\\D'l \\w'*(u2'u 0'\\v'-.25m'*(u3
```

The result looks like

```
before in after
```

### Underlining with overstriking \z and \ul

There is another possibility for underlining by using overstriking with **\zc** (print *c* with zero width without spacing) and **\ul** (underline character). This produces the underlining of 1 character, both in **nroff** and in **troff**.

For example the underlining of a character say **t** looks like **\z[ul]t** or **\z(ult**

Longer words look then a bit strange, but a useful mode is to write each character into a whole own line.

To underlines the 3 character part "tar" of the word "start":

```
before s\  
\z\[ul]t\  
\z\[ul]a\  
\z\[ul]r\  
t after
```

or

```
before s\  
\z\(ult\  
\z\(ula\  
\z\(ulr\  
t after
```

The result looks like

```
before start after
```

### Compatibility

The differences between the *roff* language recognized by GNU *troff* and that of AT&T *troff*, as well as the device, font, and device-independent intermediate output formats described by CSTR #54 are documented in *groff\_diff(7)*.

*groff* provides an AT&T compatibility mode; see *groff(1)*.

### Debugging

*groff* is not the easiest language to debug, in part thanks to its design features of recursive interpolation and the use of multi-stage pipeline processing in the surrounding system. Nevertheless there exist several features useful for troubleshooting.

Preprocessors use the **.lf** request to preserve the identities of line numbers and names of input files. *groff* emits a variety of error diagnostics and supports several categories of warning; the output of these can be selectively suppressed with **.warn** (and see the **-E**, **-w**, and **-W** options of *troff(1)*). Backtraces can be automatically produced when errors or warnings occur (the **-b** option of *troff(1)*) or generated on demand (**.backtrace**). **.tm**, **.tmc**, and **.tm1** can be used to emit customized diagnostic messages or for instrumentation while troubleshooting. **.ex** and **.ab** cause early termination with successful and error exit codes respectively, to halt further processing when continuing would be fruitless. The state of the formatter can be examined with requests that write lists of defined names—macros, strings, and diversions—(**.pm**); environments (**.pev**), registers (**.pnr**), and page location traps (**.ptr**) to the standard error stream.

### Authors

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### See also

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

“Troff User’s Manual” by Joseph F. Ossanna, 1976 (revised by Brian W. Kernighan, 1992), AT&T Bell Laboratories Computing Science Technical Report No. 54, widely called simply “CSTR #54”, documents the language, device and font description file formats, and device-independent output format referred to collectively in *groff* documentation as “AT&T *troff*”.

“A Typesetter-independent TROFF” by Brian W. Kernighan, 1982, AT&T Bell Laboratories Computing Science Technical Report No. 97 (CSTR #97), provides additional insights into the device and font description file formats and device-independent output format.

*groff(1)* is the preferred interface to the *groff* system; it manages the pipeline that carries a source document through preprocessors, the *troff* formatter, and an output driver to viewable or printable form. It also exhaustively lists the man pages provided with the GNU *roff* system.

*groff\_char(7)*

discusses character encoding issues, escape sequences that produce glyphs, and enumerates *groff*'s predefined special character escape sequences.

*groff\_diff(7)*

covers the differences between the GNU *troff* formatter, its device and font description file formats, its device-independent output format, and those of AT&T *troff*, whose design it reimplements.

*groff\_font(5)*

describes the formats of the files that describe devices (*DESC*) and fonts.

*groff\_tmac(5)*

surveys macro packages provided with *groff*, describes how documents can take advantage of them, offers guidance on writing macro packages and using diversions, and includes historical information on macro package naming conventions.

*roff(7)* presents a detailed history of *roff* systems and summarizes concepts common to them.

**Name**

groff\_char – GNU roff special character and glyph repertoire

**Description**

The GNU *roff* typesetting system has a large glyph repertoire suitable for production of varied literary, professional, technical, and mathematical documents. However, its input character set is restricted to that defined by the standards ISO Latin-1 (ISO 8859-1) and IBM code page 1047 (an EBCDIC arrangement of Latin-1). For ease of document maintenance in UTF-8 environments, it is advisable to use only the Unicode basic Latin code points, a subset of all of the foregoing historically referred to as US-ASCII, which has only 94 visible, printable code points.

AT&T *troff* in the 1970s faced a similar problem of typesetter devices with a glyph repertoire differing from that of the computers that controlled them. Its solution was a form of escape sequence known as a *special character* to access several dozen additional glyphs available in the fonts prepared for mounting in the phototypesetter. These glyphs were mapped onto a two-character name space for a degree of mnemonic convenience; for example, the escape sequence `\aa` encoded an acute accent and `\sc` a section sign. (Characters that don't require an escape sequence for their expression, like "a", are termed "ordinary".)

As in other respects, *groff* has removed historical *roff* limitations on the lengths of special character escape sequences, but recognizes and retains compatibility with the historical names. *groff* expands the lexicon of glyphs available by name and permits users to define their own special character escape sequences with the **char** request.

This document lists all of the glyph names predefined by *groff*'s font description files and presents the systematic notation by which it enables access to arbitrary Unicode code points and construction of composite glyphs. Glyphs listed may be unavailable, or may vary in appearance, depending on the output device and font chosen when the page was formatted. This page was rendered for device **pdf** using font **TR**.

A few escape sequences that are not *groff* special characters also produce glyphs; these exist for syntactical or historical reasons. `\'`, `\`, `\-`, and `\_` are translated on input to the special character escape sequences `\[aq]`, `\[ga]`, `\[-]`, and `\[ul]`, respectively. Others include `\.`, `\.` (backslash-dot), and `\e`; see *groff(7)*. A small number of special characters represent glyphs that are not encoded in Unicode; examples include the baseline rule `\[ru]` and the Bell System logo `\[bs]`.

In *groff*, you can test output device support for any character (ordinary or special) with the conditional expression operator **"c"**.

```
.ie c \[bs] \{Welcome to the \[bs] Bell System;
did you get the Wehrmacht helmet or the Death Star?\}
.el No Bell System logo.
```

For brevity in the remainder of this document, we shall refer to systems conforming to the ISO 646:1991 IRV, ISO 8859, or ISO 10646 ("Unicode") character encoding standards as "ISO" systems, and those employing IBM code page 1047 as "EBCDIC" systems. That said, EBCDIC systems that support *groff* are known to also support UTF-8.

While *groff* accepts eight-bit encoded input, not all such code points are valid as input. On ISO platforms, character codes 0, 11, 13–31, and 128–159 are invalid. (This is all C0 and C1 controls except for SOH through LF [Control+A to Control+J], and FF [Control+L].) On EBCDIC platforms, 0, 8–9, 11, 13–20, 23–31, and 48–63 are invalid. Some of these code points are used by *groff* for internal purposes, which is one reason it does not support UTF-8 natively.

**Fundamental character set**

The ninety-four characters catalogued above, plus the space, tab, and newline, form the fundamental character set for *groff* input; anything in the language, even over one million code points in Unicode, can be expressed using it. On ISO systems, code points in the range 33–126 comprise a common set of printable glyphs in all of the aforementioned ISO character encoding standards. It is this character set and (with some noteworthy exceptions) the corresponding glyph repertoire for which AT&T *troff* was implemented. On EBCDIC systems, printable characters are in the range 66–201 and 203–254; those without counterparts in the ISO range 33–126 are discussed in the next subsection.

All of the following characters map to glyphs as you would expect.

!	#	\$	%	&	(	)	*	+	,	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[	]	_
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{		}

The remaining seven of the ninety-four code points in this range surprise computing professionals and others intimately familiar with the ISO character encodings. The developers of AT&T *troff* chose mappings for them that would be useful for typesetting technical literature in a broad range of scientific disciplines: Bell Labs used the system for preparation of AT&T's patent filings with the U.S. government. Further, the prevailing character encoding standard in the 1970s, USAS X3.4-1968 ("ASCII") deliberately supported semantic ambiguity at some code points, and outright substitution at several others, to suit the localization demands of various national standards bodies.

The table below presents the seven exceptional code points with their typical keycap engravings, their glyph mappings and semantics in *roff* systems, and the escape sequences producing the Unicode basic Latin character they replace. The first, the neutral double quote, is a partial exception because it does represent itself, but since the *roff* language also uses it to quote macro arguments, *groff* supports a special character escape sequence as an alternative form so that the glyph can be easily included in macro arguments without requiring the user to master the quoting rules that AT&T *troff* required in that context. (Some requests, like **ds**, also treat " non-literally.) Furthermore, not all of the special character escape sequences are portable to AT&T *troff* and all of its descendants; these *groff* extensions are presented using its special character form `\[]`, whereas portable special character escape sequences are shown in the traditional `\(` form. `\-` and `\e` are portable to all known *troff*s. `\e` means "the glyph of the current escape character"; it therefore can produce unexpected output if the **ec** request is used. On devices with a limited glyph repertoire, glyphs in the "keycap" and "appearance" columns on the same row of the table may look identical; except for the neutral double quote, this will *not* be the case on more-capable devices. Review your document using as many different output devices as possible.

Keycap	Appearance and meaning	Special character and meaning
"	" neutral double quote	<code>\[dq]</code> neutral double quote
'	' closing single quote	<code>\[aq]</code> neutral apostrophe
-	- hyphen	<code>\-</code> or <code>\[-]</code> minus sign/Unix dash
\	(escape character)	<code>\e</code> or <code>\[rs]</code> reverse solidus
^	^ modifier circumflex	<code>\(ha</code> circumflex/caret/"hat"
`	` opening single quote	<code>\(ga</code> grave accent
~	~ modifier tilde	<code>\(ti</code> tilde

The hyphen-minus is a particularly unfortunate case of overloading. Its awkward name in ISO 8859 and later standards reflects the many distinguishable purposes to which it had already been put by the 1980s, including a hyphen, a minus sign, and (alone or in repetition) dashes of varying widths. For best results in *roff* systems, use the "—" character in input outside an escape sequence *only* to mean a hyphen, as in the phrase "long-term". For a minus sign in running text or a Unix command-line option dash, use `\-` (or `\[-]` in *groff* if you find it helps the clarity of the source document). (Another minus sign, for use in mathematical equations, is available as `\(mi)`). AT&T *troff* supported em-dashes as `\(em`, as does *groff*.

The special character escape sequence for the apostrophe as a neutral single quote is typically needed only in technical content; typing words like "can't" and "Anne's" in a natural way will render correctly, because in ordinary prose an apostrophe is typeset either as a closing single quotation mark or as a neutral single quote, depending on the capabilities of the output device. By contrast, special character escape sequences should be used for quotation marks unless portability to limited or historical *troff* implementations is necessary; on those systems, the input convention is to pair the grave accent with the apostrophe for single quotes, and to double both characters for double quotes. AT&T *troff* defined no special characters for quotation marks or the apostrophe. Repeated single quotes ("thus") will be visually distinguishable from double quotes ("thus") on terminal devices, and perhaps on others (depending on the font selected).

AT&T <i>troff</i> input	recommended <i>groff</i> input
A Winter's Tale	A Winter's Tale
`U.K. outer quotes'	\[oq]U.K. outer quotes\[cq]
`U.K. ``inner'' quotes'	\[oq]U.K. \[lq]inner\[rq] quotes\[cq]
``U.S. outer quotes''	\[lq]U.S. outer quotes\[rq]
``U.S. `inner' quotes''	\[lq]U.S. \[oq]inner\[cq] quotes\[rq]

If you frequently require quotation marks in your document, see if the macro package you're using supplies strings or macros to facilitate quotation, or define them yourself (except in man pages).

Using Unicode basic Latin characters to compose boxes and lines is ill-advised. *roff* systems have special characters for drawing horizontal and vertical lines; see subsection "Rules and lines" below. Preprocessors like *tbl(1)* and *pic(1)* draw boxes and will produce the best possible output for the device, falling back to basic Latin glyphs only when necessary.

### Eight-bit encodings and Latin-1 supplement

ISO 646 is a seven-bit code encoding 128 code points; eight-bit codes are twice the size. ISO 8859-1 and code page 1047 allocated the additional space to what Unicode calls "C1 controls" (control characters) and the "Latin-1 supplement". The C1 controls are neither printable nor usable as *groff* input.

Two characters in the Latin-1 supplement are handled specially on input. *troff* never produces them as output.

**NBSP** encodes a no-break space; it is mapped to `\~`, the adjustable non-breaking space escape sequence.

**SHY** encodes a soft hyphen; it is mapped to `\%`, the hyphenation control escape sequence.

The remaining characters in the Latin-1 supplement represent themselves. Although they can be specified directly with the keyboard on systems configured to use Latin-1 as the character encoding, it is more portable, both to other *roff* systems and to UTF-8 environments, to use their special character escape sequences, shown below.

¡	\[r!]	inverted exclamation mark	Ñ	\[~N]	N tilde
¢	\[ct]	cent sign	Ò	\[`O]	O grave
£	\[Po]	pound sign	Ó	\['O]	O acute
¤	\[Cs]	currency sign	Ô	\[^O]	O circumflex
¥	\[Ye]	yen sign	Õ	\[~O]	O tilde
¦	\[bb]	broken bar	Ö	\[:O]	O dieresis
§	\[sc]	section sign	×	\[mu]	multiplication sign
¨	\[ad]	dieresis accent	Ø	\[/O]	O slash
©	\[co]	copyright sign	Ù	\[`U]	U grave
<sup>a</sup>	\[Of]	feminine ordinal indicator	Ú	\['U]	U acute
«	\[Fo]	left double chevron	Û	\[^U]	U circumflex
¬	\[no]	logical not	Ü	\[:U]	U dieresis
®	\[rg]	registered sign	Ý	\['Y]	Y acute
ˉ	\[a-]	macron accent	Þ	\[TP]	uppercase thorn
°	\[de]	degree sign	ß	\[ss]	lowercase sharp s
±	\[+-]	plus-minus	à	\[`a]	a grave
<sup>2</sup>	\[S2]	superscript two	á	\['a]	a acute
<sup>3</sup>	\[S3]	superscript three	â	\[^a]	a circumflex
´	\[aa]	acute accent	ã	\[~a]	a tilde
µ	\[mc]	micro sign	ä	\[:a]	a dieresis
¶	\[ps]	pilcrow sign	å	\[oa]	a ring
·	\[pc]	centered period	æ	\[ae]	ae ligature
¸	\[ac]	cedilla accent	ç	\[,c]	c cedilla
<sup>1</sup>	\[S1]	superscript one	è	\[`e]	e grave
º	\[Om]	masculine ordinal indicator	é	\['e]	e acute
»	\[Fc]	right double chevron	ê	\[^e]	e circumflex

¼	\[14]	one quarter symbol	ë	\[:e]	e dieresis
½	\[12]	one half symbol	ì	\[~i]	i grave
¾	\[34]	three quarters symbol	í	\['i]	e acute
¿	\[r?]	inverted question mark	î	\[^i]	i circumflex
À	\[~A]	A grave	ï	\[:i]	i dieresis
Á	\['A]	A acute	ð	\[Sd]	lowercase eth
Â	\[^A]	A circumflex	ñ	\[~n]	n tilde
Ã	\[~A]	A tilde	ò	\[~o]	o grave
Ä	\[:A]	A dieresis	ó	\['o]	o acute
Å	\[oA]	A ring	ô	\[^o]	o circumflex
Æ	\[AE]	AE ligature	õ	\[~o]	o tilde
Ç	\[,C]	C cedilla	ö	\[:o]	o dieresis
È	\[~E]	E grave	÷	\[di]	division sign
É	\['E]	E acute	ø	\[/o]	o slash
Ê	\[^E]	E circumflex	ù	\[~u]	u grave
Ë	\[:E]	E dieresis	ú	\['u]	u acute
Ì	\[~I]	I grave	û	\[^u]	u circumflex
Í	\['I]	I acute	ü	\[:u]	u dieresis
Î	\[^I]	I circumflex	ý	\['y]	y acute
Ï	\[:I]	I dieresis	þ	\[Tp]	lowercase thorn
Ð	\[-D]	uppercase eth	ÿ	\[:y]	y dieresis

### Special character escape forms

Glyphs that lack a character code in the basic Latin repertoire to directly represent them are entered by one of several special character escape forms. Such glyphs can be simple or composite, and accessed either by name or numerically by code point. Code points and combining properties are determined by character encoding standards, whereas glyph names as used here originated in AT&T *troff* special character escape sequences. Any character valid in a *groff* identifier may be used in a glyph name. Predefined glyph names use only characters in the basic Latin repertoire.

`\gl` is a special character escape sequence for the glyph with the two-character name *gl*. This is the original syntax form supported by AT&T *troff*. The acute accent, `\aa`, is an example.

`\C'glyph-name'`

is a special character escape sequence for *glyph-name*, which can be of arbitrary length. The delimiter, shown here as a neutral apostrophe, can be any character not occurring in *glyph-name*. This syntax form was introduced in later versions of AT&T device-independent *troff*. The foregoing acute accent example can be expressed as `\C'aa'`.

`\[glyph-name]`

is a special character escape sequence for *glyph-name*, which can be of arbitrary length but must not contain a closing square bracket “]”. (No glyph names predefined by *groff* employ “]”.) The foregoing acute accent example can be expressed in *groff* as `\[aa]`.

`\C'c'` and `\[c]` are not synonyms for the ordinary character “c”, but request the special character named “\c”. For example, “`\[a]`” is not “a”, but rather a special character with the internal glyph name (used in font description files and diagnostic messages) `\a`, which is typically undefined. The only such glyph name *groff* predefines is the minus sign, which can therefore be accessed as `\C'-'` or `\[-]`.

`\[base-glyph composite-1 composite-2 ... composite-n]`

is a composite glyph. Glyphs like a lowercase “e” with an acute accent, as in the word “café”, can be expressed as `\[e aa]`. See subsection “Accents” below for a table of combining glyph names.

Unicode encodes far more characters than *groff* has glyph names for; special character escape forms based on numerical code points enable access to any of them. Frequently used glyphs or glyph combinations can be stored in strings, and new glyph names can be created with the **char** request, enabling the user to devise *ad hoc* names for them; see [groff\(7\)](#).

**\unnnn[n[n]]**

is a Unicode numeric special character escape sequence. With this form, any Unicode character can be accessed by code point using four to six hexadecimal digits, with hexadecimal letters accepted in uppercase form only. Thus, **\u02DA** accesses the (spacing) ring accent, producing “”.

Unicode code points can be composed as well; when they are, GNU *troff* requires NFD (Normalization Form D), where all Unicode glyphs are maximally decomposed. (Exception: precomposed characters in the Latin-1 supplement described above are also accepted. Do not count on this exception remaining in a future GNU *troff* that accepts UTF-8 input directly.) Thus, GNU *troff* accepts “caf[e]”, “caf[e aa]”, and “caf[u0065\_0301]”, as ways to input “café”. (Due to its legacy 8-bit encoding compatibility, at present it also accepts “caf[u00E9]” on ISO Latin-1 systems.)

**\ubase-glyph[\_combining-component]..]**

constructs a composite glyph from Unicode numeric special character escape sequences. The code points of the base glyph and the combining components are each expressed in hexadecimal, with an underscore ( \_ ) separating each component. Thus, **\u006E\_0303** produces “ñ”.

**\charnnn]**

expresses an eight-bit code point where *nnn* is the code point of the character, a decimal number between 0 and 255 without leading zeroes. This legacy numeric special character escape sequence is used to map characters onto glyphs via the **trin** request in macro files loaded by *grotty*(1).

**Glyph tables**

In this section, *groff*'s glyph name repertoire is presented in tabular form. The meanings of the columns are as follows.

**Output** shows the glyph as it appears on the device used to render this document; although it can have a notably different shape on other devices (and is subject to user-directed translation and replacement), *groff* attempts reasonable equivalency on all output devices.

**Input** shows the *groff* character (ordinary or special) that normally produces the glyph. Some code points have multiple glyph names.

**Unicode** is the code point notation for the glyph or combining glyph sequence as described in subsection “Special character escape forms” above. It corresponds to the standard notation for Unicode short identifiers such that *groff*'s **unnnn** is equivalent to Unicode's U+*nnnn*.

**Notes** describes the glyph, elucidating the mnemonic value of the glyph name where possible.

A plus sign “+” indicates that the glyph name appears in the AT&T *troff* user's manual, CSTR #54 (1992 revision). When using the AT&T special character syntax **\(xx**, widespread portability can be expected from such names.

Entries marked with “\*\*\*” denote glyphs used for mathematical purposes. On typesetter devices, such glyphs are typically drawn from a *special* font (see *groff\_font*(5)). Often, such glyphs lack bold or italic style forms or have metrics that look incongruous in ordinary prose. A few which are not uncommon in running text have “text variants”, which should work better in that context. Conversely, a handful of glyphs that are normally drawn from a text font may be required in mathematical equations. Both sets of exceptions are noted in the tables where they appear (“Logical symbols” and “Mathematical symbols”).

**Basic Latin**

Apart from basic Latin characters with special mappings, described in subsection “Fundamental character set” above, a few others in that range have special character glyph names. These were defined for ease of input on non-U.S. keyboards lacking keycaps for them, or for symmetry with other special character glyph names serving a similar purpose.

The vertical bar is overloaded; the **\[ba]** and **\[or]** escape sequences may render differently. See subsection “Mathematical symbols” below for special variants of the plus, minus, and equals signs normally drawn from this range.

Output	Input	Unicode	Notes
"	\[dq]	u0022	neutral double quote
#	\[sh]	u0023	number sign
\$	\[Do]	u0024	dollar sign
'	\[aq]	u0027	apostrophe, neutral single quote
/	\[sl]	u002F	slash, solidus +
@	\[at]	u0040	at sign
[	\[lB]	u005B	left square bracket
\	\[rs]	u005C	reverse solidus
]	\[rB]	u005D	right square bracket
^	\[ha]	u005E	circumflex, caret, “hat” +
{	\[lC]	u007B	left brace
		u007C	bar
	\[ba]	u007C	bar
	\[or]	u007C	bitwise or +
}	\[rC]	u007D	right brace
~	\[ti]	u007E	tilde +

### Supplementary Latin letters

Historically, `\[ss]` could be considered a ligature of “sz”. An uppercase form is available as `\[u1E9E]`, but in the German language it is of specialized use; `\[B]` does *not* normally uppercase-transform to it, but rather to “SS”. “Lowercase f with hook” is also used as a function symbol; see subsection “Mathematical symbols” below.

Output	Input	Unicode	Notes
Ð	\[-D]	u00D0	uppercase eth
ð	\[sd]	u00F0	lowercase eth
Þ	\[TP]	u00DE	uppercase thorn
þ	\[Tp]	u00FE	lowercase thorn
ß	\[ss]	u00DF	lowercase sharp s
ı	\[.i]	u0131	i without tittle
	\[.j]	u0237	j without tittle
f	\[Fn]	u0192	lowercase f with hook, function
Ł	\[/L]	u0141	L with stroke
ł	\[/l]	u0142	l with stroke
Ø	\[/O]	u00D8	O with stroke
ø	\[/o]	u00F8	o with stroke

### Ligatures and digraphs

Output	Input	Unicode	Notes
ff	\[ff]	u0066_0066	ff ligature +
fi	\[fi]	u0066_0069	fi ligature +
fl	\[fl]	u0066_006C	fl ligature +
ffi	\[Fi]	u0066_0066_0069	ffi ligature +
ffl	\[Fl]	u0066_0066_006C	ffl ligature +
Æ	\[AE]	u00C6	AE ligature
æ	\[ae]	u00E6	ae ligature
Œ	\[OE]	u0152	OE ligature
œ	\[oe]	u0153	oe ligature
IJ	\[IJ]	u0132	IJ digraph
ij	\[ij]	u0133	ij digraph

### Accents

Normally, the formatting of a special character advances the drawing position as an ordinary character does. `groff`'s **composite** request designates a special character as combining. The `composite.tmac` macro file, loaded automatically by the default `troffrc`, maps the following special characters to the combining charac-

ters shown below. The non-combining code point in parentheses is used when the special character occurs in isolation (compare “caf[e aa]” and “caf[aa]e”).

Output	Input	Unicode	Notes
¨	\[a"]	u030B (u02DD)	double acute accent
ˉ	\[a-]	u0304 (u00AF)	macron accent
˙	\[a.]	u0307 (u02D9)	dot accent
ˆ	\[a^]	u0302 (u005E)	circumflex accent
ˆ	\[aa]	u0301 (u00B4)	acute accent +
˘	\[ga]	u0300 (u0060)	grave accent +
˘	\[ab]	u0306 (u02D8)	breve accent
¸	\[ac]	u0327 (u00B8)	cedilla accent
¨	\[ad]	u0308 (u00A8)	dieresis accent
ˇ	\[ah]	u030C (u02C7)	caron accent
◌◌	\[ao]	u030A (u02DA)	ring accent
˜	\[a~]	u0303 (u007E)	tilde accent
¸	\[ho]	u0328 (u02DB)	hook accent

### Accented characters

All of these glyphs can be composed using combining glyph names as described in subsection “Special character escape forms” above; the names below are short aliases for convenience.

Output	Input	Unicode	Notes
Á	\['A]	u0041_0301	A acute
Ć	\['C]	u0043_0301	C acute
É	\['E]	u0045_0301	E acute
Í	\['I]	u0049_0301	I acute
Ó	\['O]	u004F_0301	O acute
Ú	\['U]	u0055_0301	U acute
Ý	\['Y]	u0059_0301	Y acute
á	\['a]	u0061_0301	a acute
ć	\['c]	u0063_0301	c acute
é	\['e]	u0065_0301	e acute
í	\['i]	u0069_0301	i acute
ó	\['o]	u006F_0301	o acute
ú	\['u]	u0075_0301	u acute
ý	\['y]	u0079_0301	y acute
Ä	\[:A]	u0041_0308	A dieresis
Ë	\[:E]	u0045_0308	E dieresis
Ï	\[:I]	u0049_0308	I dieresis
Ö	\[:O]	u004F_0308	O dieresis
Ü	\[:U]	u0055_0308	U dieresis
ÿ	\[:Y]	u0059_0308	Y dieresis
ä	\[:a]	u0061_0308	a dieresis
ë	\[:e]	u0065_0308	e dieresis
ï	\[:i]	u0069_0308	i dieresis
ö	\[:o]	u006F_0308	o dieresis
ü	\[:u]	u0075_0308	u dieresis
ÿ	\[:y]	u0079_0308	y dieresis
Â	\[^A]	u0041_0302	A circumflex
Ê	\[^E]	u0045_0302	E circumflex
Î	\[^I]	u0049_0302	I circumflex
Ô	\[^O]	u004F_0302	O circumflex

Û	\[^U]	u0055_0302	U circumflex
â	\[^a]	u0061_0302	a circumflex
ê	\[^e]	u0065_0302	e circumflex
î	\[^i]	u0069_0302	i circumflex
ô	\[^o]	u006F_0302	o circumflex
û	\[^u]	u0075_0302	u circumflex
À	\[`A]	u0041_0300	A grave
È	\[`E]	u0045_0300	E grave
Ì	\[`I]	u0049_0300	I grave
Ò	\[`O]	u004F_0300	O grave
Ù	\[`U]	u0055_0300	U grave
à	\[`a]	u0061_0300	a grave
è	\[`e]	u0065_0300	e grave
ì	\[`i]	u0069_0300	i grave
ò	\[`o]	u006F_0300	o grave
ù	\[`u]	u0075_0300	u grave
Ã	\[~A]	u0041_0303	A tilde
Ñ	\[~N]	u004E_0303	N tilde
Õ	\[~O]	u004F_0303	O tilde
ã	\[~a]	u0061_0303	a tilde
ñ	\[~n]	u006E_0303	n tilde
õ	\[~o]	u006F_0303	o tilde
Š	\[vS]	u0053_030C	S caron
š	\[vs]	u0073_030C	s caron
Ž	\[vZ]	u005A_030C	Z caron
ž	\[vz]	u007A_030C	z caron
Ç	\[,C]	u0043_0327	C cedilla
ç	\[,c]	u0063_0327	c cedilla
Å	\[oA]	u0041_030A	A ring
å	\[oa]	u0061_030A	a ring

### Quotation marks

The neutral double quote, often useful when documenting programming languages, is also available as a special character for convenient embedding in macro arguments; see subsection “Fundamental character set” above.

Output	Input	Unicode	Notes
„	\[Bq]	u201E	low double comma quote
,	\[bq]	u201A	low single comma quote
“	\[lq]	u201C	left double quote
”	\[rq]	u201D	right double quote
‘	\[oq]	u2018	single opening (left) quote
’	\[cq]	u2019	single closing (right) quote
’	\[aq]	u0027	apostrophe, neutral single quote
"	"	u0022	neutral double quote
"	\[dq]	u0022	neutral double quote
«	\[Fo]	u00AB	left double chevron
»	\[Fc]	u00BB	right double chevron
<	\[fo]	u2039	left single chevron
>	\[fc]	u203A	right single chevron

### Punctuation

The Unicode name for U+00B7 is “middle dot”, which is unfortunately confusable with the *groff* mnemonic for the visually similar but semantically distinct multiplication dot; see subsection “Mathematical symbols” below.

Output	Input	Unicode	Notes
¡	\[r!]	u00A1	inverted exclamation mark
¿	\[r?]	u00BF	inverted question mark
·	\[pc]	u00B7	centered period
—	\[em]	u2014	em-dash +
-	\[en]	u2013	en-dash
-	\[hy]	u2010	hyphen +

### Brackets

On typewriter devices, the bracket extensions are font-invariant glyphs; that is, they are rendered the same way regardless of font (with a drawing escape sequence). On terminals, they are *not* font-invariant; *groff* maps them rather arbitrarily to U+23AA (“curly bracket extension”). In AT&T *troff*, only one glyph was available to vertically extend brackets, braces, and parentheses: `\(bv`.

Not all devices supply bracket pieces that can be piled up with `\b` due to the restrictions of the escape’s piling algorithm. A general solution to build brackets out of pieces is the following macro:

```

.\" Make a pile centered vertically 0.5em above the baseline.
.\" The first argument is placed at the top.
.\" The pile is returned in string 'pile'.
.eo
.de pile-make
. nr pile-wd 0
. nr pile-ht 0
. ds pile-args
.
. nr pile-# \n[.]$
. while \n[pile-#] \{\
.   nr pile-wd (\n[pile-wd] >? \w'\[$\n[pile-#]]')
.   nr pile-ht +(\n[rst] - \n[rsb])
.   as pile-args \v'\n[rsb]u'\
.   as pile-args \Z'\[$\n[pile-#]]'\
.   as pile-args \v'-\n[rst]u'\
.   nr pile-# -1
. \}
.
. ds pile \v'(-0.5m + (\n[pile-ht]u / 2u))'\
. as pile \*[pile-args]\
. as pile \v'((\n[pile-ht]u / 2u) + 0.5m)'\
. as pile \h'\n[pile-wd]u'\
..
.ec

```

Another complication is the fact that some glyphs which represent bracket pieces in AT&T *troff* can be used for other mathematical symbols as well, for example `\(lf` and `\(rf`, which provide the floor operator. Some output devices, such as `dvi`, don’t unify such glyphs. For this reason, the glyphs `\[lf]`, `\[rf]`, `\[lc]`, and `\[rc]` are not unified with similar-looking bracket pieces. In *groff*, only glyphs with long names are guaranteed to pile up correctly for all devices—provided those glyphs are available.

Output	Input	Unicode	Notes
[	[	u005B	left square bracket
[	\[lB]	u005B	left square bracket

]	]	u005D	right square bracket
]	\[rB]	u005D	right square bracket
{	{	u007B	left brace
{	\[lC]	u007B	left brace
}	}	u007D	right brace
}	\[rC]	u007D	right brace
<	\[la]	u27E8	left angle bracket
>	\[ra]	u27E9	right angle bracket
	\[bv]	u23AA	brace vertical extension + ***
	\[braceex]	u23AA	brace vertical extension
[	\[bracketlefttp]	u23A1	left square bracket top
	\[bracketleftex]	u23A2	left square bracket extension
L	\[bracketleftbt]	u23A3	left square bracket bottom
]	\[bracketrighttp]	u23A4	right square bracket top
	\[bracketrightex]	u23A5	right square bracket extension
]	\[bracketrightbt]	u23A6	right square bracket bottom
{	\[lt]	u23A7	left brace top +
{	\[lk]	u23A8	left brace middle +
{	\[lb]	u23A9	left brace bottom +
{	\[bracelefttp]	u23A7	left brace top
{	\[braceleftmid]	u23A8	left brace middle
{	\[braceleftbt]	u23A9	left brace bottom
	\[braceleftex]	u23AA	left brace extension
}	\[rt]	u23AB	right brace top +
}	\[rk]	u23AC	right brace middle +
}	\[rb]	u23AD	right brace bottom +
}	\[bracerighttp]	u23AB	right brace top
}	\[bracerightmid]	u23AC	right brace middle
}	\[bracerightbt]	u23AD	right brace bottom
	\[bracerightex]	u23AA	right brace extension
(	\[parenlefttp]	u239B	left parenthesis top
	\[parenleftex]	u239C	left parenthesis extension
(	\[parenleftbt]	u239D	left parenthesis bottom
)	\[parenrighttp]	u239E	right parenthesis top
	\[parenrightex]	u239F	right parenthesis extension
)	\[parenrightbt]	u23A0	right parenthesis bottom

**Arrows**

Output	Input	Unicode	Notes
←	\[<-]	u2190	horizontal arrow left +
→	\[->]	u2192	horizontal arrow right +
↔	\[<>]	u2194	bidirectional horizontal arrow
↓	\[da]	u2193	vertical arrow down +
↑	\[ua]	u2191	vertical arrow up +
↕	\[va]	u2195	bidirectional vertical arrow
⇐	\[lA]	u21D0	horizontal double arrow left
⇒	\[rA]	u21D2	horizontal double arrow right
⇔	\[hA]	u21D4	bidirectional horizontal double arrow
⇓	\[dA]	u21D3	vertical double arrow down

↑↑	<code>\[uA]</code>	u21D1	vertical double arrow up
	<code>\[vA]</code>	u21D5	bidirectional vertical double arrow
—	<code>\[an]</code>	u23AF	horizontal arrow extension

### Rules and lines

On typesetter devices, the font-invariant glyphs (see subsection “Brackets” above) `\[br]`, `\[ul]`, and `\[rn]` form corners when adjacent; they can be used to build boxes. On terminal devices, they are mapped as shown in the table. The Unicode-derived names of these three glyphs are approximations.

The input character `_` always accesses the underscore glyph in a font; `\[ul]`, by contrast, may be font-invariant on typesetter devices.

The baseline rule `\[ru]` is a font-invariant glyph, namely a rule of one-half em.

In AT&T *troff*, `\[rn]` also served as a one en extension of the square root symbol. *groff* favors `\[radicalx]` for this purpose; see subsection “Mathematical symbols” below.

Output	Input	Unicode	Notes
		u007C	bar
	<code>\[ba]</code>	u007C	bar
	<code>\[br]</code>	u2502	box rule +
—	—	u005F	underscore, low line +
—	<code>\[ul]</code>	---	underrule +
=	<code>\[rn]</code>	u203E	overline +
—	<code>\[ru]</code>	---	baseline rule +
	<code>\[bb]</code>	u00A6	broken bar
/	/	u002F	slash, solidus +
/	<code>\[sl]</code>	u002F	slash, solidus +
\	<code>\[rs]</code>	u005C	reverse solidus

### Text markers

Output	Input	Unicode	Notes
○	<code>\[ci]</code>	u25CB	circle +
•	<code>\[bu]</code>	u2022	bullet +
†	<code>\[dg]</code>	u2020	dagger +
‡	<code>\[dd]</code>	u2021	double dagger +
◇	<code>\[lz]</code>	u25CA	lozenge, diamond
□	<code>\[sq]</code>	u25A1	square +
¶	<code>\[ps]</code>	u00B6	pilcrow sign
§	<code>\[sc]</code>	u00A7	section sign +
☞	<code>\[lh]</code>	u261C	hand pointing left +
☜	<code>\[rh]</code>	u261E	hand pointing right +
@	@	u0040	at sign
@	<code>\[at]</code>	u0040	at sign
#	#	u0023	number sign
#	<code>\[sh]</code>	u0023	number sign
↵	<code>\[CR]</code>	u21B5	carriage return
✓	<code>\[OK]</code>	u2713	check mark

### Legal symbols

The Bell System logo is not supported in *groff*.

Output	Input	Unicode	Notes
©	<code>\[co]</code>	u00A9	copyright sign +
®	<code>\[rg]</code>	u00AE	registered sign +
™	<code>\[tm]</code>	u2122	trade mark sign
	<code>\[bs]</code>	---	Bell System logo +

**Currency symbols**

Output	Input	Unicode	Notes
\$	<code>\\$</code>	u0024	dollar sign
\$	<code>\[Do]</code>	u0024	dollar sign
¢	<code>\[ct]</code>	u00A2	cent sign +
€	<code>\[eu]</code>	u20AC	Euro sign
€	<code>\[Eu]</code>	u20AC	variant Euro sign
¥	<code>\[Ye]</code>	u00A5	yen sign
£	<code>\[Po]</code>	u00A3	pound sign
¤	<code>\[Cs]</code>	u00A4	currency sign

**Units**

Output	Input	Unicode	Notes
°	<code>\[de]</code>	u00B0	degree sign +
‰	<code>\[%0]</code>	u2030	per thousand, per mille sign
′	<code>\[fm]</code>	u2032	arc minute sign, foot mark +
″	<code>\[sd]</code>	u2033	arc second sign
μ	<code>\[mc]</code>	u00B5	micro sign
<sup>a</sup>	<code>\[Of]</code>	u00AA	feminine ordinal indicator
<sup>o</sup>	<code>\[Om]</code>	u00BA	masculine ordinal indicator

**Logical symbols**

The variants of the not sign may differ in appearance or spacing depending on the device and font selected. Unicode does not encode a discrete “bitwise or” sign: on typesetter devices, it is drawn shorter than the bar, about the same height as a capital letter. Terminal devices unify `\[ba]` and `\[or]`.

Output	Input	Unicode	Notes
∧	<code>\[AN]</code>	u2227	logical and
∨	<code>\[OR]</code>	u2228	logical or
¬	<code>\[no]</code>	u00AC	logical not + ***
⌋	<code>\[tno]</code>	u00AC	text variant of <code>\[no]</code>
∃	<code>\[te]</code>	u2203	there exists
∀	<code>\[fa]</code>	u2200	for all
∋	<code>\[st]</code>	u220B	such that
∴	<code>\[3d]</code>	u2234	therefore
∴	<code>\[tf]</code>	u2234	therefore
		u007C	bar
	<code>\[or]</code>	u007C	bitwise or +

**Mathematical symbols**

`\[Fn]` also appears in subsection “Supplementary Latin letters” above. Observe the two varieties of the plus-minus, multiplication, and division signs; `\[+-]`, `\[mu]`, and `\[di]` are normally drawn from the special font, but have text font variants. Also be aware of three glyphs available in special font variants that are normally drawn from text fonts: the plus, minus, and equals signs. These variants may differ in appearance or spacing depending on the device and font selected.

In AT&T *troff*, `\(rn` (“root en extender”) served as the horizontal extension of the radical (square root) sign, `\(sr`, and was drawn at the maximum height of the typeface’s bounding box; this enabled the special character to double as an overline (see subsection “Rules and lines” above). A contemporary font’s radical sign might not ascend to such an extreme. In *groff*, you can instead use `\[radicalex]` to continue the radical sign `\[sr]`; these special characters are intended for use with text fonts. `\[sqrt]` and `\[sqrtex]` are their counterparts with mathematical spacing.

Output	Input	Unicode	Notes
½	<code>\[12]</code>	u00BD	one half symbol +
¼	<code>\[14]</code>	u00BC	one quarter symbol +

$\frac{3}{4}$	<code>\[34]</code>	u00BE	three quarters symbol +
$\frac{1}{8}$	<code>\[18]</code>	u215B	one eighth symbol
$\frac{3}{8}$	<code>\[38]</code>	u215C	three eighths symbol
$\frac{5}{8}$	<code>\[58]</code>	u215D	five eighths symbol
$\frac{7}{8}$	<code>\[78]</code>	u215E	seven eighths symbol
<sup>1</sup>	<code>\[S1]</code>	u00B9	superscript one
<sup>2</sup>	<code>\[S2]</code>	u00B2	superscript two
<sup>3</sup>	<code>\[S3]</code>	u00B3	superscript three
+	<code>+</code>	u002B	plus
+	<code>\[p1]</code>	u002B	special variant of plus + ***
-	<code>\[-]</code>	u002D	minus
-	<code>\[mi]</code>	u2212	special variant of minus + ***
	<code>\[-+]</code>	u2213	minus-plus
±	<code>\[+-]</code>	u00B1	plus-minus + ***
±	<code>\[t+-]</code>	u00B1	text variant of <code>\[+-]</code>
·	<code>\[md]</code>	u22C5	multiplication dot
×	<code>\[mu]</code>	u00D7	multiplication sign + ***
×	<code>\[tmu]</code>	u00D7	text variant of <code>\[mu]</code>
⊗	<code>\[c*]</code>	u2297	circled times
⊕	<code>\[c+]</code>	u2295	circled plus
÷	<code>\[di]</code>	u00F7	division sign + ***
÷	<code>\[tdi]</code>	u00F7	text variant of <code>\[di]</code>
/	<code>\[f/]</code>	u2044	fraction slash
*	<code>*</code>	u002A	asterisk
*	<code>\[**]</code>	u2217	mathematical asterisk +
≤	<code>\[&lt;=]</code>	u2264	less than or equal to +
≥	<code>\[&gt;=]</code>	u2265	greater than or equal to +
≪	<code>\[&lt;&lt;]</code>	u226A	much less than
≫	<code>\[&gt;&gt;]</code>	u226B	much greater than
=	<code>=</code>	u003D	equals
=	<code>\[eq]</code>	u003D	special variant of equals + ***
≠	<code>\[!]=]</code>	u003D_0338	not equals +
≡	<code>\[==]</code>	u2261	equivalent +
≢	<code>\[ne]</code>	u2261_0338	not equivalent
≈	<code>\[=~]</code>	u2245	approximately equal to
≈	<code>\[ =]</code>	u2243	asymptotically equal to +
~	<code>\[ti]</code>	u007E	tilde +
~	<code>\[ap]</code>	u223C	similar to, tilde operator +
≈	<code>\[~~]</code>	u2248	almost equal to
≈	<code>\[~=]</code>	u2248	almost equal to
∝	<code>\[pt]</code>	u221D	proportional to +
∅	<code>\[es]</code>	u2205	empty set +
∈	<code>\[mo]</code>	u2208	element of a set +
∉	<code>\[nm]</code>	u2208_0338	not element of set
⊂	<code>\[sb]</code>	u2282	proper subset +
⊄	<code>\[nb]</code>	u2282_0338	not subset
⊃	<code>\[sp]</code>	u2283	proper superset +
⊄	<code>\[nc]</code>	u2283_0338	not superset
⊆	<code>\[ib]</code>	u2286	subset or equal +
⊇	<code>\[ip]</code>	u2287	superset or equal +

$\cap$	<code>\[ca]</code>	u2229	intersection, cap +
$\cup$	<code>\[cu]</code>	u222A	union, cup +
$\sphericalangle$	<code>\[/_]</code>	u2220	angle
$\perp$	<code>\[pp]</code>	u22A5	perpendicular
$\int$	<code>\[is]</code>	u222B	integral +
$\int$	<code>\[integral]</code>	u222B	integral ***
$\Sigma$	<code>\[sum]</code>	u2211	summation ***
$\Pi$	<code>\[product]</code>	u220F	product ***
	<code>\[coproduct]</code>	u2210	coproduct ***
$\nabla$	<code>\[gr]</code>	u2207	gradient +
$\sqrt{\quad}$	<code>\[sr]</code>	u221A	radical sign, square root +
$\overline{\quad}$	<code>\[rn]</code>	u203E	overline +
$\sqrt{\quad}$	<code>\[radicalex]</code>	---	radical extension
$\sqrt{\quad}$	<code>\[sqrt]</code>	u221A	radical sign, square root ***
$\sqrt{\quad}$	<code>\[sqrtex]</code>	---	radical extension ***
$\lceil$	<code>\[lc]</code>	u2308	left ceiling +
$\rceil$	<code>\[rc]</code>	u2309	right ceiling +
$\lfloor$	<code>\[lf]</code>	u230A	left floor +
$\rfloor$	<code>\[rf]</code>	u230B	right floor +
$\infty$	<code>\[if]</code>	u221E	infinity +
$\aleph$	<code>\[Ah]</code>	u2135	aleph symbol
$f$	<code>\[Fn]</code>	u0192	lowercase f with hook, function
$\Im$	<code>\[Im]</code>	u2111	blackletter I, imaginary part
$\Re$	<code>\[Re]</code>	u211C	blackletter R, real part
$\wp$	<code>\[wp]</code>	u2118	Weierstrass p
$\partial$	<code>\[pd]</code>	u2202	partial differential
$\hbar$	<code>\[-h]</code>	u210F	h bar
$\hbar$	<code>\[hbar]</code>	u210F	h bar

### Greek glyphs

These glyphs are intended for technical use, not for typesetting Greek language text; normally, the uppercase letters have upright shape, and the lowercase ones are slanted.

Output	Input	Unicode	Notes
A	<code>\[*A]</code>	u0391	uppercase alpha +
B	<code>\[*B]</code>	u0392	uppercase beta +
Γ	<code>\[*G]</code>	u0393	uppercase gamma +
Δ	<code>\[*D]</code>	u0394	uppercase delta +
E	<code>\[*E]</code>	u0395	uppercase epsilon +
Z	<code>\[*Z]</code>	u0396	uppercase zeta +
H	<code>\[*Y]</code>	u0397	uppercase eta +
Θ	<code>\[*H]</code>	u0398	uppercase theta +
I	<code>\[*I]</code>	u0399	uppercase iota +
K	<code>\[*K]</code>	u039A	uppercase kappa +
Λ	<code>\[*L]</code>	u039B	uppercase lambda +
M	<code>\[*M]</code>	u039C	uppercase mu +
N	<code>\[*N]</code>	u039D	uppercase nu +
Ξ	<code>\[*C]</code>	u039E	uppercase xi +
O	<code>\[*O]</code>	u039F	uppercase omicron +
Π	<code>\[*P]</code>	u03A0	uppercase pi +
P	<code>\[*R]</code>	u03A1	uppercase rho +
Σ	<code>\[*S]</code>	u03A3	uppercase sigma +

Τ	\[*T]	u03A4	uppercase tau +
Υ	\[*U]	u03A5	uppercase upsilon +
Φ	\[*F]	u03A6	uppercase phi +
Χ	\[*X]	u03A7	uppercase chi +
Ψ	\[*Q]	u03A8	uppercase psi +
Ω	\[*W]	u03A9	uppercase omega +
α	\[*a]	u03B1	lowercase alpha +
β	\[*b]	u03B2	lowercase beta +
γ	\[*g]	u03B3	lowercase gamma +
δ	\[*d]	u03B4	lowercase delta +
ε	\[*e]	u03B5	lowercase epsilon +
ζ	\[*z]	u03B6	lowercase zeta +
η	\[*y]	u03B7	lowercase eta +
θ	\[*h]	u03B8	lowercase theta +
ι	\[*i]	u03B9	lowercase iota +
κ	\[*k]	u03BA	lowercase kappa +
λ	\[*l]	u03BB	lowercase lambda +
μ	\[*m]	u03BC	lowercase mu +
ν	\[*n]	u03BD	lowercase nu +
ξ	\[*c]	u03BE	lowercase xi +
ο	\[*o]	u03BF	lowercase omicron +
π	\[*p]	u03C0	lowercase pi +
ρ	\[*r]	u03C1	lowercase rho +
σ	\[*s]	u03C3	lowercase sigma +
τ	\[*t]	u03C4	lowercase tau +
υ	\[*u]	u03C5	lowercase upsilon +
φ	\[*f]	u03D5	lowercase phi +
χ	\[*x]	u03C7	lowercase chi +
ψ	\[*q]	u03C8	lowercase psi +
ω	\[*w]	u03C9	lowercase omega +
	\[+e]	u03F5	variant epsilon (lunate)
ϑ	\[+h]	u03D1	variant theta (cursive form)
ϖ	\[+p]	u03D6	variant pi (similar to omega)
ϕ	\[+f]	u03C6	variant phi (curly shape)
ς	\[+s]	u03C2	terminal lowercase sigma +

### Playing card symbols

Output	Input	Unicode	Notes
♣	\[CL]	u2663	solid club suit
♠	\[SP]	u2660	solid spade suit
♥	\[HE]	u2665	solid heart suit
♦	\[DI]	u2666	solid diamond suit

### History

A consideration of the typefaces originally available to AT&T *nroff* and *troff* illuminates many conventions that one might regard as idiosyncratic fifty years afterward. (See section “History” of *roff(7)* for more context.) The face used by the Teletype Model 37 terminals of the Murray Hill Unix Room was based on ASCII, but assigned multiple meanings to several code points, as suggested by that standard. Decimal 34 (") served as a dieresis accent and neutral double quotation mark; decimal 39 (') as an acute accent, apostrophe, and closing (right) single quotation mark; decimal 45 (–) as a hyphen and a minus sign; decimal 94 (^) as a circumflex accent and caret; decimal 96 (ˆ) as a grave accent and opening (left) single quotation mark; and decimal 126 (~) as a tilde accent and (with a half-line motion) swung dash. The Model 37 bore an optional extended character set offering upright Greek letters and several mathematical symbols; these were documented as early as the *kbd(VII)* man page of the (First Edition) *Unix Programmer's Manual*.

At the time Graphic Systems delivered the C/A/T phototypesetter to AT&T, the ASCII character set was not considered a standard basis for a glyph repertoire by traditional typographers. In the stock Times roman, italic, and bold styles available, several ASCII characters were not present at all, nor was most of the Teletype’s extended character set. AT&T commissioned a “special” font to ensure no loss of repertoire.

A representation of the coverage of the C/A/T’s text fonts follows. The glyph resembling an underscore is a baseline rule, and that resembling a vertical line is a box rule. In italics, the box rule was not slanted. We also observe that the hyphen and minus sign were already “de-unified” by the fonts provided; a decision whither to map an input “-” therefore had to be taken.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	fi	fl	ffi	ffl												
!	\$	%	&	(	)	'	'	*	+	-	.	,	:	;	=	?	[	]							
•	□	—	-	_	¼	½	¾	°	†	¢	®	©													

The special font supplied the missing ASCII and Teletype extended glyphs, among several others. The plus, minus, and equals signs appeared in the special font despite availability in text fonts “to insulate the appearance of equations from the choice of standard [read: text] fonts”—a priority since *troff* was turned to the task of mathematical typesetting as soon as it was developed.

We note that AT&T took the opportunity to de-unify the apostrophe/right single quotation mark from the acute accent (a choice ISO later duplicated in its 8859 series of standards). A slash intended to be mirror-symmetric with the backslash was also included, as was the Bell System logo; we do not attempt to depict the latter.

$\alpha$	$\beta$	$\gamma$	$\delta$	$\epsilon$	$\zeta$	$\eta$	$\theta$	$\iota$	$\kappa$	$\lambda$	$\mu$	$\nu$	$\xi$	$\omicron$	$\pi$	$\rho$	$\sigma$	$\varsigma$	$\tau$	$\upsilon$	$\phi$	$\chi$	$\psi$	$\omega$
Γ	Δ	Θ	Λ	Ξ	Π	Σ	Υ	Φ	Ψ	Ω														
"	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
≥	≤	≅	≈	≠	↑	↓	←	→	×	÷	±	∞	∂	∇	¬	∫	∝	√	∩	∪	∩	∪	∩	∪
§	‡	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗

One ASCII character as rendered by the Model 37 was apparently abandoned. That device printed decimal 124 (!) as a broken vertical line, like Unicode U+00A6 (!). No equivalent was available on the C/A/T; the box rule `\[br]`, brace vertical extension `\[bv]`, and “or” operator `\[or]` were used as contextually appropriate.

Devices supported by AT&T device-independent *troff* exhibited some differences in glyph detail. For example, on the Autologic APS-5 phototypesetter, the square `\[sq]` became filled in the Times bold face.

## Files

The files below are loaded automatically by the default *troffrc*.

`/usr/local/share/groff/1.23.0/tmac/composite.tmac`

assigns alternate mappings for identifiers after the first in a composite special character escape sequence. See subsection “Accents” above.

`/usr/local/share/groff/1.23.0/tmac/fallbacks.tmac`

defines fallback mappings for Unicode code points such as the increment sign (U+2206) and upper- and lowercase Roman numerals.

## Authors

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## See also

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. Section “Using Symbols” may be of particular note. You can browse it interactively with “info '(groff) Using Symbols”.

“An extension to the *troff* character set for Europe”, E.G. Keizer, K.J. Simonsen, J. Akkerhuis; EUUG Newsletter, Volume 9, No. 2, Summer 1989

The Unicode Standard (<http://www.unicode.org>)

“7-bit Character Sets” (<https://www.aivosto.com/articles/charsets-7bit.html>) by Tuomas Salste documents the inherent ambiguity and configurable code points of the ASCII encoding standard.

“Nroff/Troff User’s Manual” by Joseph F. Ossanna, 1976, AT&T Bell Laboratories Computing Science Technical Report No. 54, features two tables that throw light on the glyph repertoire available to “typesetter *roff*” when it was first written. Be careful of re-typeset versions of this document that can be found on the Internet. Some do not accurately represent the original document: several glyphs are obviously missing. More subtly, lowercase Greek letters are rendered upright, not slanted as they appeared in the C/A/T’s special font and as expected by *troff* users.

[groff\\_rfc1345\(7\)](#) describes an alternative set of special character glyph names, which extends and in some cases overrides the definitions listed above.

[groff\(1\)](#), [troff\(1\)](#), [groff\(7\)](#)

**Name**

groff\_diff – differences between GNU roff and AT&T troff

**Description**

The GNU *roff* text processing system, *groff*, is largely compatible with AT&T *troff*, the typesetting system originating in Unix systems of the 1970s. At the same time, *groff* removes many arbitrary limitations and adds features, both to the language and to the intermediate, device-independent output format. Differences arising from *groff*'s implementation of AT&T *troff* features are also noted.

**Language**

*groff* features identifiers of arbitrary length, supports non-integral type sizes, adds new escape sequences and requests, provides new conditional expression operators, recognizes additional scaling units and numerical operators, and extends the function of some escape sequences and requests already present in AT&T *troff*.

**Long names**

*groff* introduces many new requests; with three exceptions, they all have names longer than two characters. The names of registers, fonts, strings/macros/diversions, environments, special characters (glyphs), and colors can be of any length. More generally, anywhere AT&T *troff* supports an escape form that uses an opening parenthesis “(” to introduce a two-character argument, *groff* supports a square-bracketed form “[ ]” where the argument within can be of arbitrary length.

**Colors**

*groff* supports color output with a variety of color spaces and up to 16 bits per channel. Some devices, particularly terminals, may be more limited. When color support is enabled, two colors are current at any given time: the *stroke color*, with which glyphs, rules (lines), and geometric objects like circles and polygons are drawn, and the *fill color*, which can be used to paint the interior of closed geometric figures. The **color**, **defcolor**, **gcolor**, and **fcolor** requests; **\m** and **\M** escape sequences; and **.color**, **.m**, and **.M** registers exercise color support.

**Fractional type sizes and new scaling units**

A *scaled point* is equal to  $1/sizescale$  points, where *sizescale* is a parameter specified in the device description file, *DESC*, and defaults to 1. A new scaling unit “z” has the effect of multiplying by *sizescale*. Requests and escape sequences in *groff* interpret arguments that represent a type size as being in units of scaled points; that is, they evaluate such arguments using an implied default scaling unit of “z”. Arguments treated in this way comprise those to the escape sequences **\H** and **\s**, to the request **.ps**, the third argument to the **.cs** request, and the second and fourth arguments to the **.tkf** request.

For example, if *sizescale* is 1000, then a scaled point is one one-thousandth of a point. The request “**.ps 10.25**” is synonymous with “**.ps 10.25z**” and sets the type size to 10250 scaled points, or 10.25 points.

Consequently, in *groff*, the register **\n[s]** can contain a non-integral type size. The new register **\n[.ps]** returns the type size in scaled points.

It makes no sense to use the “z” scaling unit in a numeric expression whose default scaling unit is neither “u” nor “z”, so *groff* disallows this. Similarly, it is nonsensical to use a scaling unit other than “z” or “u” in a numeric expression whose default scaling unit is “z”, so *groff* disallows this as well.

Another new scaling unit, “s”, multiplies by the number of basic units in a scaled point. For instance, “**\n[.ps]s**” is equal to “**1m**” by definition. Do not confuse the “s” and “z” scaling units.

A further two new measurement units available in *groff* are “M”, which indicates hundredths of an em, and “f”, which multiplies by 65,536. The latter provides convenient fractions for color definitions with the **.defcolor** request. For example, 0.5f equals 32768u.

**Numeric expressions**

Spaces are permitted in a numeric expression within parentheses. Three new operators are available as well.

*e1*>?*e2* Compute the maximum of *e1* and *e2*.

$e1 < ? e2$  Compute the minimum of  $e1$  and  $e2$ .

$(c;e)$  Evaluate  $e$  using  $c$  as the default scaling unit. If  $c$  is missing, ignore scaling units in the evaluation of  $e$ .

### Conditional expressions

More conditions can be tested with the **.if** and **.ie** requests, as well as the new **.while** request.

**c**  $g$  True if a glyph  $g$  is available, where  $g$  is a Unicode basic Latin character; a *groff* special character  $\backslash(xx$  or  $\backslash[xxx]$ ;  $\backslash N'xxx'$ ; or has been defined by any of the **.char**, **.fchar**, **.fschar**, or **.schar** requests.

**d**  $name$  True if there is a string, macro, diversion, or request called  $name$ .

**F**  $font$  True if a font called  $font$  exists.  $font$  is handled as if it were opened with the **.ft** request (that is, font translation and styles are applied), without actually mounting it. This test doesn't load the complete font, but only its header, to verify its validity.

**m**  $color$

True if there is a color called  $color$ .

**r**  $reg$  True if there is a register called  $reg$ .

**S**  $style$  True if a style called  $style$  has been registered. Font translation is applied.

**v** Always false. This condition is for compatibility with certain other *troff* implementations only. (This refers to *vtroff*, a translator that would convert the C/A/T output from early-vintage AT&T *troff* to a form suitable for Versatec and Benson-Varian plotters.)

### Escape sequences

*groff* introduces several new escape sequences and extends the syntax of a few AT&T *troff* escape sequences (namely, **\D**, **\f**, **\k**, **\n**, **\\$**, and **\\***). In the following list, escape sequences are collated alphabetically at first, and then by symbol roughly in Unicode code point order.

**\A'***anything*'

This expands to **1** or **0**, depending on whether *anything* is or is not acceptable as the name of a string, macro, diversion, register, environment, font, or color. It returns **0** if *anything* is empty. This is useful if you want to look up user input in some sort of associative table.

**\B'***anything*'

This expands to **1** or **0**, depending on whether *anything* is or is not a valid numeric expression. It returns **0** if *anything* is empty.

**\D'...'** All drawing commands supported by the AT&T *troff* device-independent intermediate output format are accepted. See subsection "Drawing Commands" below for GNU extensions.

**\E** This is equivalent to an escape character, but it is not interpreted in copy mode. Strings to start and end superscripting could be defined as follows.

```
.ds { \v'-.3m'\s'\En[.s]*6u/10u'
.ds } \s0\v'.3m'
```

The use of **\E** ensures that these definitions work even if **\\*{** gets interpreted in copy mode (for example, by being used in a macro argument).

**\F[xxx]** Select font  $xxx$ , which may be a font name, mounting position, or registered style that is then combined with the current font family to select the typeface. **\F[]** is a synonym of **\fP**; i.e., it selects the previous font.

**\F**  $f$

**\F**  $(fm$

**\F**  $[fam]$

Select font family. See the **.fam** request below. **\F[]** selects the previous font family, or the default family if there is none. **\fP** does not; it selects font family "P" instead.

- \k**(*rg*)  
**\k**[*reg*] Mark horizontal position in register with two-character name *rg* or arbitrarily long name *reg*.
- \m***x*  
**\m**(*xx*)  
**\m**[*xxx*]  
 Set the stroke color. **\m**[] restores the previous stroke color.
- \M***x*  
**\M**(*xx*)  
**\M**[*xxx*]  
 Set the fill color. **\M**[] restores the previous fill color.
- \m**[*xxx*] Interpolate register *xxx*.
- \O***n*  
**\O**[*n*] Suppress *troff* output of glyphs and geometric primitives. The sequences **\O2**, **\O3**, **\O4**, and **\O5** are intended for internal use by *grohtml*(1).
- \O0**  
**\O1** Disable and enable, respectively, the emission of glyphs and geometric primitives to the output driver, provided that this sequence occurs at the outermost level (see **\O3** and **\O4**). Horizontal motions corresponding to non-overstruck glyph widths still occur. These sequences also reset the registers **opminx**, **opminy**, **opmaxx**, and **opmaxy** to  $-1$ . These four registers mark the top left and bottom right hand corners of a box encompassing all written glyphs.
- \O2** Provided that this sequence occurs at the outermost level, enable emission of glyphs and geometric primitives, and write to the standard error stream the page number and values of the four aforementioned registers encompassing glyphs written since the last interpolation of a **\O** sequence, as well as the page offset, line length, image file name (if any), horizontal and vertical device motion quanta, and input file name. Numeric values are in basic units.
- \O3**  
**\O4** Begin and end a nesting level, respectively. This is an internal mechanism for *grohtml* while producing images. At startup, *troff* is at the outermost level. These sequences are generated when processing the source document with *pre-grohtml*, which uses *troff* with the **ps** output device, Ghostscript, and the PNM tools to produce images in PNG format. They start a new page if the device is not **html** or **xhtml**, to reduce the possibility of images crossing a page boundary.
- \O5**[*Pfile*]  
 Provided that this sequence occurs at the outermost level, write the name *file* to the standard error stream at position *P*, which must be one of **l**, **r**, **c**, or **i**, corresponding to left, right, centered, and inline alignments within the document, respectively. *file* is a name associated with the production of the next image.
- \R**'*name ±n*'  
 Synonymous with "**.nr** *name ±n*".
- \s**[*±n*]  
**\s**±[*n*]  
**\s**'±*n*'  
**\s**±'*n*' Set the type size to, or increment or decrement it by, *n* scaled points; *n* is a numeric expression with a default scaling unit of "z".

**\W***x*  
**\W**(*xx*  
**\W**[*xxx*]

Interpolate the contents of the environment variable *xxx*, as returned by *getenv*(3). **\W** is interpreted even in copy mode.

**\X**'*anything*'

Within **\X** arguments, the escape sequences **\&**, **\)**, **\%**, and **\:** are ignored; **\space** and **\~** are converted to single space characters; and **\** has its escape character stripped. So that the basic Latin subset of the Unicode character set (that is, ISO 646:1991-IRV or, popularly, “US-ASCII”) can be reliably encoded in device control commands, seven special character escape sequences (**\-**, **\[a]**, **\[d]**, **\[g]**, **\[h]**, **\[r]**, and **\[t]**) are mapped to basic Latin glyphs; see [groff\\_char\(7\)](#). The use of any other escape sequence in **\X** arguments is normally an error.

If the **use\_charnames\_in\_special** directive appears in the output device’s *DESC* file, the use of special character escape sequences is *not* an error; they are simply output verbatim (with the exception of the seven mapped to Unicode basic Latin characters, discussed above). **use\_charnames\_in\_special** is currently employed only by [grohtml\(1\)](#).

**\Y***x*  
**\Y**(*xx*  
**\Y**[*xxx*]

This is approximately equivalent to **\X**’\*[*xxx*]’.

However the contents of the string or macro *xxx* are not interpreted; also it is permitted for *xxx* to have been defined as a macro and thus contain newlines (it is not permitted for the argument to **\X** to contain newlines). The inclusion of newlines requires an extension to the AT&T *troff* output format, and confuses drivers that do not know about this extension.

**\Z**'*anything*'

Print *anything* and then restore the horizontal and vertical position; *anything* may not contain tabs or leaders.

**\#** Everything up to and including the next newline is ignored. This escape sequence is interpreted even in copy mode. **\#** is like **\'**, except that **\'** does not ignore a newline; the latter therefore cannot be used by itself for a whole-line comment—it leaves a blank line on the input stream.

**\\$0** The name by which the current macro was invoked. The **als** request can make a macro have more than one name.

**\\$(***nn*

**\\$(***nnn*) In a macro or string, this gives the *nn*-th or *nnn*-th argument. Macros and strings can have an unlimited number of arguments.

**\\$\*** In a macro or string, the concatenation of all the arguments separated by spaces.

**\\$@** In a macro or string, the concatenation of all the arguments with each surrounded by double quotes, and separated by spaces.

**\\$^** In a macro, the representation of all parameters as if they were an argument to the **ds** request.

**\)** Like **\&** except that it behaves like a character declared with the **.cflags** request to be transparent for the purposes of end-of-sentence recognition.

**\\*[***xxx arg1 arg2 . . .*

Interpolate string *xxx*, taking *arg1*, *arg2*, . . . as arguments.

**V** Apply an *italic correction*: modify the spacing of the preceding glyph so that the distance between it and the following glyph is correct if the latter is of upright shape. For example, if an italic “f” is followed immediately by a roman right parenthesis, then in many fonts the top right portion of the “f” overlaps the top left of the right parenthesis, producing *f)*, which is ugly. Inserting **V** between them produces *f)* and avoids this problem. Use this escape sequence whenever an oblique glyph is immediately followed by an upright glyph without any intervening space.



**.als** *new old*

Create an alias *new* for the existing request, string, macro, or diversion named *old*, causing the names to refer to the same stored object. If *old* is undefined, a warning in category “**mac**” is produced, and the request is ignored. The **.am**, **.as**, **.da**, **.de**, **.di**, and **.ds** requests (together with their variants) create a new object only if the name of the macro, diversion, or string is currently undefined or if it is defined as a request; normally, they modify the value of an existing object. To remove an alias, call **.rm** on its name. The object itself is not destroyed until it has no more names.

**.am1** *xx yy*

Similar to **.am**, but compatibility mode is switched off during execution. To be more precise, a “compatibility save” token is inserted at the beginning, and a “compatibility restore” token at the end. As a consequence, the requests **.am**, **.am1**, **.de**, and **.de1** can be intermixed freely since the compatibility save/restore tokens only affect the macro parts defined by **.am1** and **.ds1**.

**.ami** *xx yy*

Append to macro indirectly. See the **dei** request below.

**.ami1** *xx yy*

Same as the **ami** request but compatibility mode is switched off during execution.

**.as1** *name string*

Similar to **.as**, but compatibility mode is switched off when the appended portion of the string is later interpolated. To be more precise, a “compatibility save” token is inserted at the beginning of the appended string *string*, and a “compatibility restore” token at the end. As a consequence, the requests **.as**, **.as1**, **.ds**, and **.ds1** can be intermixed freely since the compatibility save/restore tokens only affect the (sub)strings defined by **.as1** and **.ds1**.

**.asciify** *div*

*Unformat* the diversion *div* in a way such that Unicode basic Latin (ASCII) characters, characters translated with the **.trin** request, space characters, and some escape sequences, that were formatted and diverted into *div* are treated like ordinary input characters when *div* is reread. Doing so can be useful in conjunction with the **.writem** request. **.asciify** can be also used for gross hacks; for example, the following sets register **n** to 1.

```
.tr @.
.di x
@nr n 1
.br
.di
.tr @@
.asciify x
.x
```

**.asciify** cannot return all items in a diversion to their source equivalent: nodes such as those produced by **\N[...]** will remain nodes, so the result cannot be guaranteed to be a pure string. See section “Copy mode” in [groff\(7\)](#). Glyph parameters such as the type face and size are not preserved; use **.unformat** to achieve that.

**.backtrace**

Write a backtrace of the input stack to the standard error stream. Also see the **-b** option of [troff\(1\)](#).

**.blm** [*name*]

Set a blank line macro (trap). If a blank line macro is thus defined, *groff* executes *macro* when a blank line is encountered in the input file, instead of the usual behavior. A line consisting only of spaces is also treated as blank and subject to this trap. If no argument is supplied, the default blank line behavior is (re-)established.

**.box** *name*

**.boxa** *name*

These requests are similar to the **di** and **da** requests, respectively, with the exception that any pending output line does not become part of the diversion (i.e., a box diversion always starts on a new output line) but is restored after ending the diversion, discarding any partially collected line in the diversion.

**.break** Exit a **while** loop. Do not confuse this request with a typographical break or the **br** request. See **.continue**.

**.brp** This is the same as **\p**.

**.cflags** *n c1 c2 ...*

Assign properties encoded by the number *n* to characters *c1*, *c2*, and so on.

Input characters, including special characters introduced by an escape, have certain properties associated with them. (Note that output glyphs don't have such properties. In *groff*, a glyph is a numbered box with a given height above and depth below the baseline, and a width—nothing more.) These properties can be modified with this request. The first argument is the sum of the desired flags and the remaining arguments are the characters to be assigned those properties. Spaces between the *cn* arguments are optional. Any argument *cn* can be a character class defined with the **.class** request rather than an individual character.

The non-negative integer *n* is the sum of any of the following. Some combinations are nonsensical, such as “**33**” (1 + 32).

- 1 Recognize the character as ending a sentence if followed by a newline or two spaces. Initially, characters “**?!**” have this property.
- 2 Enable breaks before the character. A line is not broken at a character with this property unless the characters on each side both have non-zero hyphenation codes. This exception can be overridden by adding 64. Initially, no characters have this property.
- 4 Enable breaks after the character. A line is not broken at a character with this property unless the characters on each side both have non-zero hyphenation codes. This exception can be overridden by adding 64. Initially, characters “**~[hy][em]**” have this property.
- 8 Mark the glyph associated with this character as overlapping other instances of itself horizontally. Initially, characters “**\[ul][rn][ru][radicalex][sqrtext]**” have this property.
- 16 Mark the glyph associated with this character as overlapping other instances of itself vertically. Initially, the character “**\[br]**” has this property.
- 32 Mark the character as transparent for the purpose of end-of-sentence recognition. In other words, an end-of-sentence character followed by any number of characters with this property is treated as the end of a sentence if followed by a newline or two spaces. This is the same as having a zero space factor in  $\TeX$ . Initially, characters “**''')\*[\dg][dd][rq][cq]**” have this property.
- 64 Ignore hyphenation codes of the surrounding characters. Use this value in combination with values 2 and 4. Initially, no characters have this property.

For example, if you need an automatic break point after the en-dash in numerical ranges like “3000–5000”, insert

```
.cflags 68 \[en]
```

into your document. Note, however, that this can lead to bad layout if done without thinking; in most situations, a better solution than changing the **.cflags** value is inserting “**\:**” right after the hyphen at the places that really need a break point.

The remaining values were implemented for East Asian language support; those who use alphabetic scripts exclusively can disregard them.

- 128 Prohibit a break before the character, but allow a break after the character. This works only in combination with values 256 and 512 and has no effect otherwise. Initially, no characters have this property.
- 256 Prohibit a break after the character, but allow a break before the character. This works only in combination with values 128 and 512 and has no effect otherwise. Initially, no characters have this property.
- 512 Allow a break before or after the character. This works only in combination with values 128 and 256 and has no effect otherwise. Initially, no characters have this property.

In contrast to values 2 and 4, the values 128, 256, and 512 work pairwise. If, for example, the left character has value 512, and the right character 128, no break will be automatically inserted between them. If we use value 6 instead for the left character, a break after the character can't be suppressed since the neighboring character on the right doesn't get examined.

#### **.char** *g string*

Define a new character or glyph *g* to be *string*, which can be empty. More precisely, **.char** defines a *groff* object (or redefines an existing one) that is accessed with the name *g* on input, and produces *string* on output. Every time glyph *g* needs to be printed, *string* is processed in a temporary environment and the result is wrapped up into a single object. Compatibility mode is turned off and the escape character is set to \ while *string* is processed. Any boldening, constant spacing, or track kerning is applied to this object rather than to individual glyphs in *string*.

An object defined by this request can be used just like a normal glyph provided by the output device. In particular, other characters can be translated to it with the **.tr** request; it can be made the leader glyph with the **.lc** request; repeated patterns can be drawn with it using the **\l** and **\L** escape sequences; and words containing *g* can be hyphenated correctly, if the **.hcode** request is used to give the object a hyphenation code.

There is a special anti-recursion feature: use of the object within its own definition is handled like a normal character (one not defined with **.char**).

The **.tr** and **.trin** requests take precedence if **.char** accesses the same symbol.

A glyph definition can be removed with the **.rchar** request.

#### **.chop** *object*

Remove the last character from the macro, string, or diversion named *object*. This is useful for removing the newline from the end of a diversion that is to be interpolated as a string. This request can be used repeatedly on the same *object*; see section “Gtroff Internals” in *Groff: The GNU Implementation of troff*, the *groff* Texinfo manual, for details on nodes inserted additionally by *groff*.

#### **.class** *name c1 c2 ...*

Define a character class (or simply “class”) *name* comprising the characters or range expressions *c1*, *c2*, and so on.

A class thus defined can then be referred to in lieu of listing all the characters within it. Currently, only the **.cflags** request can handle references to character classes.

In the request's simplest form, each *cn* is a character (or special character).

```
.class [quotes] ' \[aq] \[dq] \[oq] \[cq] \[lq] \[rq]
```

Since class and glyph names share the same name space, it is recommended to start and end the class name with “[” and “]”, respectively, to avoid collisions with existing character names defined by *groff* or the user (with **.char** and related requests). This practice applies the presence of “[” in the class name to prevent the usage of the special character escape form “[. .]”, thus you must use the **\C** escape to access a class with such a name.

You can also use a character range expression consisting of a start character followed by “–” and then an end character. Internally, *groff* converts these two character names to Unicode code points (according to the *groff* glyph list [GGL]), which determine the start and end values of the range.

If that fails, the class definition is skipped. Furthermore, classes can be nested.

```
.class [prepunct] , : ; > }
.class [prepunctx] \C' [prepunct] ' \[u2013]-\[u2016]
```

The class “[**prepunctx**]” thus contains the contents of the class “[**prepunct**]” and characters in the range U+2013–U+2016.

If you want to include “–” in a class, it must be the first character value in the argument list, otherwise it gets misinterpreted as part of the range syntax.

Note that it is not possible to use class names as end points of range definitions.

A typical use of the **.class** request is to control line-breaking and hyphenation rules as defined by the **.cflags** request. For example, to inhibit line breaks before the characters belonging to the “[**prepunctx**]” class defined in the previous example, you can write the following.

```
.cflags 2 \C' [prepunctx]'
```

**.close** *stream*

Close the stream named *stream*; *stream* will no longer be an acceptable argument to the **write** request. See the **open** request.

**.composite** *glyph1 glyph2*

Map glyph name *glyph1* to glyph name *glyph2* if it is used in  $\backslash[. .]$  with more than one component.

**.continue**

Skip the remainder of a **while** loop’s body, immediately starting the next iteration. See **break**.

**.color** *n*

If *n* is non-zero or missing, enable colors (this is the default), otherwise disable them.

**.cp** *n* If *n* is non-zero or missing, enable compatibility mode, otherwise disable it. In compatibility mode, long names are not recognized, and the incompatibilities caused by long names do not arise.

**.defcolor** *ident scheme color-component . . .*

Define a color named *ident*. *scheme* identifies a color space and determines the number of required *color-components*; it must be one of “**rgb**” (three components), “**cm**” (three components), “**cm**” (four components), or “**gray**” (one component). “**grey**” is accepted as a synonym of “**gray**”. The color components can be encoded as a hexadecimal value starting with # or ##. The former indicates that each component is in the range 0–255 (0–FF), the latter the range 0–65535 (0–FFFF). Alternatively, each color component can be specified as a decimal fraction in the range 0–1, interpreted using a default scaling unit of “**f**”, which multiplies its value by 65,536 (but clamps it at 65,535).

Each output device has a color named “**default**”, which cannot be redefined. A device’s default stroke and fill colors are not necessarily the same.

**.de1** *xx yy*

Similar to **.de**, but compatibility mode is switched off during execution. On entry, the current compatibility mode is saved and restored at exit.

**.dei** *xx [yy]*

Define macro indirectly, with the name of the macro to be defined in string *xx* and the name of the end macro terminating its definition in string *yy*.

**.dei1** *xx [yy]*

As **.dei**, but compatibility mode is switched off when the definition of the macro named in the string *xx* is executed.

**.device** *anything*

This request performs (almost) the same operation as the  $\backslash X$  escape sequence. *anything* is read in copy mode. A leading " is stripped; this enables *anything* to contain leading spaces.

**.devicem** *name*

This request performs the same operation as the `\Y` escape sequence, embedding the contents of a macro in the intermediate output as a “**x X**” device control command.

**.do** *name* ...

Interpret the string, request, diversion, or macro *name* (along with any arguments) with compatibility mode disabled. Compatibility mode is restored (only if it was active) when the *expansion* of *name* is interpreted; that is, the restored compatibility state applies to the contents of the macro, string, or diversion *name* as well as data read from files or pipes if *name* is any of the **so**, **soquiet**, **mso**, **msoquiet**, or **pso** requests.

For example,

```
.de mac1
FOO
..
.del mac2
groff
.mac1
..
.de mac3
compatibility
.mac1
..
.de ma
\\$1
..
.cp 1
.do mac1
.do mac2 \" mac2, defined with .del, calls "mac1"
.do mac3 \" mac3 calls "ma" with argument "c1"
.do mac3 \[ti] \" groff syntax accepted in .do arguments
```

results in

```
FOO groff FOO compatibility c1 ~
```

as output.

**.ds1** *name string*

Similar to **.ds**, but compatibility mode is switched off when the string is later interpolated. To be more precise, a “compatibility save” token is inserted at the beginning of the string, and a “compatibility restore” token at the end.

**.ecr** Restore the escape character saved with **ecs**, or set escape character to “`\`” if none has been saved.

**.ecs** Save the current escape character.

**.envc** *environment*

Copy the contents of *environment* to the current environment.

The following environment data are not copied:

- a partially collected line, if present;
- the interruption status of the previous input line (due to use of the `\c` escape sequence);
- the count of remaining lines to center, to right-justify, or to underline (with or without underlined spaces)—these are set to zero;
- the activation status of temporary indentation;
- input traps and their associated data;

- the activation status of line numbering (which can be reactivated with “**.nm +0**”); and
- the count of consecutive hyphenated lines (set to zero).

**.fam** [*family*]

Set the font family to *family*. If no argument is given, switch to the previous font family, or the default family if there is none. Use “**\F[]**” to do this with an escape sequence; “**\FP**” selects font family “P” instead. The initial font family is “T” (Times), but can be overridden by the output device—see [groff\\_font\(5\)](#). The current font family is associated with the environment.

**.fchar** *c string*

Define fallback character (or glyph) *c* to be *string*. The syntax of this request is the same as the **char** request; the only difference is that a glyph defined with **char** hides the glyph with the same name in the current font, whereas a glyph defined with **.fchar** is checked only if the particular glyph isn’t found in the current font. This test happens before checking special fonts.

**.fcolor** *color*

Set the fill color to *color*. Without an argument, restore the previous fill color.

**.fschar** *f c string*

Define fallback character (or glyph) *c* for font *f* to be *string*. The syntax of this request is the same as the **char** request (with an additional argument to specify the font); a glyph defined with **fschar** is searched after the list of fonts declared with the **fspecial** request but before the list of fonts declared with **.special**.

**.fspecial** *f s1 s2 ...*

When the current font is *f*, fonts *s1*, *s2*, ... are special, that is, they are searched for glyphs not in the current font. Any fonts specified in the **.special** request are searched after fonts specified in the **.fspecial** request. Without argument, reset the list of global special fonts to be empty.

**.ftr** *f g* Translate font *f* to *g*. Whenever a font named *f* is referred to in an **\f** escape sequence, in the **F** and **S** conditional expression operators, or in the **ft**, **ul**, **bd**, **cs**, **tkf**, **special**, **fspecial**, **fp**, or **sty** requests, font *g* is used. If *g* is missing or equal to *f*, then font *f* is not translated.

**.fzoom** *f zoom*

Set zoom factor *zoom* for font *f*. *zoom* must be a non-negative integer multiple of 1/1000th. If it is missing or is equal to zero, it means the same as 1000, namely no magnification. *f* must be a real font name, not a style.

**.gcolor** *color*

Set the stroke color to *color*. Without an argument, restore the previous stroke color.

**.hcode** *c1 code1 [c2 code2] ...*

Set the hyphenation code of character *c1* to *code1*, that of *c2* to *code2*, and so on. A hyphenation code must be an ordinary character (not a special character escape sequence) other than a digit or a space. The request is ignored if given no arguments.

For hyphenation to work, hyphenation codes must be set up. At startup, *groff* assigns hyphenation codes to the letters “a–z” (mapped to themselves), to the letters “A–Z” (mapped to “a–z”), and zero to all other characters. Normally, hyphenation patterns contain only lowercase letters which should be applied regardless of case. In other words, they assume that the words “FOO” and “Foo” should be hyphenated exactly as “foo” is. The **.hcode** request extends this principle to letters outside the Unicode basic Latin alphabet; without it, words containing such letters won’t be hyphenated properly even if the corresponding hyphenation patterns contain them.

**.hla** *lang*

Set the hyphenation language to *lang*. Hyphenation exceptions specified with the **.hw** request and hyphenation patterns and exceptions specified with the **.hpf** and **.hpfa** requests are associated with the hyphenation language. The **.hla** request is usually invoked by a localization file, which is in turn loaded by the *troffrc* or *troffrc-end* file; see the **.hpf** request below.

The hyphenation language is associated with the environment.

**.hlm** [*n*]

Set the maximum number of consecutive hyphenated lines to *n*. If *n* is negative, there is no maximum. If omitted, *n* is  $-1$ . This value is associated with the environment. Only lines output from a given environment count towards the maximum associated with that environment. Hyphens resulting from `\%` are counted; explicit hyphens are not.

**.hpf** *pattern-file*

Read hyphenation patterns from *pattern-file*. This file is sought in the same way that macro files are with the **.mso** request or the `-mname` command-line option to *groff(1)*.

The *pattern-file* should have the same format as (simple)  $\TeX$  pattern files. More specifically, the following scanning rules are implemented.

- A percent sign starts a comment (up to the end of the line) even if preceded by a backslash.
- “Digraphs” like `\$` are not supported.
- “`^^xx`” (where each *x* is 0–9 or a–f) and `^^c` (character *c* in the code point range 0–127 decimal) are recognized; other uses of `^` cause an error.
- No macro expansion is performed.
- **hpf** checks for the expression `\patterns{...}` (possibly with whitespace before or after the braces). Everything between the braces is taken as hyphenation patterns. Consequently, “{” and “}” are not allowed in patterns.
- Similarly, `\hyphenation{...}` gives a list of hyphenation exceptions.
- `\endinput` is recognized also.
- For backwards compatibility, if `\patterns` is missing, the whole file is treated as a list of hyphenation patterns (except that the “%” character is recognized as the start of a comment).

Use the **hpfcode** request (see below) to map the encoding used in hyphenation pattern files to *groff*’s input encoding.

The set of hyphenation patterns is associated with the hyphenation language set by the **hla** request. The **hpf** request is usually invoked by a localization file loaded by the *troffrc* file. By default, *troffrc* loads the localization file for English. (As of *groff* 1.23.0, localization files for Czech (*cs*), German (*de*), English (*en*), French (*fr*), Japanese (*ja*), Swedish (*sv*), and Chinese (*zh*) exist.) For Western languages, the localization file sets the hyphenation mode and loads hyphenation patterns and exceptions.

A second call to **hpf** (for the same language) replaces the old patterns with the new ones.

Invoking **hpf** causes an error if there is no hyphenation language.

If no **hpf** request is specified (either in the document, in a file loaded at startup, or in a macro package), *groff* won’t automatically hyphenate at all.

**hpfa** *pattern-file*

As **hpf**, except that the hyphenation patterns and exceptions from *pattern-file* are appended to the patterns already applied to the hyphenation language of the environment.

**hpfcode** *a b [c d] ...*

Define mapping values for character codes in pattern files. This is an older mechanism no longer used by *groff*’s own macro files; for its successor, see **hcode** above. **hpf** or **hpfa** apply the mapping after reading or appending to the active list of patterns. Its arguments are pairs of character codes—integers from 0 to 255. The request maps character code *a* to code *b*, code *c* to code *d*, and so on. Character codes that would otherwise be invalid in *groff* can be used. By default, every code maps to itself except those for letters “A” to “Z”, which map to those for “a” to “z”.

**.hym** [*length*]

Set the (right) hyphenation margin to *length*. If the adjustment mode is not “**b**” or “**n**”, the line is not hyphenated if it is shorter than *length*. Without an argument, the default hyphenation margin is reset to its default value, 0. The default scaling unit is “**m**”. The hyphenation margin is associated with the environment.

A negative argument resets the hyphenation margin to zero, emitting a warning in category “range”.

**.hys** [*hyphenation-space*]

Suppress hyphenation of the line in adjustment modes “**b**” or “**n**”, if it can be justified by adding no more than *hyphenation-space* extra space to each inter-word space. Without an argument, the hyphenation space adjustment threshold is set to its default value, 0. The default scaling unit is “**m**”. The hyphenation space adjustment threshold is associated with the current environment.

A negative argument resets the hyphenation space adjustment threshold to zero, emitting a warning in category “range”.

**.itc** *n name*

As **.it**, but lines interrupted with the `\c` escape sequence are not applied to the line count.

**.kern** *n* If *n* is non-zero or missing, enable pairwise kerning, otherwise disable it.**.length** *reg anything*

Compute the number of characters in *anything* and return the count in the register *reg*. If *reg* doesn't exist, it is created. *anything* is read in copy mode.

```
.ds xxx abcd\h'3i'efgh
.length yyy \*[xxx]
\n[yyy]
14
```

**.linetabs** *n*

If *n* is non-zero or missing, enable line-tabs mode, otherwise disable it (which is the default). In line-tabs mode, tab distances are computed relative to the (current) output line. Otherwise they are taken relative to the input line. For example, the following

```
.ds x a\t\c
.ds y b\t\c
.ds z c
.ta li 3i
\*x
\*y
\*z
```

yields

```
a           b           c
```

In line-tabs mode, the same code gives

```
a           b           c
```

Line-tabs mode is associated with the current environment; the read-only register `\n[linetabs]` is set to 1 if in line-tabs mode, and 0 otherwise.

**.lsm** [*name*]

Set the leading space macro (trap) to *name*. If there are leading space characters on an input line, *name* is invoked in lieu of the usual *roff* behavior; the leading spaces are removed. The count of leading spaces on an input line is stored in `\n[lsm]`, and the amount of corresponding horizontal motion in `\n[lss]`, irrespective of whether a leading space trap is set. When it is, the leading spaces are removed from the input line, and no motion is produced before calling *name*. If no argument is supplied, the default leading space behavior is (re-)established.

- .mso** *file*  
The same as the **so** request except that *file* is searched for in the same directories as macro files for the **-m** command-line option. If the file name to be included has the form *name.tmac* and it isn't found, **.mso** tries to include **tmac.name** instead and vice versa. If *file* does not exist, a warning in category "**file**" is emitted and the request has no other effect.
- .msoquiet** *file*  
As **.mso**, but no warning is emitted if *file* does not exist.
- .nop** *anything*  
Interpret *anything* as if it were an input line. This is similar to "**.if 1**". **.nop** is not really "no operation"; its argument *is* processed—unconditionally. It can be used to cause text lines to share indentation with surrounding control lines.
- .nroff** Make the **n** built-in condition true and the **t** built-in condition false. This can be reversed using the **troff** request.
- .open** *stream filename*  
Open *filename* for writing and associate the stream named *stream* with it. See also the **close** and **write** requests.
- .opena** *stream filename*  
Like **open**, but if *filename* exists, append to it instead of truncating it.
- .output** *string*  
Emit *string* directly to the intermediate output (subject to copy-mode interpretation); this is similar to **!** used at the top level. An initial double quote in *string* is stripped off to allow initial blanks.
- .pev** Report the state of the current environment followed by that of all other environments to the standard error stream.
- .pnr** Write the names and values of all currently defined registers to the standard error stream.
- .psbb** *filename*  
Get the bounding box of a PostScript image *filename*. This file must conform to Adobe's Document Structuring Conventions; the request attempts to extract the bounding box values from a **%%BoundingBox** comment. After invocation, the *x* and *y* coordinates (in PostScript units) of the lower left and upper right corners can be found in the registers **\n[lx]**, **\n[ly]**, **\n[urx]**, and **\n[ury]**, respectively. If an error occurs, these four registers are set to zero.
- .pso** *command*  
This behaves like the **so** request except that input comes from the standard output of *command*.
- .ptr** Print the names and positions of all traps (not including input line traps and diversion traps) on stderr. Empty slots in the page trap list are printed as well, because they can affect the priority of subsequently planted traps.
- .pvs ±n** Set the post-vertical line space to *n*; default scaling unit is "**p**". This value is added to each line after it has been output. With no argument, the post-vertical line space is set to its previous value.  
  
The total vertical line spacing consists of four components: **.vs** and **\x** with a negative value which are applied before the line is output, and **.pvs** and **\x** with a positive value which are applied after the line is output.
- .rchar** *c1 c2 ...*  
Remove the definitions of glyphs *c1*, *c2*, and so on. This undoes the effect of a **.char** request.
- .return** Within a macro, return immediately. If called with an argument, return twice, namely from the current macro and from the macro one level higher. No effect otherwise.
- .rfschar** *f c1 c2 ...*  
Remove the font-specific definitions of glyphs *c1*, *c2*, ... for font *f*. Whitespace is optional between *cn* arguments. See **.fschar**.

- .rj**  
**.rj *n*** Right justify the next *n* input lines. Without an argument right justify the next input line. The number of lines to be right justified is available in the `\n[rj]` register. This implicitly does `.ce 0`. The `ce` request implicitly does `.rj 0`.
- .rnn *xx yy***  
 Rename register *xx* to *yy*. If *xx* doesn't exist, the request is ignored.
- .schar *c string***  
 Define global fallback character (or glyph) *c* to be *string*. The syntax of this request is the same as the `char` request; a glyph defined with `schar` is searched after the list of fonts declared with the `special` request but before the mounted special fonts.
- .shc *glyph***  
 Set the soft hyphen glyph, inserted when a word is hyphenated automatically or at a hyphenation character, to *glyph*. If the argument is omitted, the soft hyphen glyph is set to the default, `\[hy]`. If the selected glyph does not exist in the font in use at a potential hyphenation point, then the line is not broken at that point. Neither character definitions (specified with the `char` request) nor translations (specified with the `tr` request) are considered when assigning the soft hyphen glyph.
- .shift *n*** In a macro, shift the arguments by *n* positions: argument *i* becomes argument *i - n*; arguments 1 to *n* are no longer available. If *n* is missing, arguments are shifted by 1. Shifting by negative amounts is currently undefined.
- .sizes *s1 s2 ... sn [0]***  
 Set the available type sizes to *s1*, *s2*, ... *sn* scaled points. The list of sizes can be terminated by an optional "0". Each *si* can also be a range *m-n*. In contrast to the device description file directive of the same name (see [groff\\_font\(5\)](#)), the argument list can't extend over more than one line.
- .soquiet *file***  
 As `.so`, but no warning is emitted if *file* does not exist.
- .special *s1 s2 ...***  
 Fonts *s1*, *s2*, ... are special and are searched for glyphs not in the current font. Without arguments, reset the list of special fonts to be empty.
- .spreadwarn [*limit*]**  
 Emit a **break** warning if the additional space inserted for each space between words in an output line adjusted to both margins with "`.ad b`" is larger than or equal to *limit*. A negative value is treated as zero; an absent argument toggles the warning on and off without changing *limit*. The default scaling unit is **m**. At startup, `.spreadwarn` is inactive and *limit* is 3 m.
- For example,
- ```
.spreadwarn 0.2m
```
- causes a warning if **break** warnings are not suppressed and *troff* must add 0.2 m or more for each inter-word space in a line. See [troff\(1\)](#) for warning types and control.
- .stringdown *str***  
**.stringup *str***  
 Alter the string named *str* by replacing each of its bytes with its lowercase (**down**) or uppercase (**up**) version (if one exists). *groff* special characters (see [groff\\_char\(7\)](#)) can be used and the output will usually transform in the expected way due to the regular glyph naming convention for accented characters.
- ```
.ds resume R\[ 'e]sum\[ 'e]\
\[resume]
.stringdown resume
\[resume]
.stringup resume
\[resume]
```

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**.sty** *nf* Associate style *f* with font position *n*. A font position can be associated either with a font or with a style. The current font is the index of a font position and so is also either a font or a style. When it is a style, the font that is actually used is the font the name of which is the concatenation of the name of the current family and the name of the current style. For example, if the current font is 1 and font position 1 is associated with style **R** and the current font family is **T**, then font **TR** is used. If the current font is not a style, then the current family is ignored. When the requests **cs**, **bd**, **tkf**, **uf**, or **fspecial** are applied to a style, then they are applied instead to the member of the current family corresponding to that style. The default family can be set with the **-f** command-line option. The **styles** command in the DESC file controls which font positions (if any) are initially associated with styles rather than fonts.

**.substring** *str start [end]*

Replace the string named *str* with its substring bounded by the indices *start* and *end*, inclusive. The first character in the string has index 0. If *end* is omitted, it is implicitly set to the largest valid value (the string length minus one). Negative indices count backwards from the end of the string: the last character has index -1, the character before the last has index -2, and so on.

```
.ds xxx abcdefgh
.substring xxx 1 -4
\[xxx]
bcde
.substring xxx 2
\[xxx]
de
```

**.tkf** *fs1 n1 s2 n2*

Enable track kerning for font *f*. When the current font is *f* the width of every glyph is increased by an amount between *n1* and *n2*; when the current type size is less than or equal to *s1* the width is increased by *n1*; when it is greater than or equal to *s2* the width is increased by *n2*; when the type size is greater than or equal to *s1* and less than or equal to *s2* the increase in width is a linear function of the type size.

**.tm1** *string*

Similar to the **tm** request, *string* is read in copy mode and written on the standard error, but an initial double quote in *string* is stripped off to allow initial blanks.

**.tmc** *string*

Similar to **tm1** but without writing a final newline.

**.trf** *filename*

Transparently output the contents of file *filename*. Each line is output as if preceded by **\**; however, the lines are not subject to copy-mode interpretation. If the file does not end with a newline, then a newline is added. For example, you can define a macro *x* containing the contents of file *f*, using

```
.di x
.trf f
.di
```

Unlike with the **cf** request, the file cannot contain characters, such as NUL, that are not valid troff input characters.

**.trin** *abcd*

This is the same as the **tr** request except that the **asciify** request uses the character code (if any) before the character translation. Example:

```
.trin ax
.di xxx
a
```

```
.br
.di
.xxx
.trin aa
.asciify xxx
.xxx
```

The result is **x a**. Using **tr**, the result would be **x x**.

**.trnt** *abcd*

This is the same as the **tr** request except that the translations do not apply to text that is transparently throughput into a diversion with **\!**. For example,

```
.tr ab
.di x
\!.tm a
.di
.x
```

prints **b**; if **trnt** is used instead of **tr** it prints **a**.

**.troff** Make the **n** built-in condition false, and the **t** built-in condition true. This undoes the effect of the **nroff** request.

**.unformat** *div*

Like **.asciify**, unformat the diversion *div*. However, **.unformat** handles only tabs and spaces between words, the latter usually arising from spaces or newlines in the input. Tabs are treated as input tokens, and spaces become adjustable again. The vertical sizes of lines are not preserved, but glyph information (font, type size, space width, and so on) is retained.

**.vpt** *n* Enable vertical position traps if *n* is non-zero, disable them otherwise. Vertical position traps are traps set by the **wh** or **dt** requests. Traps set by the **it** request are not vertical position traps. The parameter that controls whether vertical position traps are enabled is global. Initially, vertical position traps are enabled.

**.warn** [*n*]

Select the categories, or “types”, of reported warnings. *n* is the sum of the numeric codes associated with each warning category that is to be enabled; all other categories are disabled. The categories and their associated codes are listed in section “Warnings” of *troff(1)*. For example, “**.warn 0**” disables all warnings, and “**.warn 1**” disables all warnings except those about missing glyphs. If no argument is given, all warning categories are enabled.

**.warnscale** *si*

Set the scaling unit used in warnings to *si*. Valid values for *si* are **u**, **i**, **c**, **p**, and **P**. At startup, it is set to **i**.

**.while** *cond-expr anything*

Evaluate the conditional expression *cond-expr*, and repeatedly execute *anything* unless and until *cond-expr* evaluates false. *anything*, which is often a conditional block, is referred to as the **while** request’s *body*.

*troff* treats the body of a **while** request similarly to that of a **de** request (albeit one not read in copy mode), but stores it under an internal name and deletes it when it exits. The operation of a macro containing a **while** request can slow significantly if the **while** body is large. Each time the macro is executed, the **while** body is parsed and stored again. An often better solution—and one that is more portable, since AT&T *troff* lacked the **while** request—is to instead write a recursive macro. It will only be parsed once (unless you redefine it). To prevent infinite loops, the default number of available recursion levels is 1,000 or somewhat less (because things other than macro calls can be on the input stack). You can disable this protective measure, or raise the limit, by setting the **slimit** register. See section “Debugging” below.

If a **while** body begins with a conditional block, its closing brace must end an input line.

The **break** and **continue** requests alter a **while** loop's flow of control.

**.write** *stream anything*

Write *anything* to the stream named *stream*. *stream* must previously have been the subject of an **open** request. *anything* is read in copy mode; a leading " is stripped.

**.writec** *stream anything*

Similar to **write** but without writing a final newline.

**.writem** *stream xx*

Write the contents of the macro or string *xx* to the stream named *stream*. *stream* must previously have been the subject of an **open** request. *xx* is read in copy mode.

### Extended requests

**.cf** *filename*

When used in a diversion, this embeds in the diversion an object which, when reread, will cause the contents of *filename* to be transparently copied through to the output. In AT&T *troff*, the contents of *filename* are immediately copied through to the output regardless of whether there is a current diversion; this behavior is so anomalous that it must be considered a bug.

**.de** *xx yy*

**.am** *xx yy*

**.ds** *xx yy*

**.as** *xx yy*

In compatibility mode, these requests behave similarly to **.de1**, **.am1**, **.ds1**, and **.as1**, respectively: a "compatibility save" token is inserted at the beginning, and a "compatibility restore" token at the end, with compatibility mode switched on during execution.

**.hy** *n* New values 16 and 32 are available; the former enables hyphenation before the last character in a word, and the latter enables hyphenation after the first character in a word.

**.ss** *word-space-size additional-sentence-space-size*

A second argument to the **.ss** request sets the amount of additional space separating sentences on the same output line. If omitted, this amount is set to *word-space-size*. The arguments' units are twelfths of the space width of the current font (see [groff\\_font\(5\)](#)) and default to 12.

**.ta** *[[n1 n2 ... nn ]T r1 r2 ... rn]*

*groff* supports an extended syntax to specify repeating tab stops after the "T" mark. These values are always taken as relative distances from the previous tab stop. This is the idiomatic way to specify tab stops at equal intervals in *groff*.

The syntax summary above instructs *groff* to set tabs at positions *n1*, *n2*, ..., *nn*, then at *nn + r1*, *nn + r2*, ..., *nn + rn*, then at *nn + rn + r1*, *nn + rn + r2*, ..., *nn + rn + rn*, and so on.

### New registers

The following read-only registers are available:

**\n[.br]** Within a macro call, it is set to 1 if the macro is called with the 'normal' control character ('.' by default), and set to 0 otherwise. This allows the reliable modification of requests.

```
.als bp*orig bp
.de bp
.tm before bp
.ie \n[.br] .bp*orig
.el 'bp*orig
.tm after bp
..
```

Using this register outside of a macro makes no sense (it always returns zero in such cases).

- \n[C]** 1 if compatibility mode is in effect, 0 otherwise.
- \n.cdp]**  
The depth of the last glyph added to the current environment. It is positive if the glyph extends below the baseline.
- \n.ce]** The number of lines remaining to be centered, as set by the **ce** request.
- \n.cht]** The height of the last glyph added to the current environment. It is positive if the glyph extends above the baseline.
- \n.color]**  
1 if colors are enabled, 0 otherwise.
- \n.cp]** Within a **.do** request, holds the saved value of compatibility mode (see **\n[C]** above).
- \n.csk]**  
The skew of the last glyph added to the current environment. The *skew* of a glyph is how far to the right of the center of a glyph the center of an accent over that glyph should be placed.
- \n.ev]** The name or number of the current environment. This is a string-valued register.
- \n.fam]**  
The current font family. This is a string-valued register.
- \n.fn]** The current (internal) real font name. This is a string-valued register. If the current font is a style, the value of **\n.fn]** is the proper concatenation of family and style name.
- \n.fp]** The number of the next free font position.
- \n.g]** Always 1. Macros should use this to determine whether they are running under GNU troff.
- \n.height]**  
The current height of the font as set with **\MH**.
- \n.hla]** The hyphenation language in the current environment.
- \n.hlc]** The count of immediately preceding consecutive hyphenated lines in the current environment.
- \n.hlm]**  
The maximum number of consecutive hyphenated lines allowed in the current environment.
- \n.hy]** The hyphenation mode in the current environment.
- \n.hym]**  
The hyphenation margin in the current environment.
- \n.hys]**  
The hyphenation space adjustment threshold in the current environment.
- \n.in]** The indentation that applies to the current output line.
- \n.int]** Set to a positive value if last output line is interrupted (i.e., if it contains **\c**).
- \n.kern]**  
1 if pairwise kerning is enabled, 0 otherwise.
- \n.lg]** The current ligature mode (as set by the **lg** request).
- \n.linotabs]**  
The current line-tabs mode (as set by the **linotabs** request).
- \n.ll]** The line length that applies to the current output line.
- \n.lt]** The title length as set by the **lt** request.
- \n.m]** The name of the current stroke color. This is a string-valued register.
- \n.M]** The name of the current fill color. This is a string-valued register.

- \n[.ne]** The amount of space that was needed in the last **ne** request that caused a trap to be sprung. Useful in conjunction with the **\n[.trunc]** register.
- \n[.nm]**  
1 if output line numbering is enabled (even if temporarily suppressed), 0 otherwise.
- \n[.ns]** 1 if no-space mode is active, 0 otherwise.
- \n[.O]** The current output level as set with **\O**.
- \n[.P]** 1 if the current page is in the output list set with **-o**.
- \n[.pe]** 1 during a page ejection caused by the **bp** request, 0 otherwise.
- \n[.pn]** The number of the next page, either the value set by a **pn** request, or the number of the current page plus 1.
- \n[.ps]** The current type size in scaled points.
- \n[.psr]**  
The last-requested type size in scaled points.
- \n[.pvs]**  
The current post-vertical line space as set with the **pvs** request.
- \n[.rj]** The number of lines to be right-justified as set by the **rj** request.
- \n[.slant]**  
The slant of the current font as set with **\S**.
- \n[.sr]** The last requested type size in points as a decimal fraction. This is a string-valued register.
- \n[.ss]**
- \n[.sss]** The values of minimal inter-word spacing and additional inter-sentence space, respectively, in twelfths of the space width of the current font. Set by the **.ss** request.
- \n[.sty]** The current font style. This is a string-valued register.
- \n[.tabs]**  
A string representation of the current tab settings suitable for use as an argument to the **ta** request.
- \n[.trunc]**  
The amount of vertical space truncated by the most recently sprung vertical position trap, or, if the trap was sprung by an **ne** request, minus the amount of vertical motion produced by the **ne** request. In other words, at the point a trap is sprung, it represents the difference of what the vertical position would have been but for the trap, and what the vertical position actually is. Useful in conjunction with the **\n[.ne]** register.
- \n[.U]** Set to 1 if in unsafe mode (as determined by *troff*'s **-U** command-line option) and 0 otherwise.
- \n[.vpt]**  
1 if vertical position traps are enabled, 0 otherwise.
- \n[.warn]**  
The sum of the numbers associated with each of the currently enabled warnings. The number associated with each warning is listed in *troff(1)*.
- \n[.x]** The major version number of the running *troff* formatter. For example, if the version number is 1.23.0, then **\n[.x]** contains 1.
- \n[.y]** The minor version number of the running *troff* formatter. For example, if the version number is 1.23.0, then **\n[.y]** contains 23.
- \n[.Y]** The revision number of the running *troff* formatter. For example, if the version number is 1.23.0, then **\n[.Y]** contains 0.

**\n[.zoom]**

The zoom value of the current font, in multiples of 1/1000th. Zero if no magnification.

**\n[llx]****\n[lly]****\n[urx]**

**\n[ury]** These four read/write registers are set by the **psbb** request and contain the bounding box values (in PostScript units) of a given PostScript image.

The following read/write registers are set by the **\w** escape sequence:

**\n[rst]**

**\n[rsb]** Like the **st** and **sb** registers, but take account of the heights and depths of glyphs.

**\n[ssc]** The amount of horizontal space (possibly negative) that should be added to the last glyph before a subscript.

**\n[skw]**

How far to right of the center of the last glyph in the **\w** argument, the center of an accent from a roman font should be placed over that glyph.

Other available read/write registers are:

**\n[c.]** The current input line number. **\n[c.]** is a read-only alias to this register.

**\n[hours]**

The number of hours past midnight. Initialized at startup.

**\n[hp]** The current horizontal position at input line.

**\n[lsn]**

**\n[ls]** If there are leading spaces on an input line, these registers hold the count of leading spaces and the amount of corresponding horizontal motion, respectively.

**\n[minutes]**

The number of minutes after the hour. Initialized at startup.

**\n[seconds]**

The number of seconds after the minute. Initialized at startup.

**\n[systat]**

The return value of the `system()` function executed by the last **sy** request.

**\n[slimit]**

If greater than 0, sets the maximum quantity of objects on *troff*'s internal input stack. If less than or equal to 0, there is no limit: recursion can continue until program memory is exhausted. The default value is 1000, fixed at compile time.

**\n[year]**

The current year. AT&T *troff*'s **\n[yr]** register stores the current year minus 1900.

**Miscellaneous**

GNU *troff* predefines a string, **\\*[.T]** containing the argument given to the **-T** command-line option, namely the output device (for example, **pdf** or **utf8**). The (read-only) register **\n[.T]** interpolates 1 if *troff* is called with the **-T** command-line option, and 0 otherwise.

Fonts not listed in the *DESC* file are automatically mounted on the next available font position when they are referenced. If a font is to be mounted explicitly with the **.fp** request on an unused font position, it should be mounted on the first unused font position, which can be found in the **\n[.fp]** register; although *troff* does not enforce that strictly. Rather, it does not allow a font to be mounted at a position whose number is much greater than that of any currently used position.

Interpolating a string does not hide existing macro arguments. Thus, in a macro, a more efficient way of doing

```
.xx \$$@
```

is

```
\*[xx]\
```

If the font description file contains pairwise kerning information, glyphs from that font are kerned. Kerning between two glyphs can be inhibited by placing a non-printing input break `\&` between them.

In a string comparison in a condition, characters that appear at different interpolation depths from the first delimiter character are not recognized as the second or third delimiters. This also applies to the `.tl` request. In a `\w` escape sequence, a character that appears at a different interpolation depth from the starting delimiter character is not recognized as the closing delimiter character. The same is true for `\A`, `\b`, `\B`, `\C`, `\l`, `\L`, `\o`, `\X`, and `\Z`. When decoding a macro or string argument that is delimited by double quotes, a character that appears at a different interpolation depth from the starting delimiter character is not recognized as the closing delimiter character. The implementation of `\$$@` ensures that the double quotes surrounding an argument appear at the same interpolation depth, which differs from the depth of the argument itself. In a long escape name `]` is not recognized as a closing delimiter except when it occurs at the same interpolation depth as the opening `[`. In compatibility mode, no attention is paid to the interpolation depth.

In *groff*, the `.tr` request can map characters onto `\~`.

A font can control the widths of spaces emitted by the `\|` and `\^` escape sequences by defining glyphs of these names (including the leading backslash).

In *groff*, tabs and spaces are allowed between the first and second dots (or between the dot and the name of the ending macro) that end a macro definition. Example:

```
.if t \{\
.  de bar
.    nop Hello, I'm 'bar'.
.  .
.\}
```

## Intermediate output format

The output format of *groff* is modeled after that used by AT&T *troff* once it adopted a device-independent approach in the early 1980s. Only the differences are documented here.

### Units

The argument to the `s` command is in scaled points (in units of points/*n*, where *n* is the argument to the `sizescale` command in the *DESC* file). The argument to the `x Height` command is also in scaled points.

### Text commands

`Nn` Print glyph with index *n* (a non-negative integer) of the current font.

If the `tcommand` line is present in the *DESC* file, GNU *troff* uses the following two commands.

`txxx` *xxx* is any sequence of characters terminated by a space or a newline (to be more precise, it is a sequence of glyphs which are accessed with the corresponding characters); the first character should be printed at the current position, the current horizontal position should be increased by the width of the first character, and so on for each character. The width of the glyph is that given in the font file, appropriately scaled for the current type size, and rounded so that it is a multiple of the horizontal motion quantum. Special characters cannot be printed using this command.

`un xxx` This is same as the `t` command except that after printing each character, the current horizontal position is increased by the sum of the width of that character and *n*.

Note that single characters can have the eighth bit set, as can the names of fonts and special characters.

The names of glyphs and fonts can be of arbitrary length; drivers should not assume that they are only two characters long.

When a glyph is to be printed, that glyph is always in the current font. Unlike device-independent *troff*, it is not necessary for drivers to search special fonts to find a glyph.

New commands implement color support.

**mc** *cyan magenta yellow*

**md**

**mg** *gray*

**mk** *cyan magenta yellow black*

**mr** *red green blue*

Set the components of the stroke color with respect to various color spaces. **md** resets the stroke color to the default value. The arguments are integers in the range 0 to 65535.

The **x** device control command has been extended.

**x u n** If *n* is 1, start underlining of spaces. If *n* is 0, stop underlining of spaces. This is needed for the **cu** request in **nroff** mode and is ignored otherwise.

### Drawing commands

The **D** drawing command has been extended. These extensions are not used by GNU **pic** if the **-n** option is given.

**Df n**\n Set the shade of gray to be used for filling solid objects to *n*; *n* must be an integer between 0 and 1000, where 0 corresponds solid white and 1000 to solid black, and values in between correspond to intermediate shades of gray. This applies only to solid circles, solid ellipses and solid polygons. By default, a level of 1000 is used. Whatever color a solid object has, it should completely obscure everything beneath it. A value greater than 1000 or less than 0 can also be used: this means fill with the shade of gray that is currently being used for lines and text. Normally this is black, but some drivers may provide a way of changing this.

The corresponding **\D'f..'** command shouldn't be used since its argument is always rounded to an integer multiple of the horizontal motion quantum, which can lead to surprising results.

**DC d**\n Draw a solid circle with a diameter of *d* with the leftmost point at the current position.

**DE dx dy**\n

Draw a solid ellipse with a horizontal diameter of *dx* and a vertical diameter of *dy* with the leftmost point at the current position.

**Dp dx<sub>1</sub> dy<sub>1</sub> dx<sub>2</sub> dy<sub>2</sub> ... dx<sub>n</sub> dy<sub>n</sub>**\n

Draw a polygon with, for  $i = 1, \dots, n + 1$ , the *i*-th vertex at the current position +  $\sum_{j=1}^{i-1} (dx_j, dy_j)$ . At the moment, GNU **pic** only uses this command to generate triangles and rectangles.

**DP dx<sub>1</sub> dy<sub>1</sub> dx<sub>2</sub> dy<sub>2</sub> ... dx<sub>n</sub> dy<sub>n</sub>**\n

Like **Dp** but draw a solid rather than outlined polygon.

**Dt n**\n Set the current line thickness to *n* machine units. Traditionally, AT&T *troff* drivers use a line thickness proportional to the current type size; drivers should continue to do this if no **Dt** command has been given, or if a **Dt** command has been given with a negative value of *n*. A zero value of *n* selects the smallest available line thickness.

A difficulty arises in how the current position should be changed after the execution of these commands. This is not of great importance since the code generated by GNU **pic** does not depend on this. Given a drawing command of the form

$$\mathbb{D}'c x_1 y_1 x_2 y_2 \dots x_n y_n'$$

where *c* is not one of **c**, **e**, **l**, **a**, or **~**, AT&T *troff* treats each of the  $x_i$  as a horizontal quantity, and each of the  $y_i$  as a vertical quantity and assumes that the width of the drawn object is  $\sum_{i=1}^n x_i$ , and that the height is  $\sum_{i=1}^n y_i$ . (The assumption about the height can be seen by examining the **st** and **sb** registers after using such a **D** command in a **\w** escape sequence). This rule also holds for all the original drawing commands with the exception of **De**. For the sake of compatibility GNU *troff* also follows this rule, even though it produces an ugly result in the case of the **Dt** and **Df**, and, to a lesser extent, **DE** commands. Thus after executing a

**D** command of the form

**Dc**  $x_1 y_1 x_2 y_2 \dots x_n y_n \backslash n$

the current position should be increased by  $(\sum_{i=1}^n x_i, \sum_{i=1}^n y_i)$ .

Fill colors are implemented with another set of extensions.

**DFc** *cyan magenta yellow* \n

**DFd** \n

**DFg** *gray* \n

**DFk** *cyan magenta yellow black* \n

**DFr** *red green blue* \n

Set the components of the fill color similarly to the **m** commands above.

The drawing position isn't changed by these color commands, in contrast to **Df**.

### Device control commands

There is a continuation convention which permits the argument to the **x X** command to contain newlines: when outputting the argument to the **x X** command, GNU troff follows each newline in the argument with a + character (as usual, it terminates the entire argument with a newline); thus if the line after the line containing the **x X** command starts with +, then the newline ending the line containing the **x X** command should be treated as part of the argument to the **x X** command, the + should be ignored, and the part of the line following the + should be treated like the part of the line following the **x X** command.

The first three output commands are guaranteed to be:

**x T** *device*

**x res** *n h v*

**x init**

### Debugging

In addition to AT&T *troff* debugging features, *groff* emits more error diagnostics when syntactical or semantic nonsense is encountered and supports several categories of warning; the output of these can be selectively suppressed with **.warn** (and see the **-E**, **-w**, and **-W** options of *troff(1)*). Backtraces can be automatically produced when errors or warnings occur (the **-b** option of *troff(1)*) or generated on demand (**.backtrace**).

*groff* also adds more flexible diagnostic output requests (**.tmc** and **.tm1**). More aspects of formatter state can be examined with requests that write lists of defined registers (**.pnr**), environments (**.pev**), and page location traps (**.ptr**) to the standard error stream.

### Implementation differences

*groff* has a number of features that cause incompatibilities with documents written using old versions of *roff*. Some GNU extensions to *roff* have become supported by other implementations.

When adjusting to both margins, AT&T *troff* at first adjusts spaces starting from the right; *troff* begins from the left. Both implementations adjust spaces from opposite ends on alternating output lines in this adjustment mode to prevent “rivers” in the text.

*groff* does not always hyphenate words as AT&T *troff* does. The AT&T implementation uses a set of hard-coded rules specific to U.S. English, while *groff* uses language-specific hyphenation pattern files derived from T<sub>E</sub>X. Furthermore, in old versions of *troff* there was a limited amount of space to store hyphenation exceptions (arguments to the **.hw** request); *groff* has no such restriction.

Long names may be *groff*'s most obvious innovation. AT&T *troff* interprets “**.dsabcd**” as defining a string “**ab**” with contents “**cd**”. Normally, *groff* interprets this as a call of a macro named “**dsabcd**”. AT&T *troff* also interprets **\\*[** and **\n[** as an interpolation of a string or register, respectively, called “[”. In *groff*, however, the “[” is normally interpreted as delimiting a long name. In compatibility mode, *groff* interprets names in the traditional way, which means that they are limited to one or two characters. See the **-C** option in *groff(1)* and, above, the **.C** and **.cp** registers, and **.cp** and **.do** requests, for more on compatibility mode.

The register **\n[.cp]** is specialized and may require a statement of rationale. When writing macro packages

or documents that use *groff* features and which may be mixed with other packages or documents that do not—common scenarios include serial processing of man pages or use of the `.so` or `.mso` requests—you may desire correct operation regardless of compatibility mode enablement in the surrounding context. It may occur to you to save the existing value of `\n(.C` into a register, say, `_C`, at the beginning of your file, turn compatibility mode off with `“.cp 0”`, then restore it from that register at the end with `“.cp \n_C”`. At the same time, a modular design of a document or macro package may lead you to multiple layers of inclusion. You cannot use the same register name everywhere lest you “clobber” the value from a preceding or enclosing context. The two-character register name space of AT&T *troff* is confining and mnemonically challenging; you may wish to use *groff*’s more capacious name space. However, attempting `“.nr _my_saved_C \n(.C”` will not work in compatibility mode; the register name is too long. “This is exactly what `.do` is for,” you think, `“.do nr _my_saved_C \n(.C”`. The foregoing will always save zero to your register, because `.do` turns compatibility mode *off* while it interprets its argument list. What you need is:

```
.do nr _my_saved_C \n[.cp]
.cp 0
```

at the beginning of your file, followed by

```
.cp \n[_my_saved_C]
.do rr _my_saved_C
```

at the end. As in the C language, we all have to share one big name space, so choose a register name that is unlikely to collide with other uses.

The existence of the `.T` string is a common feature of post-CSTR #54 *troff*s—DWB 3.3, Solaris, Heirloom Doctools, and Plan 9 *troff* all support it—but valid values are specific to each implementation. This behavior of the `.T` register differs from AT&T *troff*, which interpolated 1 only if *nroff* was the formatter and was called with `-T`.

AT&T *troff* and other implementations handle `.lf` differently. For them, its *line* argument changes the line number of the *current* line.

AT&T *troff* had only environments named `“0”`, `“1”`, and `“2”`. In GNU *troff*, any number of environments may exist, using any valid identifiers for their names.

Normally, *groff* preserves the interpolation depth in delimited arguments, but not in compatibility mode. For example, on terminal devices,

```
.ds xx '
\w'abc\'*(xxdef'
```

produces `“168”` ordinarily, but `“72def”` in compatibility mode.

Furthermore, the escape sequences `\f`, `\H`, `\m`, `\M`, `\R`, `\s`, and `\S` are transparent for the purpose of recognizing a control character at the beginning of a line only in compatibility mode. For example, this code produces bold output in both cases, but the text differs,

```
.de xx '
Hello!
.
.\fB.xx\fP
```

producing `“.xx”` in normal mode and `“Hello!”` in compatibility mode.

*groff* does not allow the use of the escape sequences `\|`, `\^`, `\&`, `\{`, `\}`, `“\ ”`, `\'`, `\`, `\-`, `\_`, `\!`, `\%`, `\c`, in names of strings, macros, diversions, registers, fonts, or environments; AT&T *troff* does. The `\A` escape sequence (see subsection “Escape sequences” above) may be helpful in avoiding use of these escape sequences in names.

Normally, the syntax form `\sn` accepts only a single character (a digit) for *n*, consistently with other forms that originated in AT&T *troff*, like `\*`, `\$`, `\f`, `\g`, `\k`, `\n`, and `\z`. In compatibility mode only, a non-zero *n* must be in the range 4–39. Legacy documents relying upon this quirk of parsing should be migrated to another `\s` form. [Background: The Graphic Systems C/A/T phototypesetter (the original device target for AT&T *troff*) supported only a few discrete type sizes in the range 6–36 points, so Ossanna contrived a special case in the parser to do what the user must have meant. Kernighan warned of this in the 1992 revision of CSTR #54 (§2.3), and more recently, McIlroy referred to it as a “living fossil”.]

Fractional type sizes cause one noteworthy incompatibility. In AT&T *troff* the **.ps** request ignores scaling units and thus “**.ps 10u**” sets the type size to 10 points, whereas in *groff* it sets the type size to 10 scaled points. See subsection “Fractional type sizes and new scaling units” above.

The **.ab** request differs from AT&T *troff*: GNU *troff* writes no message to the standard error stream if no arguments are given, and it exits with a failure status instead of a successful one.

The **.bp** request differs from AT&T *troff*: GNU *troff* does not accept a scaling unit on the argument, a page number; the former (somewhat uselessly) does.

In AT&T *troff* the **.pm** request reports macro, string, and diversion sizes in units of 128-byte blocks, and an argument reduces the report to a sum of the above in the same units. *groff* ignores any arguments and reports the sizes in bytes.

Unlike AT&T *troff*, *groff* does not ignore the **.ss** request if the output is a terminal device; instead, the values of minimal inter-word and additional inter-sentence space are each rounded down to the nearest multiple of 12.

In *groff*, there is a fundamental difference between unformatted input characters, and formatted output characters (glyphs). Everything that affects how a glyph is output is stored with the glyph; once a glyph has been constructed, it is unaffected by any subsequent requests that are executed, including the **.bd**, **.cs**, **.tkf**, **.tr**, or **.fp** requests. Normally, glyphs are constructed from input characters immediately before the glyph is added to the current output line. Macros, diversions, and strings are all, in fact, the same type of object; they contain lists of input characters and glyphs in any combination. Special characters can be both: before being added to the output, they act as input entities; afterwards, they denote glyphs. A glyph does not behave like an input character for the purposes of macro processing; it does not inherit any of the special properties that the input character from which it was constructed might have had. Consider the following example.

```
.di x
\\ \\
.br
.di
.x
```

It prints “\” in *groff*; each pair of input backslashes is turned into one output backslash and the resulting output backslashes are not interpreted as escape characters when they are reread. AT&T *troff* would interpret them as escape characters when they were reread and would end up printing one “\”.

One correct way to obtain a printable backslash in most documents is to use the `\e` escape sequence; this always prints a single instance of the current escape character, regardless of whether or not it is used in a diversion; it also works in both *groff* and AT&T *troff*. (Naturally, if you’ve changed the escape character, you need to prefix the “e” with whatever it is—and you’ll likely get something other than a backslash in the output.)

The other correct way, appropriate in contexts independent of the backslash’s common use as a *roff* escape character—perhaps in discussion of character sets or other programming languages—is the character escape `\(rs` or `\[rs]`, for “reverse solidus”, from its name in the ECMA-6 (ISO/IEC 646) standard. [This escape sequence is not portable to AT&T *troff*, but is to its lineal descendant, Heirloom Doctools *troff*, as of its 060716 release (July 2006).]

To store an escape sequence in a diversion that is interpreted when the diversion is reread, either use the traditional `\!` transparent output facility, or, if this is unsuitable, the new `\?` escape sequence. See subsection “Escape sequences” above and sections “Diversions” and “Gtroff Internals” in *Groff: The GNU Implementation of troff*, the *groff* Texinfo manual.

In the somewhat pathological case where a diversion exists containing a partially collected line and a partially collected line at the top-level diversion has never existed, AT&T *troff* will output the partially collected line at the end of input; *groff* will not.

**Intermediate output format**

Its extensions notwithstanding, the *groff* intermediate output format has some incompatibilities with that of AT&T *troff*, but full compatibility is sought; problem reports and patches are welcome. The following incompatibilities are known.

- The positioning after drawing polygons conflicts with the AT&T *troff* practice.
- The intermediate output cannot be rescaled to other devices as AT&T *troff*'s could.

**Authors**

This document was written by James Clark and modified by Werner Lemberg and Bernd Warken.

**See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

“Troff User’s Manual” by Joseph F. Ossanna, 1976 (revised by Brian W. Kernighan, 1992), AT&T Bell Laboratories Computing Science Technical Report No. 54, widely called simply “CSTR #54”, documents the language, device and font description file formats, and device-independent output format referred to collectively in *groff* documentation as “AT&T *troff*”.

“A Typesetter-independent TROFF” by Brian W. Kernighan, 1982, AT&T Bell Laboratories Computing Science Technical Report No. 97, provides additional insights into the device and font description file formats and device-independent output format.

[groff\(1\)](#), [groff\(7\)](#), [roff\(7\)](#)

**Name**

groff\_hdtbl – Heidelberger table macros for GNU roff

**Description**

The *hdtbl* macros consist of four base and three optional macros, controlled by about twenty arguments. The syntax is simple and similar to the HTML table model and nearly as flexible: you can write sequences of tokens (macro calls with their arguments and content data), separated by blanks and beginning with a macro call, into the same line to get compact and cleanly arranged input. An advantage of *hdtbl* is that the tables are constructed without calling a preprocessor; this means that *groff(7)*'s full macro capabilities are available. On the other hand, table processing with *hdtbl* is much slower than using the *tbl(1)* preprocessor. A further advantage is that the HTML-like syntax of *hdtbl* will be easily converted to HTML; this is not implemented yet.

**Usage**

In this and the next section, we present examples to help users understand the basic workflow of *hdtbl*. First of all, you must load the *hdtbl.tmac* file. As with nearly all other *groff* macro packages, there are two possibilities to do so: Either add the line

```
.mso hdtbl.tmac
```

to your *roff* file before using any macros of the *hdtbl* package, or add the option

```
-m hdtbl
```

to the command line of *groff* (before the document file which contains *hdtbl* macros). Then you can include on or more tables in your document, where each one must be started and ended with the `.TBL` and `.ETB` macros, respectively.

In this man page, we approximate the result of each example as terminal output to be as generic as possible since *hdtbl* currently only supports the **ps** and **pdf** output drivers.

The simplest well-formed table consists of just single calls to the four base table macros in the right order. Here we construct a table with only one cell.

```
.TBL
.TR
.TD
contents of the table cell
.ETB
```

A terminal representation is

```
+-----+
| contents-of-the-table-cell |
+-----+
```

Equivalent to the above is the following notation.

```
.TBL .TR .TD "contents of the table cell" .ETB
```

By default, the formatted table is inserted into the surrounding text at the place of its definition. If the vertical space isn't sufficient, it is placed at the top of the next page. Tables can also be stored for later insertion.

Using '*row-number\*column-number*' as the data for the table cells, a table with two rows and two columns can be written as

```
.TBL cols=2
. TR .TD 1*1 .TD 1*2
. TR .TD 2*1 .TD 2*2
.ETB
```

A terminal representation is

1*1	1*2
2*1	2*2

Here we see a difference from HTML tables: The number of columns must be explicitly specified using the ‘cols=*m*’ argument (or indirectly via the ‘width’ argument, see below).

The contents of a table cell is arbitrary; for example, it can be another table, without restriction to the nesting depth. A given table layout can be either constructed with suitably nested tables or with proper arguments to .TD and .TH, controlling column and row spanning. Note, however, that this table

```
.TBL
.  TR
.    TD
.      nop 1*1 1*2
.  TR
.    TD
.      TBL cols=2 border=
.        TR
.          TD
.            nop 2*1
.          TD
.            nop 2*2
.        ETB
.    ETB
.ETB
```

and this table

```
.TBL cols=2
.  TR
.    TD colspan=2
.      nop 1*1 1*2
.  TR
.    TD
.      nop 2*1
.    TD
.      nop 2*2
.ETB
```

are similar but not identical (the use of .nop is purely cosmetic to get proper indentation).

The first table looks like

1*1 1*2
2*1 2*2

and the second one like

1*1 1*2
2*1 2*2

Here is the latter table in a more compact form.

```
.TBL cols=2 .TR ".TD colspan=2" 1*1 1*2
.          TR .TD 2*1 .TD 2*2 .ETB
```

If a macro has one or more arguments (see below), and it is not starting a line, everything belonging to this macro including the macro itself must be enclosed in double quotes.

### Macros and arguments

The order of macro calls and other tokens follows the HTML model. In the following list, valid predecessors and successors of all *hdtbl* macros are given, together with the possible arguments.

Macro arguments are separated by blanks. The order of arguments is arbitrary; they are of the form

```
key=value
```

or

```
key='value1 [value2 [...]]'
```

with the only exception of the optional argument of the macro `.ETB`, which is the string `'hold'`. Another possible form is

```
"key=value1 [value2 [...]]"
```

However, this is limited to the case where the macro is the first one in the line and not already enclosed in double quotes.

Argument values specified below as *c* are colors predefined by *groff* or colors defined by the user with the `.defcolor` request. Argument values *d* are decimal numbers with or without decimal point. Argument values *m* are natural numbers. Argument values *n* are numerical values with the usual *groff* scaling indicators. Some of the arguments are specific to one or two macros, but most of them can be specified with `.TBL`, `.TR`, `.TD`, and `.TH`. These common arguments are explained in the next subsection.

Most of the argument default values can be changed by the user by setting corresponding default registers or strings, as listed below.

**.TBL** [*args*]

Begin a new table.

**predecessor:** `.TD`, `.TH`, `.ETB`, cell contents

**successor:** `.CPTN`, `.TR`

**arguments:**

`border=[n]`

Thickness of the surrounding box border. `'border='` (no value) means neither a surrounding box border nor any horizontal or vertical separator lines between the table rows and cells. `'border=0'` suppresses the surrounding box border, but still allows separator lines between cells and rows.

**Default:** `'border=.1n'` (register `'t*b'`).

`bc=c` Border color.

**Default:** `'bc=red4'` (string `'t*bc'`).

`cols=m`

Number of table columns. This argument is necessary if more than one column is in the table and no `'width'` arguments are present.

**Default:** `'cols=1'` (register `'t*cols'`).

`cpd=n` Cell padding, i.e., the extra space between the cell space border and the cell contents.

**Default:** `'cpd=.5n'` (register `'t*cpd'`).

`csp=n` Cell spacing, i.e., the extra space between the table border or vertical or horizontal lines between cells and the cellspace.

**Default:** `'csp=.5n'` (register `'t*csp'`).

`tal=l|c|r`

Horizontal alignment of the table, if it is smaller than the line width. ‘`tal=l`’: left alignment. ‘`tal=c`’: centered alignment. ‘`tal=r`’: right alignment.

**Default:** ‘`tal=l`’ (register ‘`t*tal`’).

`width='w1 [w2 [...]]'`

Widths of table cells. `w1`, `w2`, ... are either numbers of type *n* or natural numbers with the pseudo-scaling indicator ‘%’, with the meaning “percent of the actual line length (or column length for inner tables, respectively)”. If there are less width values than table columns, the last width value is used for the remaining cells. The argument

`width='1.5i 10%'`

for example indicates that the first column is 1.5 inches wide; the remaining columns take 1/10 of the column length each.

**Default:** The table width equals the outer line length or column length; the columns have equal widths.

`height=n`

Height of the table. If the table with its contents is lower than *n*, the last row is stretched to this value.

**.CPTN** [*args*]

Text of caption.

The (optionally numbered) table caption. `.CPTN` is optional.

**predecessor:** `.TBL`

**successor:** `.TR`

**arguments:**

`val=t|b`

Vertical alignment of the table caption. ‘`val=t`’: The caption is placed above the table. ‘`val=b`’: The caption is placed below the table.

**Default:** ‘`val=t`’ (string ‘`t*cptn`’).

**.TR** [*args*]

Begin a new table row.

**predecessor:** `.TBL`, `.CPTN`, `.TD`, `.TH`, `.ETB`, *cell contents*

**successor:** `.TD`, `.TH`

**arguments:**

`height=n`

The height of the row. If a cell in the row is higher than *n*, this value is ignored; otherwise the row height is stretched to *n*.

**.TD** [*args* [*cell contents*]]

Begin a table data cell.

**.TH** [*args* [*cell contents*]]

Begin a table header cell.

Arguments and cell contents can be mixed. The macro `.TH` is not really necessary and differs from `.TD` only in three default settings, similar to the `<TH>` and `<TD>` HTML tags: The contents of `.TH` is horizontally and vertically centered and typeset in boldface.

**predecessor:** `.TR`, `.TD`, `.TH`, `.ETB`, *cell contents*

**successor:** `.TD`, `.TH`, `.TR`, `.ETB`, *cell contents*

**arguments:**

`colspan=m`

The width of this cell is the sum of the widths of the *m* cells above and below this row.

`rowspan=m`

The height of this cell is the sum of the heights of the  $m$  cells left and right of this column.

**Remark:** Overlapping of column and row spanning, as in the following table fragment (the overlapping happens in the second cell in the second row), is invalid and causes incorrect results.

```
.TR .TD 1*1 ".TD 1*2 rowspan=2" .TD 1*3
.TR ".TD 2*1 colspan=2" .TD 2*3
```

A working example for headers and cells with **colspan** is

```
.TBL cols=3
. TR ".TH colspan=2" header1+2 .TH header3
. TR .TD 1*1 .TD 1*2 .TD 1*3
. TR .TD 2*1 ".TD colspan=2" 2*2+3
.ETB
```

This looks like

header1+2		header3
1*1	1*2	1*3
2*1	2*2+3	

A working example with **rowspan** is

```
.TBL cols=3
. TR
. TD 1*1
. TD rowspan=2 1+2*2
. TD 1*3
.
. TR
. TD 2*1
. TD 2*3
.ETB
```

which looks like

1*1	1+2*2	1*3
2*1		2*3

**.ETB** [**hold**]

End of the table.

This macro finishes a table. It causes one of the following actions.

- If the argument 'hold' is given, the table is held until it is freed by calling the macro `.t*free`, which in turn prints the table immediately, either at the current position or at the top of the next page if its height is larger than the remaining space on the page.
- Otherwise, if the table is higher than the remaining space on the page, it is printed at the top of the next page.

- If neither of the two above constraints hold, the table is printed immediately at the place of its definition.

**predecessor:** .TD, .TH, .ETB, cell contents

**successor:** .TBL, .TR, .TD, .TH, .ETB, cell contents

**arguments:**

`hold` Prevent the table from being printed until it is freed by calling the macro `.t*free`. This argument is ignored for inner (nested) tables.

**.t\*free** [*n*]

Free the next held table or *n* held tables. Call this utility macro to print tables which are held by using the 'hold' argument of the .ETB macro.

#### Arguments common to .TBL, .TR, .TD, and .TH

The arguments described in this section can be specified with the .TBL and .TR macros, but they are eventually passed on to the table cells. If omitted, the defaults take place, which the user can change by setting the corresponding default registers or strings, as documented below. Setting an argument with the .TBL macro has the same effect as setting it for all rows in the table. Setting an argument with a .TR macro has the same effect as setting it for all the .TH or .TD macro in this row.

`bgc=[c]`

The background color of the table cells. This includes the area specified with the 'csp' argument. The argument 'bgc=' (no value) suppresses a background color; this makes the background transparent.

**Default:** 'bgc=bisque' (string 't\*bgc').

`fgc=c` The foreground color of the cell contents.

**Default:** 'fgc=red4' (string 't\*fgc').

`ff=name`

The font family for the table. *name* is a *groff* font family identifier, such as A for Avant Garde or HN for Helvetica Narrow.

**Default:** The font family found before the table (string 't\*ff').

`fst=style`

The font style for the table. One of R, B, I, or BI for roman, **bold**, *italic*, or **bold italic**, respectively. As with *roff*'s .ft request, the 'fst' argument can be used to specify the font family and font style together, for example 'fst=HNBI' instead of 'ff=HN' and 'fst=BI'.

**Default:** The font style in use right before the table (string 't\*fst').

`fsz='d1 [d2]'`

A decimal or fractional factor *d1*, by which the point size for the table is changed, and *d2*, by which the vertical line spacing is changed. If *d2* is omitted, value *d1* is taken for both.

**Default:** 'fsz='1.0 1.0'' (string 't\*fsz').

`hal=1|c|b|r`

Horizontal alignment of the cell contents in the table. 'hal=1': left alignment. 'hal=c': centered alignment. 'hal=b': both (left and right) alignment. 'hal=r': right alignment.

**Default:** 'hal=b' (string 't\*hal').

`val=t|m|b`

Vertical alignment of the cell contents in the table for cells lower than the current row. 'val=t': alignment below the top of the cell. 'val=m': alignment in the middle of the cell. 'val=b': alignment above the cell bottom.

**Default:** 'val=t' (string 't\*val').

`hl=[s|d]`

Horizontal line between the rows. If specified with .TD or .TH this is a separator line to the cell below. 'hl=' (no value): no separator line. 'hl=s': a single separator line between the rows. 'hl=d': a double separator line.

The thickness of the separator lines is the half of the border thickness, but at least 0.1 inches. The distance between the double lines is equal to the line thickness.

**Remark:** Together with ‘border=0’ for proper formatting the value of ‘csp’ must be at least .05 inches for single separator lines and .15 inches for double separator lines.

**Default:** ‘hl=s’ (string ‘t\*hl’).

v1=[s|d]

Vertical separator line between the cells. If specified with .TD or .TH this is a separator line to the cell on the right. ‘v1=s’: a single separator line between the cells. ‘v1=d’: a double separator line. ‘v1=’ (no value): no vertical cell separator lines. For more information see the documentation of the ‘hl’ argument above.

**Default:** ‘v1=s’ (string ‘t\*v1’).

### hdtbl customization

Before creating the first table, you should configure default values to minimize the markup needed in each table. The following example sets up defaults suitable for typical papers:

```
.ds t*bgc white\" background color
.ds t*fgc black\" foreground color
.ds t*bc black\" border color
.nr t*cpd 0.1n\" cell padding
```

The file `/usr/local/share/doc/groff-1.23.0/examples/hdtbl/common.roff` provides another example setup in the “minimal Page setup” section.

A table which does not fit on a partially filled page is printed automatically on the top of the next page if you append the little utility macro `t*hm` to the page header macro of your document’s main macro package. For example, say

```
.am pg@top
. t*hm
..
```

if you use the *ms* macro package.

The macro `t*EM` checks for held or kept tables, and for missing ETB macros (table not closed). You can call this macro by appending it to the end-of-input macro of the main, or “full-service”, macro package your document uses. For example, try

```
.am pg@end-text
. t*EM
..
```

if you use the *ms* package.

### Bugs and suggestions

Please send your comments to the *groff* mailing list (`groff@gnu.org`) or directly to the author.

### Authors

The *hdtbl* macro package was written by Joachim Walsdorff (`Joachim.Walsdorff@urz.uni-heidelberg.de`).

### See also

[groff\(1\)](#) provides an overview of GNU *roff* and details how to invoke *groff* at the command line.

[groff\(7\)](#) summarizes the *roff* language and GNU extensions to it.

[tbl\(1\)](#) describes the traditional *roff* preprocessor for tables.

**Name**

groff\_man – compose manual pages with GNU roff

**Synopsis**

**groff -man** [*option* ...] [*file* ...]

**groff -m man** [*option* ...] [*file* ...]

**Description**

The GNU implementation of the *man* macro package is part of the *groff* document formatting system. It is used to produce manual pages (“man pages”) like the one you are reading.

This document presents the macros thematically; for those needing only a quick reference, the following table lists them alphabetically, with cross references to appropriate subsections below.

Man page authors and maintainers who are not already experienced *groff* users should consult [groff\\_man\\_style\(7\)](#), an expanded version of this document, for additional explanations and advice. It covers only those concepts required for man page document maintenance, and not the full breadth of the *groff* typesetting system.

Macro	Meaning	Subsection
<b>.B</b>	Bold	Font style macros
<b>.BI</b>	Bold, italic alternating	Font style macros
<b>.BR</b>	Bold, roman alternating	Font style macros
<b>.EE</b>	Example end	Document structure macros
<b>.EX</b>	Example begin	Document structure macros
<b>.I</b>	Italic	Font style macros
<b>.IB</b>	Italic, bold alternating	Font style macros
<b>.IP</b>	Indented paragraph	Paragraphing macros
<b>.JR</b>	Italic, roman alternating	Font style macros
<b>.LP</b>	Begin paragraph	Paragraphing macros
<b>.ME</b>	Mail-to end	Hyperlink macros
<b>.MR</b>	Man page cross reference	Hyperlink macros
<b>.MT</b>	Mail-to start	Hyperlink macros
<b>.P</b>	Begin paragraph	Paragraphing macros
<b>.PP</b>	Begin paragraph	Paragraphing macros
<b>.RB</b>	Roman, bold alternating	Font style macros
<b>.RE</b>	Relative inset end	Document structure macros
<b>.RI</b>	Roman, italic alternating	Font style macros
<b>.RS</b>	Relative inset start	Document structure macros
<b>.SB</b>	Small bold	Font style macros
<b>.SH</b>	Section heading	Document structure macros
<b>.SM</b>	Small	Font style macros
<b>.SS</b>	Subsection heading	Document structure macros
<b>.SY</b>	Synopsis start	Command synopsis macros
<b>.TH</b>	Title heading	Document structure macros
<b>.TP</b>	Tagged paragraph	Paragraphing macros
<b>.TQ</b>	Supplemental paragraph tag	Paragraphing macros
<b>.UE</b>	URI end	Hyperlink macros
<b>.UR</b>	URI start	Hyperlink macros
<b>.YS</b>	Synopsis end	Command synopsis macros

Macros whose use we discourage (**.AT**, **.DT**, **.HP**, **.OP**, **.PD**, and **.UC**) are described in subsection “Deprecated features” below.

**Macro reference preliminaries**

Each macro is described in a tagged paragraph. Closely related macros, such as **.EX** and **.EE**, are grouped together.

An empty macro argument can be specified with a pair of double-quotes (“”), but the *man* package is de-

signed such that this should seldom be necessary. Most macro arguments will be formatted as text in the output; exceptions are noted.

### Document structure macros

The highest level of organization of a man page is determined by this group of macros. **.TH** (title heading) identifies the document as a man page and defines information enabling *mandb*(8) or a similar tool to index it. Section headings (**.SH**), one of which is mandatory and many of which are standardized, facilitate quick location of relevant material by the reader and aid the man page writer to discuss all essential aspects of the topic. Subsection headings (**.SS**) are optional and permit sections that grow long to develop in a controlled way. Many technical discussions benefit from examples; lengthy ones, especially those reflecting multiple lines of input to or output from the system, are usefully bracketed by **.EX** and **.EE**. When none of the foregoing meets a structural demand, a region within a (sub)section can be manually inset within **.RS** and **.RE** macros.

**.TH** *title section* [*footer-middle*] [*footer-inside*] [*header-middle*]

Define the title of the man page as *title* and the volume of the manual to which it belongs as *section*. See *man*(1) for details on the section numbers and suffixes applicable to your system. *title* and *section* are positioned together at the left and right in the header line (with *section* in parentheses immediately appended to *title*). *footer-middle* is centered in the footer line. The arrangement of the rest of the footer depends on whether double-sided layout is enabled with the option **-rD1**. When disabled (the default), *footer-inside* is positioned at the bottom left. Otherwise, *footer-inside* appears at the bottom left on recto (odd-numbered) pages, and at the bottom right on verso (even-numbered) pages. The outside footer is the page number, except in the continuous-rendering mode enabled by the option **-rcR=1**, in which case it is the *title* and *section*, as in the header. *header-middle* is centered in the header line. If *section* is a simple integer between 1 and 9 (inclusive), there is no need to specify *header-middle*; *an.tmac* will supply text for it. The macro package may also abbreviate *title* and *footer-inside* with ellipses if they overrun the space available in the header and footer, respectively. For HTML output, headers and footers are suppressed.

Additionally, this macro starts a new page; the page number is reset to 1 (unless the **-rC1** option is given). This feature is intended only for formatting multiple man pages.

A man page should contain exactly one **.TH** call at or near the beginning of the file, prior to any other macro calls.

**.SH** [*heading-text*]

Set *heading-text* as a section heading. If no argument is given, a one-line input trap is planted; text on the next line becomes *heading-text*. This text is set at the left margin, in bold (or the font specified by the string **HF**) and, on typesetter devices, slightly larger than the base type size. If the heading font **\\*[HF]** is bold, use of an italic style in *heading-text* is mapped to the bold-italic style if available in the font family. The inset level is reset to 1 and paragraph indentation to the default. Text after *heading-text* is set as an ordinary paragraph (**.P**).

The content of *heading-text* and ordering of sections has been standardized by common practice, as has much of the layout of material within sections. For example, a section called “Name” or “NAME” must exist, must be the first section after the **.TH** call, and must contain only a line of the form

*topic*[, *another-topic*]. . . \- *summary-description*

for a man page to be properly indexed. See *groff\_man\_style*(7) for suggestions and *man*(7) for the conventions prevailing on your system.

**.SS** [*subheading-text*]

Set *subheading-text* as a subsection heading indented between a section heading and an ordinary paragraph (**.P**). See subsection “Horizontal and vertical spacing” below for the indentation amount. If no argument is given, a one-line input trap is planted; text on the next line becomes *subheading-text*. This text is set in bold (or the font specified by the string **HF**). If the heading font **\\*[HF]** is bold, use of an italic style in *subheading-text* is mapped to the bold-italic style if available in the font family. The inset level is reset to 1 and paragraph indentation to the default. Text after *subheading-text* is set as an ordinary paragraph (**.P**).

**.EX**

**.EE** Begin and end example. After **.EX**, filling is disabled and a constant-width (monospaced) font is selected. Calling **.EE** enables filling and restores the previous font.

These macros are extensions, introduced in Ninth Edition Research Unix, to the original *man* package. Many systems running AT&T, Heirloom Doctools, or Plan 9 *troff* support them. To be certain your page will be portable to systems that do not, copy their definitions from the *an-ext.tmac* file of a *groff* installation.

**.RS** [*indentation*]

Start a new relative inset level, moving the left margin right by *indentation*, if specified, and by a default amount otherwise; see subsection “Horizontal and vertical spacing” below. Calls to **.RS** can be nested; each call increments by 1 the inset level used by **.RE**. The inset level prior to any **.RS** calls is 1.

**.RE** [*level*]

End a relative inset; move the left margin back to that corresponding to inset level *level*. If no argument is given, move the left margin one level back.

**Paragraphing macros**

An ordinary paragraph (**.P**) is set without a first-line indentation at the current left margin. In man pages and other technical literature, definition lists are frequently encountered; these can be set as “tagged paragraphs”, which have one (**.TP**) or more (**.TQ**) leading tags followed by a paragraph that has an additional indentation. The indented paragraph (**.IP**) macro is useful to continue the indented content of a narrative started with **.TP**, or to present an itemized or ordered list. All paragraph macros break the output line at the current position. If another paragraph macro has occurred since the previous **.SH** or **.SS**, they (except for **.TQ**) follow the break with a default amount of vertical space, which can be changed by the deprecated **.PD** macro; see subsection “Horizontal and vertical spacing” below. They also reset the type size and font style to defaults (**.TQ** again excepted); see subsection “Font style macros” below.

**.P****.LP**

**.PP** Begin a new paragraph; these macros are synonymous. The indentation is reset to the default value; the left margin, as affected by **.RS** and **.RE**, is not.

**.TP** [*indentation*]

Set a paragraph with a leading tag, and the remainder of the paragraph indented. A one-line input trap is planted; text on the next line, which can be formatted with a macro, becomes the tag, which is placed at the current left margin. Subsequent text is indented by *indentation*, if specified, and by a default amount otherwise; see subsection “Horizontal and vertical spacing” below.

If the tag is not as wide as the indentation, the paragraph starts on the same line as the tag, at the applicable indentation, and continues on the following lines. Otherwise, the descriptive part of the paragraph begins on the line following the tag.

**.TQ** Set an additional tag for a paragraph tagged with **.TP**. The pending output line is broken. A one-line input trap is planted as with **.TP**.

This macro is a GNU extension not defined on systems running AT&T, Plan 9, or Solaris *troff*; see *an-ext.tmac* in section “Files” below.

**.IP** [*tag*] [*indentation*]

Set an indented paragraph with an optional tag. The *tag* and *indentation* arguments, if present, are handled as with **.TP**, with the exception that the *tag* argument to **.IP** cannot include a macro call.

**Command synopsis macros**

Command synopses are a staple of section 1 and 8 man pages. These macros aid you to construct one that has the classical Unix appearance. A command synopsis is wrapped in **.SY/YS** calls.

These macros are GNU extensions not defined on systems running AT&T, Plan 9, or Solaris *troff*; see *an-ext.tmac* in section “Files” below.

**.SY** *command*

Begin synopsis. A new paragraph begins at the left margin unless **.SY** has already been called without a corresponding **.YS**, in which case only a break is performed. Automatic hyphenation is disabled. *command* is set in bold. If a break is required, lines after the first are indented by the width of *command* plus a space.

**.YS** End synopsis. The previous indentation amount and initial hyphenation mode are restored.

**Hyperlink macros**

Man page cross references are best presented with **.MR**. Email addresses are bracketed with **.MT/.ME** and other forms of hyperlink with **.UR/.UE**. Hyperlinked text is supported on the **html**, **tty**, and **xhtml** output devices; terminals and pager programs must support ECMA-48 OSC 8 escape sequences (see *groff(1)*). When device support is unavailable or disabled with the **U** register (see section “Options” below), **.MT** and **.UR** URIs are rendered between angle brackets after the linked text.

**.MT**, **.ME**, **.UR**, and **.UE** are GNU extensions not defined on systems running AT&T, Plan 9, or Solaris *troff*; see *an-ext.tmac* in section “Files” below. The plan9port project’s *troff* implements **.MR**.

The arguments to **.MR**, **.MT**, and **.UR** should be prepared for typesetting since they can appear in the output. Use special character escape sequences to encode Unicode basic Latin characters where necessary, particularly the hyphen-minus. **\:** escape sequences are ignored when supplied to device control commands for hyperlink-aware output drivers.

**.MR** *page-title manual-section* [*trailing-text*]

Set a man page cross reference as “*page-title(manual-section)*”. If *trailing-text* (typically punctuation) is specified, it follows the closing parenthesis without intervening space. Hyphenation is disabled while the cross reference is set. *page-title* is set in the font specified by the **MF** string. The cross reference hyperlinks to a URI of the form “**man:***page-title(manual-section)*”.

**.MT** *address***.ME** [*trailing-text*]

Identify *address* as an RFC 6068 *addr-spec* for a “mailto:” URI with the text between the two macro calls as the link text. An argument to **.ME** is placed at the end of the link text without intervening space. *address* may not be visible in the rendered document if hyperlinks are enabled and supported by the output driver. If they are not, *address* is set in angle brackets after the link text and before *trailing-text*.

**.UR** *uri***.UE** [*trailing-text*]

Identify *uri* as an RFC 3986 URI hyperlink with the text between the two macro calls as the link text. An argument to **.UE** is placed at the end of the link text without intervening space. *uri* may not be visible in the rendered document if hyperlinks are enabled and supported by the output driver. If they are not, *uri* is set in angle brackets after the link text and before *trailing-text*.

The hyperlinking of **.TP** paragraph tags with **.UR/.UE** and **.MT/.ME** is not yet supported; if attempted, the hyperlink will be typeset at the beginning of the indented paragraph even on hyperlink-supporting devices.

**Font style macros**

The *man* macro package is limited in its font styling options, offering only **bold** (**.B**), *italic* (**.I**), and roman. Italic text is usually set underscored instead on terminal devices. The **.SM** and **.SB** macros set text in roman or bold, respectively, at a smaller type size; these differ visually from regular-sized roman or bold text only on typesetter devices. It is often necessary to set text in different styles without intervening space. The macros **.BI**, **.BR**, **.IB**, **.IR**, **.RB**, and **.RI**, where “B”, “I”, and “R” indicate bold, italic, and roman, respectively, set their odd- and even-numbered arguments in alternating styles, with no space separating them.

The default type size and family for typesetter devices is 10-point Times, except on the **X75-12** and **X100-12** devices where the type size is 12 points. The default style is roman.

**.B** [*text*]

Set *text* in bold. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set in bold.

**.I** [*text*] Set *text* in an italic or oblique face. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set in an italic or oblique face.

**.SM** [*text*]

Set *text* one point smaller than the default type size on typesetter devices. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set smaller.

**.SB** [*text*]

Set *text* in bold and (on typesetter devices) one point smaller than the default type size. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set smaller and in bold.

Unlike the above font style macros, the font style alternation macros below accept only arguments on the same line as the macro call. Italic corrections are applied as appropriate. If space is required within one of the arguments, first consider whether the same result could be achieved with as much clarity by using the single-style macros on separate input lines. When it cannot, double-quote an argument containing embedded space characters. Setting all three different styles within a word presents challenges; see subsection “Portability” in [groff\\_man\\_style\(7\)](#) for approaches.

**.BI** *bold-text italic-text* . . .

Set each argument in bold and italics, alternately.

**.BR** *bold-text roman-text* . . .

Set each argument in bold and roman, alternately.

**.IB** *italic-text bold-text* . . .

Set each argument in italics and bold, alternately.

**.JR** *italic-text roman-text* . . .

Set each argument in italics and roman, alternately.

**.RB** *roman-text bold-text* . . .

Set each argument in roman and bold, alternately.

**.RI** *roman-text italic-text* . . .

Set each argument in roman and italics, alternately.

### Horizontal and vertical spacing

The *indentation* argument accepted by **.RS**, **.IP**, **.TP**, and the deprecated **.HP** is a number plus an optional scaling unit. If no scaling unit is given, the *man* package assumes “n”. An indentation specified in a call to **.IP**, **.TP**, or the deprecated **.HP** persists until (1) another of these macros is called with an explicit *indentation* argument, or (2) **.SH**, **.SS**, or **.P** or its synonyms is called; these clear the indentation entirely. Relative insets created by **.RS** move the left margin and persist until **.RS**, **.RE**, **.SH**, or **.SS** is called.

The indentation amount exhibited by ordinary paragraphs set with **.P** (and its synonyms) not within an **.RS**/**.RE** relative inset, and the default used when **.IP**, **.RS**, **.TP**, and the deprecated **.HP** are not given an indentation argument, is 7.2n for typesetter devices and 7n for terminal devices (but see the **-rIN** option). Headers, footers (both set with **.TH**), and section headings (**.SH**) are set at the left margin, and subsection headings (**.SS**) indented from it by 3n (but see the **-rSN** option). The HTML output device ignores indentation.

Several macros break the output line and insert vertical space: **.SH**, **.SS**, **.TP**, **.P** (and its synonyms), **.IP**, and the deprecated **.HP**. The default inter-section and inter-paragraph spacing is 1v for terminal devices and 0.4v for typesetter devices. (The deprecated macro **.PD** can change this vertical spacing, but its use is discouraged.) In **.EX**/**.EE** sections, the inter-paragraph spacing is 1v regardless of output device. The macros **.RS**, **.RE**, **.EX**, **.EE**, and **.TQ** also cause a break but no insertion of vertical space.

### Registers

Registers are described in section “Options” below. They can be set not only on the command line but in the site *man.local* file as well; see section “Files” below.

## Strings

The following strings are defined for use in man pages. None of these is necessary in a contemporary man page; see *groff\_man\_style(7)*. Others are supported for configuration of rendering parameters; see section “Options” below.

- \\*R** interpolates a special character escape sequence for the “registered sign” glyph, `\(rg`, if available, and “(Reg.)” otherwise.
- \\*S** interpolates an escape sequence setting the type size to the document default.
- \\*(lq**
- \\*(rq** interpolate special character escape sequences for left and right double-quotation marks, `\(lq` and `\(rq`, respectively.
- \\*(Tm** interpolates a special character escape sequence for the “trade mark sign” glyph, `\(tm`, if available, and “(TM)” otherwise.

## Hooks

Two macros, both GNU extensions, are called internally by the *groff man* package to format page headers and footers and can be redefined by the administrator in a site’s *man.local* file (see section “Files” below). The presentation of **.TH** above describes the default headers and footers. Because these macros are hooks for *groff man* internals, man pages have no reason to call them. Such hook definitions will likely consist of “.sp” and “.tl” requests. They must also increase the page length with “.pl” requests in continuous rendering mode; **.PT** furthermore has the responsibility of emitting a PDF bookmark after writing the first page header in a document. Consult the existing implementations in *an.tmac* when drafting replacements.

- .BT** Set the page footer text (“bottom trap”).
- .PT** Set the page header text (“page trap”).

If you want to remove a page header or footer entirely, define the appropriate macro as empty rather than deleting it.

## Deprecated features

Use of the following in man pages for public distribution is discouraged.

### **.AT** [*system* [*release*]]

Alter the footer for use with legacy AT&T man pages, overriding any definition of the *footer-in-side* argument to **.TH**. This macro exists only to render man pages from historical systems.

*system* can be any of the following.

3	7th edition ( <i>default</i> )
4	System III
5	System V

The optional *release* argument specifies the release number, as in “System V Release 3”.

### **.DT** Reset tab stops to the default (every 0.5i).

Use of this presentation-level macro is deprecated. It translates poorly to HTML, under which exact space control and tabulation are not readily available. Thus, information or distinctions that you use tab stops to express are likely to be lost. If you feel tempted to change the tab stops such that calling this macro later is desirable to restore them, you should probably be composing a table using *tbl(1)* instead.

### **.HP** [*indentation*]

Set up a paragraph with a hanging left indentation. The *indentation* argument, if present, is handled as with **.TP**.

Use of this presentation-level macro is deprecated. A hanging indentation cannot be expressed naturally under HTML, and HTML-based man page processors may interpret it as starting an ordinary paragraph. Thus, any information or distinction you mean to express with the indentation may be lost.

**.OP** *option-name* [*option-argument*]

Indicate an optional command parameter called *option-name*, which is set in bold. If the option takes an argument, specify *option-argument* using a noun, abbreviation, or hyphenated noun phrase. If present, *option-argument* is preceded by a space and set in italics. Square brackets in roman surround both arguments.

Use of this quasi-semantic macro, an extension originating in Documenter's Workbench *troff*, is deprecated. It cannot easily be used to annotate options that take optional arguments or options whose arguments have internal structure (such as a mixture of literal and variable components). One could work around these limitations with font selection escape sequences, but it is preferable to use font style alternation macros, which afford greater flexibility.

**.PD** [*vertical-space*]

Define the vertical space between paragraphs or (sub)sections. The optional argument *vertical-space* specifies the amount; the default scaling unit is "v". Without an argument, the spacing is reset to its default value; see subsection "Horizontal and vertical spacing" above.

Use of this presentation-level macro is deprecated. It translates poorly to HTML, under which exact control of inter-paragraph spacing is not readily available. Thus, information or distinctions that you use **.PD** to express are likely to be lost.

**.UC** [*version*]

Alter the footer for use with legacy BSD man pages, overriding any definition of the *footer-inside* argument to **.TH**. This macro exists only to render man pages from historical systems.

*version* can be any of the following.

3	3rd Berkeley Distribution ( <i>default</i> )
4	4th Berkeley Distribution
5	4.2 Berkeley Distribution
6	4.3 Berkeley Distribution
7	4.4 Berkeley Distribution

**History**

Unix Version 7 (1979) introduced the *man* macro package and supported the macros listed in this page not described as extensions, except **.P**, **.SB**, and the deprecated **.AT** and **.UC**. The only strings defined were **R** and **S**; no registers were documented. **.UC** appeared in 3BSD (1980) and **.P** in Unix System III (1980). PWB/UNIX 2.0 (1980) added the **Tm** string. 4BSD (1980) added **lq** and **rq** strings. Documenter's Workbench 1.0 (1984) exposed the **IN** and **LL** registers, which had been internal to Seventh Edition Unix *man*. 4.3BSD (1986) added **.AT** and **.P**. Ninth Edition Research Unix (1986) introduced **.EX** and **.EE**. SunOS 4.0 (1988) may have been the first to support **.SB**. *groff* 1.20 (2009) originated **.SY/.YS**, **.TQ**, **.MT/.ME**, and **.UR/.UE**. The plan9port project's *troff* introduced **.MR** in 2020.

**Options**

The following *groff* options set registers (with **-r**) and strings (with **-d**) recognized and used by the *man* macro package. To ensure rendering consistent with output device capabilities and reader preferences, man pages should never manipulate them.

**-dAD=adjustment-mode**

Set line adjustment to *adjustment-mode*, which is typically "b" for adjustment to both margins (the default), or "l" for left alignment (ragged right margin). Any valid argument to *groff*'s ".ad" request may be used. See [groff\(7\)](#) for less-common choices.

**-rcR=1**

Enable continuous rendering. Output is not paginated; instead, one (potentially very long) page is produced. This is the default for terminal and HTML devices. Use **-rcR=0** to disable it.

- rC1** Number output pages continuously, in strictly increasing sequence, rather than resetting the page number to 1 at each new *man* document.
- rCS=1**  
Capitalize section headings, setting section headings (the argument(s) to **.SH**) in full capitals. This transformation is off by default because it discards case distinction information.
- rCT=1**  
Capitalize titles, setting the man page title (the first argument to **.TH**) in full capitals in headers and footers. This transformation is off by default because it discards case distinction information.
- rD1** Enable double-sided layout, formatting footers for even and odd pages differently; see the description of **.TH** in subsection “Document structure macros” above.
- rFT=***footer-distance*  
Set distance of the footer relative to the bottom of the page to *footer-distance*; this amount is always negative. At twice this distance, the page text is broken before writing the footer. Ignored if continuous rendering is enabled. The default is  $-0.5i$ .
- dHF=***heading-font*  
Set the font used for section and subsection headings; the default is “**B**” (bold style of the default family). Any valid argument to *groff*’s “.ft” request may be used. See [groff\(7\)](#).
- rHY=0**  
Disable automatic hyphenation. Normally, it is enabled using a mode appropriate to the *groff* locale; see section “Localization” of [groff\(7\)](#).
- rIN=***standard-indentation*  
Set the amount of indentation used for ordinary paragraphs (**.P** and its synonyms) and the default indentation amount used by **.IP**, **.RS**, **.TP**, and the deprecated **.HP**. See subsection “Horizontal and vertical spacing” above for the default. For terminal devices, *standard-indentation* should always be an integer multiple of unit “n” to get consistent indentation.
- rLL=***line-length*  
Set line length; the default is 78n for terminal devices and 6.5i for typesetter devices.
- rLT=***title-length*  
Set the line length for titles. By default, it is set to the line length (see **-rLL** above).
- dMF=***man-page-title-font*  
Set the font used for man page titles named in **.TH** and **.MR** calls; the default is “**I**” (italic style of the default family). Any valid argument to *groff*’s “.ft” request may be used; see [groff\(7\)](#). If the **MF** string ends in “I”, it is assumed to be an oblique typeface, and italic corrections are applied before and after man page titles.
- rPn** Start enumeration of pages at *n* rather than 1.
- rStype-size**  
Use *type-size* for the document’s body text; acceptable values are 10, 11, or 12 points. See subsection “Font style macros” above for the default.
- rSN=***subsection-indentation*  
Set indentation of subsection headings to *subsection-indentation*. See subsection “Horizontal and vertical spacing” above for the default.
- rU1** Enable generation of URI hyperlinks in the *grohtml* and *grotty* output drivers. *grohtml* enables them by default; *grotty* does not, pending more widespread pager support for OSC 8 escape sequences. Use **-rU0** to disable hyperlinks; this will make the arguments to **MT** and **UR** calls visible in the document text produced by link-capable drivers.
- rXp** After page *p*, number pages as *pa*, *pb*, *pc*, and so forth. The register tracking the suffixed page letter uses format “a” (see the “.af” request in [groff\(7\)](#)).

## Files

*/usr/local/share/groff/1.23.0/tmac/an.tmac*

Most *man* macros are defined in this file. It also loads extensions from *an-ext.tmac* (see below).

*/usr/local/share/groff/1.23.0/tmac/andoc.tmac*

This brief *groff* program detects whether the *man* or *mdoc* macro package is being used by a document and loads the correct macro definitions, taking advantage of the fact that pages using them must call **.TH** or **.Dd**, respectively, as their first macro. A *man* program or user typing, for example, “**groff –mandoc page.1**”, need not know which package the file *page.1* uses. Multiple man pages, in either format, can be handled; *andoc* reloads each macro package as necessary.

*/usr/local/share/groff/1.23.0/tmac/an-ext.tmac*

Definitions of macros described above as extensions (**.SY/YS**, **.TQ**, **.EX/EE**, **.UR/UE**, **.MT/ME**, and **.MR**) are contained in this file; in some cases, they are simpler versions of definitions appearing in *an.tmac*, and are ignored if the formatter is GNU *troff*. They are written to be compatible with AT&T *troff* and permissively licensed—not copylefted. To reduce the risk of name space collisions, string and register names begin only with “**m**”. Man page authors concerned about portability to legacy Unix systems are encouraged to copy these definitions into their pages, and maintainers of *troff* implementations or work-alike systems that format man pages are encouraged to re-use them.

The definitions for these macros are read after a page calls **.TH**, so they will replace any macros of the same names preceding it in your file. If you use your own implementations of these macros, they must be defined after **.TH** is called to have any effect. Furthermore, it is wise to define such page-local macros (if at all) after the “Name” section to accommodate timid *mandb* implementations that may give up their scan for indexing material early.

*/usr/local/share/groff/1.23.0/tmac/man.tmac*

This is a wrapper that loads *an.tmac*.

*/usr/local/share/groff/1.23.0/tmac/mandoc.tmac*

This is a wrapper that loads *andoc.tmac*.

*/usr/local/share/groff/site-tmac/man.local*

Put site-local changes and customizations into this file.

## Authors

M. Douglas McIlroy <m.douglas.mcilroy@dartmouth.edu> designed, implemented, and documented the AT&T *man* macros, employing them to edit the first volume of the Seventh Edition Unix manual, a compilation of all man pages supplied by the system.

The GNU version of the *man* macro package was written by James Clark; he added the **C**, **D**, **P**, and **X** registers. Werner Lemberg <wl@gnu.org> supplied the **S** and **cR** registers. Larry Kollar <kollar@alltel.net> added the **FT**, **HY**, and **SN** registers; the **HF** string; and the **PT** and **BT** macros. G. Branden Robinson <g.branden.robinson@gmail.com> implemented the **AD** and **MF** strings; **CS**, **CT**, and **U** registers; and the **MR** macro. The extension macros were written by Lemberg, Eric S. Raymond <esr@thyrsus.com>, and Robinson.

This document was originally written for the Debian GNU/Linux system by Susan G. Kleinmann <sgk@debian.org>. It was corrected and updated by Lemberg and Robinson. The extension macros were documented by Raymond and Robinson.

## See also

[tbl\(1\)](#), [eqn\(1\)](#), and [refer\(1\)](#) are preprocessors used with man pages.

[man\(1\)](#) describes the man page librarian on your system.

[groff\\_mdoc\(7\)](#) describes the *groff* version of the BSD-originated alternative macro package for man pages.

[groff\\_man\\_style\(7\)](#), [groff\(7\)](#), [groff\\_char\(7\)](#), [man\(7\)](#)

**Name**

groff\_man\_style – GNU roff man page tutorial and style guide

**Synopsis**

**groff -man** [*option* ...] [*file* ...]

**groff -m man** [*option* ...] [*file* ...]

**Description**

The GNU implementation of the *man* macro package is part of the *groff* document formatting system. It is used to produce manual pages (“man pages”) like the one you are reading.

This document presents the macros thematically; for those needing only a quick reference, the following table lists them alphabetically, with cross references to appropriate subsections below.

Macro	Meaning	Subsection
<b>.B</b>	Bold	Font style macros
<b>.BI</b>	Bold, italic alternating	Font style macros
<b>.BR</b>	Bold, roman alternating	Font style macros
<b>.EE</b>	Example end	Document structure macros
<b>.EX</b>	Example begin	Document structure macros
<b>.I</b>	Italic	Font style macros
<b>.IB</b>	Italic, bold alternating	Font style macros
<b>.IP</b>	Indented paragraph	Paragraphing macros
<b>.IR</b>	Italic, roman alternating	Font style macros
<b>.LP</b>	Begin paragraph	Paragraphing macros
<b>.ME</b>	Mail-to end	Hyperlink macros
<b>.MR</b>	Man page cross reference	Hyperlink macros
<b>.MT</b>	Mail-to start	Hyperlink macros
<b>.P</b>	Begin paragraph	Paragraphing macros
<b>.PP</b>	Begin paragraph	Paragraphing macros
<b>.RB</b>	Roman, bold alternating	Font style macros
<b>.RE</b>	Relative inset end	Document structure macros
<b>.RI</b>	Roman, italic alternating	Font style macros
<b>.RS</b>	Relative inset start	Document structure macros
<b>.SB</b>	Small bold	Font style macros
<b>.SH</b>	Section heading	Document structure macros
<b>.SM</b>	Small	Font style macros
<b>.SS</b>	Subsection heading	Document structure macros
<b>.SY</b>	Synopsis start	Command synopsis macros
<b>.TH</b>	Title heading	Document structure macros
<b>.TP</b>	Tagged paragraph	Paragraphing macros
<b>.TQ</b>	Supplemental paragraph tag	Paragraphing macros
<b>.UE</b>	URI end	Hyperlink macros
<b>.UR</b>	URI start	Hyperlink macros
<b>.YS</b>	Synopsis end	Command synopsis macros

Macros whose use we discourage (**.AT**, **.DT**, **.HP**, **.OP**, **.PD**, and **.UC**) are described in subsection “Deprecated features” below.

Man pages should be encoded using Unicode basic Latin code points exclusively, and employ the Unix line-ending convention (U+000A only).

**Macro reference preliminaries**

Each macro is described in a tagged paragraph. Closely related macros, such as **.EX** and **.EE**, are grouped together.

A macro call appears on a line starting with a dot (“.”), followed by zero or more spaces and then the macro name. Some macros accept arguments; each such argument is separated from the macro name and any subsequent arguments by one or more spaces. A newline, unless escaped (see subsection “Portability” below),

terminates the macro call.

Optional macro arguments are indicated by surrounding them with square brackets. If a macro accepts multiple arguments, those containing space characters must be double-quoted to be interpreted correctly. An empty macro argument can be specified with a pair of double-quotes (“”), but the *man* package is designed such that this should seldom be necessary. See section “Notes” below for examples of cases where better alternatives to empty arguments in macro calls are available. Most macro arguments will be formatted as text in the output; exceptions are noted.

Bear in mind that *groff* is fundamentally a programming system for typesetting. Consequently, the verb “to set” is frequently used below in the sense “to typeset”.

We describe below several *man* macros that plant one-line *input traps*: the next input line that directly produces formatted output is treated specially. For *man* documents written in the language subset described in section “Portability” below, this means that control lines using the empty request and uncommented input lines ending with an escaped newline or the `\c` escape sequence do not spring the trap; anything else does.

### Document structure macros

The highest level of organization of a man page is determined by this group of macros. **.TH** (title heading) identifies the document as a man page and defines information enabling *mandb*(8) or a similar tool to index it. Section headings (**.SH**), one of which is mandatory and many of which are standardized, facilitate quick location of relevant material by the reader and aid the man page writer to discuss all essential aspects of the topic. Subsection headings (**.SS**) are optional and permit sections that grow long to develop in a controlled way. Many technical discussions benefit from examples; lengthy ones, especially those reflecting multiple lines of input to or output from the system, are usefully bracketed by **.EX** and **.EE**. When none of the foregoing meets a structural demand, a region within a (sub)section can be manually inset within **.RS** and **.RE** macros.

#### **.TH** *title section* [*footer-middle*] [*footer-inside*] [*header-middle*]

Define the title of the man page as *title* and the volume of the manual to which it belongs as *section*. This use of “section” has nothing to do with the section headings otherwise discussed in this page; it arises from the organizational scheme of printed and bound Unix manuals. See *man*(1) for details on the section numbers and suffixes applicable to your system. *title* and *section* are positioned together at the left and right in the header line (with *section* in parentheses immediately appended to *title*). *footer-middle* is centered in the footer line. The arrangement of the rest of the footer depends on whether double-sided layout is enabled with the option **-rD1**. When disabled (the default), *footer-inside* is positioned at the bottom left. Otherwise, *footer-inside* appears at the bottom left on recto (odd-numbered) pages, and at the bottom right on verso (even-numbered) pages. The outside footer is the page number, except in the continuous-rendering mode enabled by the option **-rcR=1**, in which case it is the *title* and *section*, as in the header. *header-middle* is centered in the header line. If *section* is a simple integer between 1 and 9 (inclusive), there is no need to specify *header-middle*; *an.tmac* will supply text for it. The macro package may also abbreviate *title* and *footer-inside* with ellipses (...) if they overrun the space available in the header and footer, respectively. For HTML output, headers and footers are suppressed.

Additionally, this macro starts a new page; the page number is reset to 1 (unless the **-rC1** option is given). This feature is intended only for formatting multiple man pages.

A man page should contain exactly one **.TH** call at or near the beginning of the file, prior to any other macro calls.

By convention, *footer-middle* is the most recent modification date of the man page source document, and *footer-inside* is the name and version or release of the project providing it.

#### **.SH** [*heading-text*]

Set *heading-text* as a section heading. If no argument is given, a one-line input trap is planted; text on the next line becomes *heading-text*. This text is set at the left margin, in bold (or the font specified by the string **HF**) and, on typesetter devices, slightly larger than the base type size. If the heading font `\*[HF]` is bold, use of an italic style in *heading-text* is mapped to the bold-italic style if available in the font family. The inset level is reset to 1 and paragraph indentation to the default.

Text after *heading-text* is set as an ordinary paragraph (**.P**).

The content of *heading-text* and ordering of sections has been standardized by common practice, as has much of the layout of material within sections. For example, a section called “Name” or “NAME” must exist, must be the first section after the **.TH** call, and must contain only a line of the form

*topic*[, *another-topic*]. . . \- *summary-description*

for a man page to be properly indexed. See *man(7)* for the conventions prevailing on your system.

**.SS** [*subheading-text*]

Set *subheading-text* as a subsection heading indented between a section heading and an ordinary paragraph (**.P**). See subsection “Horizontal and vertical spacing” below for the indentation amount. If no argument is given, a one-line input trap is planted; text on the next line becomes *subheading-text*. This text is set in bold (or the font specified by the string **HF**). If the heading font **\\*[HF]** is bold, use of an italic style in *subheading-text* is mapped to the bold-italic style if available in the font family. The inset level is reset to 1 and paragraph indentation to the default. Text after *subheading-text* is set as an ordinary paragraph (**.P**).

**.EX**

**.EE** Begin and end example. After **.EX**, filling is disabled and a constant-width (monospaced) font is selected. Calling **.EE** enables filling and restores the previous font.

Example regions are useful for formatting code, shell sessions, and text file contents. An example region is not a “literal mode” of any sort: special character escape sequences must still be used to produce correct glyphs for `'`, `-`, `\`, `^`, ```, and `~`, and sentence endings are still detected and additional inter-sentence space applied. If a user (or one of *groff*’s localization support macro files) has changed the additional inter-sentence space amount, the latter process can change the rendering of, for instance, regular expressions using `.` or `?` followed by multiple spaces. Use the non-printing input break escape sequence `\&` before the spaces.

These macros are extensions, introduced in Ninth Edition Research Unix, to the original *man* package. Many systems running AT&T, Heirloom Doctools, or Plan 9 *troff* support them. To be certain your page will be portable to systems that do not, copy their definitions from the *an-ext.tmac* file of a *groff* installation.

**.RS** [*indentation*]

Start a new relative inset level, moving the left margin right by *indentation*, if specified, and by a default amount otherwise; see subsection “Horizontal and vertical spacing” below. Calls to **.RS** can be nested; each call increments by 1 the inset level used by **.RE**. The inset level prior to any **.RS** calls is 1.

**.RE** [*level*]

End a relative inset; move the left margin back to that corresponding to inset level *level*. If no argument is given, move the left margin one level back.

**Paragraphing macros**

An ordinary paragraph (**.P**) like this one is set without a first-line indentation at the current left margin. In man pages and other technical literature, definition lists are frequently encountered; these can be set as “tagged paragraphs”, which have one (**.TP**) or more (**.TQ**) leading tags followed by a paragraph that has an additional indentation. The indented paragraph (**.IP**) macro is useful to continue the indented content of a narrative started with **.TP**, or to present an itemized or ordered list. All paragraph macros break the output line at the current position. If another paragraph macro has occurred since the previous **.SH** or **.SS**, they (except for **.TQ**) follow the break with a default amount of vertical space, which can be changed by the deprecated **.PD** macro; see subsection “Horizontal and vertical spacing” below. They also reset the type size and font style to defaults (**.TQ** again excepted); see subsection “Font style macros” below.

**.P**

**.LP**

**.PP** Begin a new paragraph; these macros are synonymous. The indentation is reset to the default value; the left margin, as affected by **.RS** and **.RE**, is not.

**.TP** [*indentation*]

Set a paragraph with a leading tag, and the remainder of the paragraph indented. A one-line input trap is planted; text on the next line, which can be formatted with a macro, becomes the tag, which is placed at the current left margin. Subsequent text is indented by *indentation*, if specified, and by a default amount otherwise; see subsection “Horizontal and vertical spacing” below.

If the tag is not as wide as the indentation, the paragraph starts on the same line as the tag, at the applicable indentation, and continues on the following lines. Otherwise, the descriptive part of the paragraph begins on the line following the tag.

The line containing the tag can include a macro call, for instance to set the tag in bold with **.B**. **.TP** was used to write the first paragraph of this description of **.TP**, and **.IP** the subsequent ones.

**.TQ** Set an additional tag for a paragraph tagged with **.TP**. The pending output line is broken. A one-line input trap is planted as with **.TP**.

This macro is a GNU extension not defined on systems running AT&T, Plan 9, or Solaris *troff*; see *an-ext.tmac* in section “Files” below.

The descriptions of **.P**, **.LP**, and **.PP** above were written using **.TP** and **.TQ**.

**.IP** [*tag*] [*indentation*]

Set an indented paragraph with an optional tag. The *tag* and *indentation* arguments, if present, are handled as with **.TP**, with the exception that the *tag* argument to **.IP** cannot include a macro call.

Two convenient uses for **.IP** are

- (1) to start a new paragraph with the same indentation as an immediately preceding **.IP** or **.TP** paragraph, if no *indentation* argument is given; and
- (2) to set a paragraph with a short *tag* that is not semantically important, such as a bullet (•)—obtained with the **\(bu** special character escape sequence—or list enumerator, as seen in this very paragraph.

### Command synopsis macros

Command synopses are a staple of section 1 and 8 man pages. These macros aid you to construct one that has the classical Unix appearance. A command synopsis is wrapped in **.SY/.YS** calls.

These macros are GNU extensions not defined on systems running AT&T, Plan 9, or Solaris *troff*; see *an-ext.tmac* in section “Files” below.

**.SY** *command*

Begin synopsis. A new paragraph begins at the left margin (as with **.P**) unless **.SY** has already been called without a corresponding **.YS**, in which case only a break is performed. Automatic hyphenation is disabled. *command* is set in bold. If a break is required, lines after the first are indented by the width of *command* plus a space.

**.YS** End synopsis. The previous indentation amount and initial hyphenation mode are restored.

Multiple **.SY/.YS** blocks can be specified, for instance to distinguish differing modes of operation of a complex command like *tar(1)*; each will be vertically separated as paragraphs are.

**.SY** can also be repeated multiple times before a closing **.YS**, which is useful to indicate synonymous ways of invoking a particular mode of operation.

*groff*’s own command-line interface serves to illustrate most of the specimens of synopsis syntax one is likely to encounter.

```
.SY groff
.RB [ \-abcCeEgGijKlNpRsStUVXzZ ]
.RB [ \-d\~\c
.IR cs ]
```

```

.RB [ \-d\~\c
.IB name =\c
.IR string ]
.RB [ \-D\~\c
.IR enc ]
(and so on similarly)
.RI [ file\~ .\|\.\|. ]
.YS
.
.
.SY groff
.B \-h
.
.SY groff
.B \-\-help
.YS
.
.
.SY groff
.B \-v
.RI [ option\~ .\|\.\|\.& ]
.RI [ file\~ .\|\.\|. ]
.
.SY groff
.B \-\-version
.RI [ option\~ .\|\.\|\.& ]
.RI [ file\~ .\|\.\|. ]
.YS

```

produces the following output.

```

groff [-abcCeEgGijklNpRsStUVXzZ] [-d cs] [-d name=string] [-D enc] [-f fam] [-F dir]
  [-I dir] [-K enc] [-L arg] [-m name] [-M dir] [-n num] [-o list] [-P arg] [-r cn]
  [-r reg=expr] [-T dev] [-w name] [-W name] [file ...]

groff -h
groff --help

groff -v [option ...] [file ...]
groff --version [option ...] [file ...]

```

Several features of the above example are of note.

- The empty request (`.`), which does nothing, is used to vertically space the input file for readability by the document maintainer. Do not put blank (empty) lines in a man page source document.
- Command and option names are presented in **bold** to cue the user that they should be input literally.
- Option dashes are specified with the `\-` escape sequence; this is an important practice to make them clearly visible and to facilitate copy-and-paste from the rendered man page to a shell prompt or text file.
- Option arguments and command operands are presented in *italics* (but see subsection “Font style macros” below regarding terminals) to cue the user that they must be replaced with appropriate text.
- Symbols that are neither to be typed literally nor replaced at the user’s discretion appear in the roman style; brackets surround optional arguments, and an ellipsis indicates that the previous syntactical element may be repeated arbitrarily.
- The non-breaking adjustable space escape sequence `\~` is used to prevent the output line from being broken within the option brackets.

- The output line continuation escape sequence `\c` is used with font style alternation macros to allow all three font styles to be set without (breakable) space among them; see subsection “Portability” below.
- The non-printing input break escape sequence `\&` follows the ellipsis when further text will follow after space on the output line, keeping its last period from being interpreted as the end of a sentence and causing additional inter-sentence space to be placed after it. See subsection “Portability” below.

### Hyperlink macros

Man page cross references like `ls(1)` are best presented with `.MR`. Email addresses are bracketed with `.MT/.ME` and other forms of hyperlink with `.UR/.UE`. Hyperlinked text is supported on the `html`, `tty`, and `xhtml` output devices; terminals and pager programs must support ECMA-48 OSC 8 escape sequences (see `grotty(1)`). When device support is unavailable or disabled with the `U` register (see section “Options” below), `.MT` and `.UR` URIs are rendered between angle brackets after the linked text.

`.MT`, `.ME`, `.UR`, and `.UE` are GNU extensions not defined on systems running AT&T, Plan 9, or Solaris `troff`; see `an-ext.tmac` in section “Files” below. The plan9port project’s `troff` implements `.MR`.

The arguments to `.MR`, `.MT`, and `.UR` should be prepared for typesetting since they can appear in the output. Use special character escape sequences to encode Unicode basic Latin characters where necessary, particularly the hyphen-minus. (See section “Portability” below.) URIs can be lengthy; rendering them can result in jarring adjustment or variations in line length, or `troff` warnings when a hyperlink is longer than an output line. The application of non-printing break point escape sequences `\:` after each slash (or series thereof), and before each dot (or series thereof) is recommended as a rule of thumb. The former practice avoids forcing a trailing slash in a URI onto a separate output line, and the latter helps the reader to avoid mistakenly interpreting a dot at the end of a line as a period (or multiple dots as an ellipsis). Thus,

```
.UR http://\:example\:.com/\:fb8afcfaebc74e\:.cc
```

has several potential break points in the URI shown. Consider adding break points before or after at signs in email addresses, and question marks, ampersands, and number signs in HTTP(S) URIs. `\:` escape sequences are ignored when supplied to device control commands for hyperlink-aware output drivers.

`.MR` *page-title manual-section* [*trailing-text*]

Set a man page cross reference as “*page-title(manual-section)*”. If *trailing-text* (typically punctuation) is specified, it follows the closing parenthesis without intervening space. Hyphenation is disabled while the cross reference is set. *page-title* is set in the font specified by the `MF` string. The cross reference hyperlinks to a URI of the form “**man:** *page-title(manual-section)*”.

```
The output driver
.MR grops 1
produces PostScript from
.I troff
output.
.
The Ghostscript program (\c
.MR gs 1 )
interprets PostScript and PDF.
```

`.MT` *address*

`.ME` [*trailing-text*]

Identify *address* as an RFC 6068 *addr-spec* for a “mailto:” URI with the text between the two macro calls as the link text. An argument to `.ME` is placed at the end of the link text without intervening space. *address* may not be visible in the rendered document if hyperlinks are enabled and supported by the output driver. If they are not, *address* is set in angle brackets after the link text and before *trailing-text*.

When rendered by `groff` to a PostScript device,

```
Contact
.MT fred\:.foonly@\:fubar\:.net
Fred Foonly
.ME
```

for more information.

displays as “Contact Fred Foonly <fred.foonly@fubar.net> for more information.”

**.UR** *uri*

**.UE** [*trailing-text*]

Identify *uri* as an RFC 3986 URI hyperlink with the text between the two macro calls as the link text. An argument to **.UE** is placed at the end of the link text without intervening space. *uri* may not be visible in the rendered document if hyperlinks are enabled and supported by the output driver. If they are not, *uri* is set in angle brackets after the link text and before *trailing-text*.

When rendered by *groff* to a PostScript device,

```
The GNU Project of the Free Software Foundation
hosts the
.UR https://\:www\:.gnu\:.org/\:software/\:groff/
.I groff
home page
.UE .
```

displays as “The GNU Project of the Free Software Foundation hosts the *groff* home page <https://www.gnu.org/software/groff/>.”

The hyperlinking of **.TP** paragraph tags with **.UR/.UE** and **.MT/.ME** is not yet supported; if attempted, the hyperlink will be typeset at the beginning of the indented paragraph even on hyperlink-supporting devices.

### Font style macros

The *man* macro package is limited in its font styling options, offering only **bold (.B)**, *italic (.I)*, and roman. Italic text is usually set underscored instead on terminal devices. The **.SM** and **.SB** macros set text in roman or bold, respectively, at a smaller type size; these differ visually from regular-sized roman or bold text only on typesetter devices. It is often necessary to set text in different styles without intervening space. The macros **.BI**, **.BR**, **.IB**, **.IR**, **.RB**, and **.RI**, where “B”, “I”, and “R” indicate bold, italic, and roman, respectively, set their odd- and even-numbered arguments in alternating styles, with no space separating them.

Because font styles are presentational rather than semantic, conflicting traditions have arisen regarding which font styles should be used to mark file or path names, environment variables, and inlined literals.

The default type size and family for typesetter devices is 10-point Times, except on the **X75–12** and **X100–12** devices where the type size is 12 points. The default style is roman.

**.B** [*text*]

Set *text* in bold. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set in bold.

Use bold for literal portions of syntax synopses, for command-line options in running text, and for literals that are major topics of the subject under discussion; for example, this page uses bold for macro, string, and register names. In an **.EX/.EE** example of interactive I/O (such as a shell session), set only user input in bold.

**.I** [*text*] Set *text* in an italic or oblique face. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set in an italic or oblique face.

Use italics for file and path names, for environment variables, for C data types, for enumeration or preprocessor constants in C, for variable (user-determined) portions of syntax synopses, for the first occurrence (only) of a technical concept being introduced, for names of journals and of literary works longer than an article, and anywhere a parameter requiring replacement by the user is encountered. An exception involves variable text in a context that is already marked up in italics, such as file or path names with variable components; in such cases, follow the convention of mathematical typography: set the file or path name in italics as usual but use roman for the variable part (see **.IR** and **.RI** below), and italics again in running roman text when referring to the variable material.

**.SM** [*text*]

Set *text* one point smaller than the default type size on typesetter devices. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set smaller.

*Note:* terminals will render *text* at normal size instead. Do not rely upon **.SM** to communicate semantic information distinct from using roman style at normal size; it will be hidden from readers using such devices.

**.SB** [*text*]

Set *text* in bold and (on typesetter devices) one point smaller than the default type size. If no argument is given, a one-line input trap is planted; text on the next line, which can be further formatted with a macro, is set smaller and in bold.

*Note:* terminals will render *text* in bold at the normal size instead. Do not rely upon **.SB** to communicate semantic information distinct from using bold style at normal size; it will be hidden from readers using such devices.

Observe what is *not* prescribed for setting in bold or italics above: elements of “synopsis language” such as ellipses and brackets around options; proper names and adjectives; titles of anything other than major works of literature; identifiers for standards documents or technical reports such as CSTR #54, RFC 1918, Unicode 13.0, or POSIX.1-2017; acronyms; and occurrences after the first of a technical term or piece of jargon.

Be frugal with italics for emphasis, and particularly with bold. Article titles and brief runs of literal text, such as references to individual characters or short strings, including section and subsection headings of man pages, are suitable objects for quotation; see the `\(lq`, `\(rq`, `\(oq`, and `\(cq` escape sequences in subsection “Portability” below.

Unlike the above font style macros, the font style alternation macros below accept only arguments on the same line as the macro call. Italic corrections are applied as appropriate. If space is required within one of the arguments, first consider whether the same result could be achieved with as much clarity by using the single-style macros on separate input lines. When it cannot, double-quote an argument containing embedded space characters. Setting all three different styles within a word presents challenges; it is possible with the `\c` and/or `\f` escape sequences, but see subsection “Portability” below for caveats.

**.BI** *bold-text italic-text* ...

Set each argument in bold and italics, alternately.

```
.BI \-r\~ reg = n
```

**.BR** *bold-text roman-text* ...

Set each argument in bold and roman, alternately.

```
After invocation of
.BR .NH ,
the assigned number is made available in the strings
```

**.IB** *italic-text bold-text* ...

Set each argument in italics and bold, alternately.

```
.I groff
copes with this situation by searching for both
.IB anything .tmac
and
.BI tmac. anything
```

**.IR** *italic-text roman-text* ...

Set each argument in italics and roman, alternately.

```
The
.I groff
font file is written to
```

```
.I font.
```

**.RB** *roman-text bold-text* ...

Set each argument in roman and bold, alternately.

```
and do not handle the
.RB \(\lq "delim on" \(\rq
statement specially.
```

**.RI** *roman-text italic-text* ...

Set each argument in roman and italics, alternately.

```
.RI [ file\~ .\|.\|.]
```

### Horizontal and vertical spacing

The *indentation* argument accepted by **.RS**, **.IP**, **.TP**, and the deprecated **.HP** is a number plus an optional scaling unit. If no scaling unit is given, the *man* package assumes “n”; that is, the width of a letter “n” in the font current when the macro is called (see section “Numerical Expressions” in *groff(7)*). An indentation specified in a call to **.IP**, **.TP**, or the deprecated **.HP** persists until (1) another of these macros is called with an explicit *indentation* argument, or (2) **.SH**, **.SS**, or **.P** or its synonyms is called; these clear the indentation entirely. Relative insets created by **.RS** move the left margin and persist until **.RS**, **.RE**, **.SH**, or **.SS** is called.

The indentation amount exhibited by ordinary paragraphs set with **.P** (and its synonyms) not within an **.RS/.RE** relative inset, and the default used when **.IP**, **.RS**, **.TP**, and the deprecated **.HP** are not given an indentation argument, is 7.2n for typesetter devices and 7n for terminal devices (but see the **-rIN** option). Headers, footers (both set with **.TH**), and section headings (**.SH**) are set at the left margin, and subsection headings (**.SS**) indented from it by 3n (but see the **-rSN** option). The HTML output device ignores indentation.

It may be helpful to think of the left margin and indentation as related but distinct concepts; *groff*’s implementation of the *man* macro package tracks them separately. The left margin is manipulated by **.RS** and **.RE** (and by **.SH** and **.SS**, which reset it to the default). Indentation is controlled by the paragraphing macros (though, again, **.SH** and **.SS** reset it); it is imposed by the **.TP**, **.IP**, and deprecated **.HP** macros, and cancelled by **.P** and its synonyms. An extensive example follows.

This ordinary (**.P**) paragraph is not in a relative inset nor does it possess an indentation.

Now we have created a relative inset (in other words, moved the left margin) with **.RS** and started another ordinary paragraph with **.P**.

**tag** This tagged paragraph, set with **.TP**, is still within the **.RS** region, but lines after the first have a supplementary indentation that the tag lacks.

A paragraph like this one, set with **.IP**, will appear to the reader as also associated with the tag above, because **.IP** re-uses the previous paragraph’s indentation unless given an argument to change it. This paragraph is affected both by the moved left margin (**.RS**) and indentation (**.IP**).

This table is affected both by the left margin and indentation.
---

- This indented paragraph has a bullet for a tag, making it more obvious that the left margin and indentation are distinct; only the former affects the tag, but both affect the text of the paragraph.

This ordinary (**.P**) paragraph resets the indentation, but the left margin is still inset.

This table is affected only by the left margin.
---

Finally, we have ended the relative inset by using **.RE**, which (because we used only one **.RS/.RE** pair) has reset the left margin to the default. This is an ordinary **.P** paragraph.

Resist the temptation to mock up tabular or multi-column output with tab characters or the indentation arguments to **.IP**, **.TP**, **.RS**, or the deprecated **.HP**; the result may not render comprehensibly on an output device you fail to check, or which is developed in the future. The table preprocessor *tbl(1)* can likely meet your needs.

Several macros break the output line and insert vertical space: **.SH**, **.SS**, **.TP**, **.P** (and its synonyms), **.IP**, and the deprecated **.HP**. The default inter-section and inter-paragraph spacing is 1v for terminal devices and 0.4v for typesetter devices (“v” is a unit of vertical distance, where 1v is the distance between adjacent text baselines in a single-spaced document). (The deprecated macro **.PD** can change this vertical spacing, but its use is discouraged.) In **.EX/EE** sections, the inter-paragraph spacing is 1v regardless of output device. The macros **.RS**, **.RE**, **.EX**, **.EE**, and **.TQ** also cause a break but no insertion of vertical space.

### Registers

Registers are described in section “Options” below. They can be set not only on the command line but in the site *man.local* file as well; see section “Files” below.

### Strings

The following strings are defined for use in man pages. Others are supported for configuration of rendering parameters; see section “Options” below.

- \\*R** interpolates a special character escape sequence for the “registered sign” glyph, **\(rg**, if available, and “(Reg.)” otherwise.
- \\*S** interpolates an escape sequence setting the type size to the document default.
- \\*(lq**
- \\*(rq** interpolate special character escape sequences for left and right double-quotation marks, **\(lq** and **\(rq**, respectively.
- \\*(Tm** interpolates a special character escape sequence for the “trade mark sign” glyph, **\(tm**, if available, and “(TM)” otherwise.

None of the above is necessary in a contemporary man page. **\\*S** is superfluous, since type size changes are invisible on terminal devices and macros that change it restore its original value afterward. Better alternatives exist for the rest; simply use the **\(rg**, **\(lq**, **\(rq**, and **\(tm** special character escape sequences directly. Unless a man page author is aiming for a pathological level of portability, such as the composition of pages for consumption on simulators of 1980s Unix systems (or Solaris *troff*, though even it supports **\(rg**), the above strings should be avoided.

### Portability

It is wise to quote multi-word section and subsection titles; the **.SH** and **.SS** macros of *man(7)* implementations descended from Seventh Edition Unix supported six arguments at most. A similar restriction applied to the **.B**, **.I**, **.SM**, and font style alternation macros.

The two major syntactical categories for formatting control in the *roff* language are requests and escape sequences. Since the *man* macros are implemented in terms of *groff* requests and escape sequences, one can, in principle, supplement the functionality of *man* with these lower-level elements where necessary.

However, using raw *groff* requests (apart from the empty request “.”) is likely to make your page render poorly when processed by other tools; many of these attempt to interpret page sources directly for conversion to HTML. Some requests make implicit assumptions about things like character and page sizes that may not hold in an HTML environment; also, many of these viewers don’t interpret the full *groff* vocabulary, a problem that can lead to portions of your text being omitted or presented incomprehensibly.

For portability to modern viewers, it is best to write your page solely with the macros described in this page (except for the ones identified as deprecated, which should be avoided). The macros we have described as extensions (**.EX/EE**, **.SY/YS**, **.TQ**, **.UR/UE**, **.MT/ME**, and **.MR**) should be used with caution, as they may not yet be built in to some viewer that is important to your audience. See *an-ext.tmac* in section “Files” below.

Similar caveats apply to escape sequences. Some escape sequences are however required for correct typesetting even in man pages and usually do not cause portability problems. Several of these render glyphs

corresponding to punctuation code points in the Unicode basic Latin range (U+0000–U+007F) that are handled specially in *roff* input; the escape sequences below must be used to render them correctly and portably when documenting material that uses them syntactically—namely, any of the set ' - \ ^ ` ~ (apostrophe, dash or minus, backslash, caret, grave accent, tilde).

**\'** Comment. Everything after the double-quote to the end of the input line is ignored. Whole-line comments should be placed immediately after the empty request “.”).

**\newline**

Join the next input line to the current one. Except for the update of the input line counter (used for diagnostic messages and related purposes), a series of lines ending in backslash-newline appears to *groff* as a single input line. Use this escape sequence to break excessively long input lines for document maintenance.

**\%** Control hyphenation. The location of this escape sequence within a word marks a hyphenation point, supplementing *groff*'s automatic hyphenation patterns. At the beginning of a word, it suppresses any automatic hyphenation points within; any specified with **\%** are still honored.

**\:** Insert a non-printing break point. A word can break at such a point, but a hyphen glyph is not written to the output if it does. This escape sequence is an input word boundary, so the remainder of the word is subject to hyphenation as normal. You can use **\:** and **\%** in combination to control breaking of a file name or URI or to permit hyphenation only after certain explicit hyphens within a word. See subsection “Hyperlink macros” above for an example.

**\~** Adjustable non-breaking space. Use this escape sequence to prevent a break inside a short phrase or between a numerical quantity and its corresponding unit(s).

```
Before starting the motor,
set the output speed to\~1.
There are 1,024\~bytes in 1\~KiB.
CSTR\~#8 documents the B\~language.
```

**\&** Non-printing input break. Insert at the beginning of an input line to prevent a dot or apostrophe from being interpreted as the beginning of a *roff* request. Append to an end-of-sentence punctuation sequence to keep it from being recognized as such.

**\|** Thin space (one-sixth em on typesetters, zero-width on terminals); a non-breaking space. Used primarily in ellipses (“.\|.”) to space the dots more pleasantly on typesetter devices like PostScript and PDF.

**\-** Minus sign or basic Latin hyphen-minus. This escape sequence produces the Unix command-line option dash in the output. “-” is a hyphen in the *roff* language; some output devices replace it with U+2010 (hyphen) or similar.

**\(aq** Basic Latin neutral apostrophe. Some output devices replace “'” with a right single quotation mark.

**\(oq**

**\(cq** Opening (left) and closing (right) single quotation marks. Use these for paired directional single quotes, ‘like this’.

**\(dq** Basic Latin quotation mark (double quote). Use in macro calls to prevent “” from being interpreted as beginning a quoted argument, or simply for readability.

```
.TP
.BI "split \(dq" text \(dq
```

**\(lq**

**\(rq** Left and right double quotation marks. Use these for paired directional double quotes, “like this”.

**\(em** Em-dash. Use for an interruption—such as this one—in a sentence.

- \(en** En-dash. Use to separate the ends of a range, particularly between numbers; for example, “the digits 1–9”.
- \(ga** Basic Latin grave accent. Some output devices replace “`” with a left single quotation mark.
- \(ha** Basic Latin circumflex accent (“hat”). Some output devices replace “^” with U+02C6 (modifier letter circumflex accent) or similar.
- \(rs** Reverse solidus (backslash). The backslash is the default escape character in the *roff* language, so it does not represent itself in output. Also see **\e** below.
- \(ti** Basic Latin tilde. Some output devices replace “~” with U+02DC (small tilde) or similar.
- \c** End a text line without inserting space or attempting a break. Normally, if filling is enabled, the end of a text line is treated like a space; an output line *may* be broken there (if not, an adjustable space is inserted); if filling is disabled, the line *will* be broken there, as in **.EX/EE** examples. Nothing after **\c** on the input line is formatted. The next line is interpreted as usual and can include a macro call (contrast with *\newline*). This escape sequence is useful when three different font styles are needed in a single word, as in a command synopsis,

```
.RB [ \-\-stylesheet=\c
.IR name ]
```

or on a single line, as in **.EX/EE** examples.

```
.EX
$ \c
.B groff \-T utf8 \-Z \c
.I file \c
.B | grotty \-i
.EE
```

Alternatively, and perhaps with better portability, the **\f** font selection escape sequence can be used; see below. Using **\c** to continue a **.TP** paragraph tag across multiple input lines will render incorrectly with *groff* 1.22.3, *mandoc* 1.14.1, older versions of these programs, and perhaps with some other formatters.

- \e** Format the current escape character on the output; widely used in man pages to render a backslash glyph. It works reliably as long as the “.ec” request is not used, which should never happen in man pages, and it is slightly more portable than the more explicit **\(rs** (“reverse solidus”) special character escape sequence.

### **\fB, \fI, \fR, \fP**

Switch to bold, italic, roman, or back to the previous style, respectively. Either **\f** or **\c** is needed when three different font styles are required in a word.

```
.RB [ \-\-reference\-\-dictionary=\fI\,name\/\fP ]

.RB [ \-\-reference\-\-dictionary=\c
.IR name ]
```

Style escape sequences may be more portable than **\c**. As shown above, it is up to you to account for italic corrections with “**\V**” and “**\v**”, which are themselves GNU extensions, if desired and if supported by your implementation.

**\fP** reliably returns to the style in use immediately preceding the previous **\f** escape sequence only if no sectioning, paragraph, or style macro calls have intervened.

As long as at most two styles are needed in a word, style macros like **.B** and **.BI** usually result in more readable *roff* source than **\f** escape sequences do.

For maximum portability, escape sequences and special characters not listed above are better avoided in man pages.

## Hooks

Two macros, both GNU extensions, are called internally by the *groff man* package to format page headers and footers and can be redefined by the administrator in a site's *man.local* file (see section "Files" below). The presentation of **.TH** above describes the default headers and footers. Because these macros are hooks for *groff man* internals, man pages have no reason to call them. Such hook definitions will likely consist of ".sp" and ".tl" requests. They must also increase the page length with ".pl" requests in continuous rendering mode; **.PT** furthermore has the responsibility of emitting a PDF bookmark after writing the first page header in a document. Consult the existing implementations in *an.tmac* when drafting replacements.

**.BT** Set the page footer text ("bottom trap").

**.PT** Set the page header text ("page trap").

If you want to remove a page header or footer entirely, define the appropriate macro as empty rather than deleting it.

## Deprecated features

Use of the following in man pages for public distribution is discouraged.

**.AT** [*system* [*release*]]

Alter the footer for use with legacy AT&T man pages, overriding any definition of the *footer-inside* argument to **.TH**. This macro exists only to render man pages from historical systems.

*system* can be any of the following.

3	7th edition ( <i>default</i> )
4	System III
5	System V

The optional *release* argument specifies the release number, as in "System V Release 3".

**.DT** Reset tab stops to the default (every 0.5i [inches]).

Use of this presentation-level macro is deprecated. It translates poorly to HTML, under which exact space control and tabulation are not readily available. Thus, information or distinctions that you use tab stops to express are likely to be lost. If you feel tempted to change the tab stops such that calling this macro later is desirable to restore them, you should probably be composing a table using *tbl(1)* instead.

**.HP** [*indentation*]

Set up a paragraph with a hanging left indentation. The *indentation* argument, if present, is handled as with **.TP**.

Use of this presentation-level macro is deprecated. A hanging indentation cannot be expressed naturally under HTML, and HTML-based man page processors may interpret it as starting an ordinary paragraph. Thus, any information or distinction you mean to express with the indentation may be lost.

**.OP** *option-name* [*option-argument*]

Indicate an optional command parameter called *option-name*, which is set in bold. If the option takes an argument, specify *option-argument* using a noun, abbreviation, or hyphenated noun phrase. If present, *option-argument* is preceded by a space and set in italics. Square brackets in roman surround both arguments.

Use of this quasi-semantic macro, an extension originating in Documenter's Workbench *troff*, is deprecated. It cannot easily be used to annotate options that take optional arguments or options whose arguments have internal structure (such as a mixture of literal and variable components). One could work around these limitations with font selection escape sequences, but it is preferable to use font style alternation macros, which afford greater flexibility.

**.PD** [*vertical-space*]

Define the vertical space between paragraphs or (sub)sections. The optional argument *vertical-space* specifies the amount; the default scaling unit is "v". Without an argument, the spacing is re-

set to its default value; see subsection “Horizontal and vertical spacing” above.

Use of this presentation-level macro is deprecated. It translates poorly to HTML, under which exact control of inter-paragraph spacing is not readily available. Thus, information or distinctions that you use **.PD** to express are likely to be lost.

#### **.UC** [*version*]

Alter the footer for use with legacy BSD man pages, overriding any definition of the *footer-inside* argument to **.TH**. This macro exists only to render man pages from historical systems.

*version* can be any of the following.

3	3rd Berkeley Distribution ( <i>default</i> )
4	4th Berkeley Distribution
5	4.2 Berkeley Distribution
6	4.3 Berkeley Distribution
7	4.4 Berkeley Distribution

#### **History**

Unix Version 7 (1979) introduced the *man* macro package and supported the macros listed in this page not described as extensions, except **.P**, **.SB**, and the deprecated **.AT** and **.UC**. The only strings defined were **R** and **S**; no registers were documented. **.UC** appeared in 3BSD (1980) and **.P** in Unix System III (1980). PWB/UNIX 2.0 (1980) added the **Tm** string. 4BSD (1980) added **lq** and **rq** strings. Documenter’s Workbench 1.0 (1984) exposed the **IN** and **LL** registers, which had been internal to Seventh Edition Unix *man*. 4.3BSD (1986) added **.AT** and **.P**. Ninth Edition Research Unix (1986) introduced **.EX** and **.EE**. SunOS 4.0 (1988) may have been the first to support **.SB**. *groff* 1.20 (2009) originated **.SY/.YS**, **.TQ**, **.MT/.ME**, and **.UR/.UE**. The plan9port project’s *troff* introduced **.MR** in 2020.

#### **Options**

The following *groff* options set registers (with **-r**) and strings (with **-d**) recognized and used by the *man* macro package. To ensure rendering consistent with output device capabilities and reader preferences, man pages should never manipulate them.

##### **-dAD=adjustment-mode**

Set line adjustment to *adjustment-mode*, which is typically “**b**” for adjustment to both margins (the default), or “**I**” for left alignment (ragged right margin). Any valid argument to *groff*’s “.ad” request may be used. See [groff\(7\)](#) for less-common choices.

##### **-rcR=1**

Enable continuous rendering. Output is not paginated; instead, one (potentially very long) page is produced. This is the default for terminal and HTML devices. Use **-rcR=0** to disable it.

**-rC1** Number output pages continuously, in strictly increasing sequence, rather than resetting the page number to 1 at each new *man* document.

##### **-rCS=1**

Capitalize section headings, setting section headings (the argument(s) to **.SH**) in full capitals. This transformation is off by default because it discards case distinction information.

##### **-rCT=1**

Capitalize titles, setting the man page title (the first argument to **.TH**) in full capitals in headers and footers. This transformation is off by default because it discards case distinction information.

**-rD1** Enable double-sided layout, formatting footers for even and odd pages differently; see the description of **.TH** in subsection “Document structure macros” above.

##### **-rFT=footer-distance**

Set distance of the footer relative to the bottom of the page to *footer-distance*; this amount is always negative. At twice this distance, the page text is broken before writing the footer. Ignored if continuous rendering is enabled. The default is  $-0.5i$ .

**-dHF=heading-font**

Set the font used for section and subsection headings; the default is “**B**” (bold style of the default family). Any valid argument to *groff*’s “.ft” request may be used. See *groff*(7).

**-rHY=0**

Disable automatic hyphenation. Normally, it is enabled using a mode appropriate to the *groff* locale; see section “Localization” of *groff*(7).

**-rIN=standard-indentation**

Set the amount of indentation used for ordinary paragraphs (**.P** and its synonyms) and the default indentation amount used by **.IP**, **.RS**, **.TP**, and the deprecated **.HP**. See subsection “Horizontal and vertical spacing” above for the default. For terminal devices, *standard-indentation* should always be an integer multiple of unit “n” to get consistent indentation.

**-rLL=line-length**

Set line length; the default is 78n for terminal devices and 6.5i for typesetter devices.

**-rLT=title-length**

Set the line length for titles. (“Titles” is the *roff* term for headers and footers.) By default, it is set to the line length (see **-rLL** above).

**-dMF=man-page-title-font**

Set the font used for man page titles named in **.TH** and **.MR** calls; the default is “**I**” (italic style of the default family). Any valid argument to *groff*’s “.ft” request may be used; see *groff*(7). If the **MF** string ends in “I”, it is assumed to be an oblique typeface, and italic corrections are applied before and after man page titles.

**-rPn** Start enumeration of pages at *n* rather than 1.

**-rStype=size**

Use *type-size* for the document’s body text; acceptable values are 10, 11, or 12 points. See subsection “Font style macros” above for the default.

**-rSN=subsection-indentation**

Set indentation of subsection headings to *subsection-indentation*. See subsection “Horizontal and vertical spacing” above for the default.

**-rUI** Enable generation of URI hyperlinks in the *grohtml* and *grotty* output drivers. *grohtml* enables them by default; *grotty* does not, pending more widespread pager support for OSC 8 escape sequences. Use **-rU0** to disable hyperlinks; this will make the arguments to **MT** and **UR** calls visible in the document text produced by link-capable drivers.

**-rXp** After page *p*, number pages as *pa*, *pb*, *pc*, and so forth. The register tracking the suffixed page letter uses format “a” (see the “.af” request in *groff*(7)). For example, the option **-rX2** produces the following page numbers: 1, 2, 2a, 2b, . . . , 2aa, 2ab, and so on.

## Files

*/usr/local/share/groff/1.23.0/tmac/an.tmac*

Most *man* macros are defined in this file. It also loads extensions from *an-ext.tmac* (see below).

*/usr/local/share/groff/1.23.0/tmac/andoc.tmac*

This brief *groff* program detects whether the *man* or *mdoc* macro package is being used by a document and loads the correct macro definitions, taking advantage of the fact that pages using them must call **.TH** or **.Dd**, respectively, as their first macro. A *man* program or user typing, for example, “**groff -mandoc page.1**”, need not know which package the file *page.1* uses. Multiple man pages, in either format, can be handled; *andoc* reloads each macro package as necessary.

*/usr/local/share/groff/1.23.0/tmac/an-ext.tmac*

Definitions of macros described above as extensions (**.SY/YS**, **.TQ**, **.EX/EE**, **.UR/UE**, **.MT/ME**, and **.MR**) are contained in this file; in some cases, they are simpler versions of definitions appearing in *an.tmac*, and are ignored if the formatter is GNU *troff*. They are written to be compatible with AT&T *troff* and permissively licensed—not copylefted. To reduce the risk of

name space collisions, string and register names begin only with “**m**”. Man page authors concerned about portability to legacy Unix systems are encouraged to copy these definitions into their pages, and maintainers of *troff* implementations or work-alike systems that format man pages are encouraged to re-use them.

The definitions for these macros are read after a page calls **.TH**, so they will replace any macros of the same names preceding it in your file. If you use your own implementations of these macros, they must be defined after **.TH** is called to have any effect. Furthermore, it is wise to define such page-local macros (if at all) after the “Name” section to accommodate timid *mandb* implementations that may give up their scan for indexing material early.

*/usr/local/share/groff/1.23.0/tmac/man.tmac*

This is a wrapper that loads *an.tmac*.

*/usr/local/share/groff/1.23.0/tmac/mandoc.tmac*

This is a wrapper that loads *andoc.tmac*.

*/usr/local/share/groff/site-tmac/man.local*

Put site-local changes and customizations into this file.

```
.\" Use narrower indentation on terminals and similar.
.if n .nr IN 4n
.\" Put only one space after the end of a sentence.
.ss 12 0 \" See groff(7).
.\" Keep pages narrow even on wide terminals.
.if n .if \n[LL]>78n .nr LL 78n
.\" Ensure hyperlinks are enabled for terminals.
.nr U 1
```

On multi-user systems, it is more considerate to users whose preferences may differ from the administrator’s to be less aggressive with such settings, or to permit their override with a user-specific *man.local* file. This can be achieved by placing one or both of following requests at the end of the site-local file.

```
.soquiet \V[XDG_CONFIG_HOME]/man.local
.soquiet \V[HOME]/.man.local
```

However, a security-sandboxed *man(1)* program may lack permission to open such files.

## Notes

Some tips on troubleshooting your man pages follow.

- Some ASCII characters look funny or copy and paste wrong.

On devices with large glyph repertoires, like UTF-8-capable terminals and PDF, several keyboard glyphs are mapped to code points outside the Unicode basic Latin range because that usually results in better typography in the general case. When documenting GNU/Linux command or C language syntax, however, this translation is sometimes not desirable.

To get a “literal”... ..should be input.

'	\(aq
-	\-
\	\(rs
^	\(ha
`	\(ga
~	\(ti

Additionally, if a neutral double quote (") is needed in a macro argument, you can use **\(dq** to get it. You should *not* use **\(aq** for an ordinary apostrophe (as in “can’t”) or **\-** for an ordinary hyphen (as in “word-aligned”). Review subsection “Portability” above.

- Do I ever need to use an empty macro argument (“”)?

Probably not. When this seems necessary, often a shorter or clearer alternative is available.

Instead of. . .	. . .should be considered.
<b>.TP</b> ""	<b>.TP</b>
<b>.BI</b> "" <i>italic-text bold-text</i>	<b>.IB</b> <i>italic-text bold-text</i>
<b>.TH</b> foo 1 "" "foo 1.2.3"	<b>.TH</b> foo 1 yyyy-mm-dd "foo 1.2.3"
<b>.IP</b> "" 4n	<b>.IP</b>
<b>.IP</b> "" 4n paragraph ... ...	<b>.RS</b> 4n <b>.P</b> paragraph <b>.RE</b>
<b>.B</b> one two "" three	<b>.B</b> one two three

In the title heading (**.TH**), the date of the page’s last revision is more important than packaging information; it should not be omitted. Ideally, a page maintainer will keep both up to date.

**.IP** is sometimes ill-understood and misused, especially when no marker argument is supplied—an indentation argument is not required. By setting an explicit indentation, you may be overriding the reader’s preference as set with the **-rIN** option. If your page renders adequately without one, use the simpler form. If you need to indent multiple (unmarked) paragraphs, consider setting an inset region with **.RS** and **.RE** instead.

In the last example, the empty argument does have a subtly different effect than its suggested replacement: the empty argument causes an additional space character to be interpolated between the arguments “two” and “three”—but it is a regular breaking space, so it can be discarded at the end of an output line. It is better not to be subtle, particularly with space, which can be overlooked in source and rendered forms.

- **.RS** doesn’t indent relative to my indented paragraph.

The **.RS** macro sets the left margin; that is, the position at which an *ordinary* paragraph (**.P** and its synonyms) will be set. **.IP**, **.TP**, and the deprecated **.HP** all use the same default indentation. If not given an argument, **.RS** moves the left margin by this same amount. To create an inset relative to an indented paragraph, call **.RS** repeatedly until an acceptable indentation is achieved, or give **.RS** an indentation argument that is at least as much as the paragraph’s indentation amount relative to an adjacent **.P** paragraph. See subsection “Horizontal and vertical spacing” above for the values.

Another approach you can use with tagged paragraphs is to place an **.RS** call immediately after the paragraph tag; this will also force a break regardless of the width of the tag, which some authors prefer. Follow-up paragraphs under the tag can then be set with **.P** instead of **.IP**. Remember to use **.RE** to end the indented region before starting the next tagged paragraph (at the appropriate nesting level).

- **.RE** doesn’t move the inset back to the expected level.
- warning: scaling unit invalid in context
- warning: register 'an-saved-marginn' not defined
- warning: register 'an-saved-prevailing-indentn' not defined

The **.RS** macro takes an *indentation amount* as an argument; the **.RE** macro’s argument is a specific *inset level*. **.RE 1** goes to the level before any **.RS** macros were called, **.RE 2** goes to the level of the first **.RS** call you made, and so forth. If you desire symmetry in your macro calls, simply issue one **.RE** without an argument for each **.RS** that precedes it.

After calls to the **.SH** and **.SS** sectioning macros, all relative insets are cleared and calls to **.RE** have no effect until **.RS** is used again.

- Do I need to keep typing the indentation in a series of **.IP** calls?  
Not if you don’t want to change it. Review subsection “Horizontal and vertical spacing” above.

Instead of...	...should be considered.
<code>.IP \ (bu 4n</code> <i>paragraph</i>	<code>.IP \ (bu 4n</code> <i>paragraph</i>
<code>.IP \ (bu 4n</code> <i>another-paragraph</i>	<code>.IP \ (bu</code> <i>another-paragraph</i>

- Why doesn't the package provide a string to insert an ellipsis?

Examples of ellipsis usage are shown above, in subsection “Command synopsis macros”. The idiomatic *roff* ellipsis is three dots (periods) with thin space escape sequences `\|` internally separating them. Since dots both begin control lines and are candidate end-of-sentence characters, however, it is sometimes necessary to prefix and/or suffix an ellipsis with the non-printing input break escape sequence `\&`. That fact stands even if a string is defined to contain the sequence; moreover, if the string included the input breaks, end-of-sentence detection would be defeated in the event you used such a string at the end of an actual sentence. (Ending a sentence thus is often poor style, but not always.) A hypothetical string `EL` that contained an ellipsis, but not the trailing input break, would then need to be suffixed with `\&` when not ending a sentence.

Instead of...	...do this.
<code>.ds EL \&amp;.\ .\ .</code>	<b>Arguments are</b>
<b>Arguments are</b>	<code>.IR src-file\~ \ .\ .\&amp;</code>
<code>.IR src-file\~ \*(EL\&amp;</code>	<code>.IR dest-dir .</code>
<code>.IR dest-dir .</code>	

The first column practices a false economy; the savings in typing is offset by the cost of obscuring even the suggestion of an ellipsis to a casual reader of the source document, and reduced portability to non-*roff* man page formatters that cannot handle string definitions.

There is an ellipsis code point in Unicode, and some fonts have an ellipsis glyph, which some man pages have accessed in a non-portable way with the font-dependent `\N` escape sequence. We discourage the use of these; they usually crowd the dots into a single character cell, and will not render at all if the output device doesn't have the glyph. In syntax synopses, missing ellipses can cause great confusion. Dots and space are universally supported.

## Authors

M. Douglas McIlroy <m.douglas.mcilroy@dartmouth.edu> designed, implemented, and documented the AT&T *man* macros, employing them to edit the first volume of the Seventh Edition Unix manual, a compilation of all man pages supplied by the system.

The GNU version of the *man* macro package was written by James Clark; he added the **C**, **D**, **P**, and **X** registers. Werner Lemberg <wl@gnu.org> supplied the **S** and **cR** registers. Larry Kollar <kollar@alltel.net> added the **FT**, **HY**, and **SN** registers; the **HF** string; and the **PT** and **BT** macros. G. Branden Robinson <g.branden.robinson@gmail.com> implemented the **AD** and **MF** strings; **CS**, **CT**, and **U** registers; and the **MR** macro. The extension macros were written by Lemberg, Eric S. Raymond <esr@thyrsus.com>, and Robinson.

This document was originally written for the Debian GNU/Linux system by Susan G. Kleinmann <sgk@debian.org>. It was corrected and updated by Lemberg and Robinson. The extension macros were documented by Raymond and Robinson. Raymond also originated the portability section, to which Ingo Schwarze <schwarze@usta.de> contributed most of the material on escape sequences.

## See also

[tbl\(1\)](#), [eqn\(1\)](#), and [refer\(1\)](#) are preprocessors used with man pages.

[man\(1\)](#) describes the man page librarian on your system.

[groff\\_mdoc\(7\)](#) describes the *groff* version of the BSD-originated alternative macro package for man pages.

[groff\\_man\(7\)](#), [groff\(7\)](#), [groff\\_char\(7\)](#), [man\(7\)](#)

**Name**

**groff\_mdoc** — compose BSD-style manual (man) pages with GNU roff

**Synopsis**

**groff -mdoc** *file* . . .

**Description**

The GNU implementation of the **mdoc** macro package is part of the **groff** document formatting system. **mdoc** is a *content*-based and *domain*-based formatting package designed for writing UNIX manual pages with `troff(1)`. Its predecessor, the `man(7)` package, addressed page layout leaving the manipulation of fonts and other typesetting details to the individual author. In **mdoc**, page layout macros make up the *page structure domain* which consists of macros for titles, section headers, displays, and lists—essentially items which affect the physical position of text on a formatted page. In addition to the page structure domain, there are two more domains, the *manual* domain and the *general* text domain. The general text domain is defined as macros which perform tasks such as quoting or emphasizing pieces of text. The manual domain is defined as macros that are a subset of the day to day informal language used to describe commands, routines and related UNIX files. Macros in the manual domain handle command names, command-line arguments and options, function names, function parameters, pathnames, variables, cross references to other manual pages, and so on. These domain items have value for both the author and the future user of the manual page. Hopefully, the consistency gained across the manual set will provide easier translation to future documentation tools.

Throughout the UNIX manual pages, a manual entry is simply referred to as a man page, regardless of actual length and without sexist intention.

**Getting started**

The material presented in the remainder of this document is outlined as follows:

1. troff idiosyncrasies
  - Macro Usage
  - Passing Space Characters in an Argument
  - Trailing Blank Space Characters
  - Escaping Special Characters
  - Other Possible Pitfalls
2. A manual page template
3. Conventions
4. Title macros
5. Introduction of manual and general text domains
  - What's in a Name . . .
  - General Syntax
6. Manual domain
  - Addresses
  - Author Name
  - Arguments
  - Configuration Declarations (Section Four Only)
  - Command Modifiers
  - Defined Variables
  - Errnos

- Environment Variables
  - Flags
  - Function Declarations
  - Function Types
  - Functions (Library Routines)
  - Function Arguments
  - Return Values
  - Exit Status
  - Interactive Commands
  - Library Names
  - Literals
  - Names
  - Options
  - Pathnames
  - Standards
  - Variable Types
  - Variables
  - Manual Page Cross References
7. General text domain
    - AT&T Macro
    - BSD Macro
    - NetBSD Macro
    - FreeBSD Macro
    - DragonFly Macro
    - OpenBSD Macro
    - BSD/OS Macro
    - UNIX Macro
    - Emphasis Macro
    - Font Mode
    - Enclosure and Quoting Macros
    - No-Op or Normal Text Macro
    - No-Space Macro
    - Section Cross References
    - Symbolics
    - Mathematical Symbols
    - References and Citations
    - Trade Names (or Acronyms and Type Names)
    - Extended Arguments
  8. Page structure domain
    - Section Headers
    - Subsection Headers
    - Paragraphs and Line Spacing
    - Keeps
    - Examples and Displays
    - Lists and Columns
  9. Miscellaneous macros
  10. Predefined strings

11. Diagnostics
12. Formatting with groff, troff, and nroff
13. Files
14. See also
15. Bugs

### troff idiosyncrasies

The **mdoc** package attempts to simplify the process of writing a man page. Theoretically, one should not have to learn the tricky details of GNU `troff(1)` to use **mdoc**; however, there are a few limitations which are unavoidable and best gotten out of the way. And, too, be forewarned, this package is *not* fast.

### Macro Usage

As in GNU `troff`, a macro is called by placing a `.` (dot character) at the beginning of a line followed by the two-character (or three-character) name for the macro. There can be space or tab characters between the dot and the macro name. Arguments may follow the macro separated by spaces (but *no* tabs). It is the dot character at the beginning of the line which causes GNU `troff` to interpret the next two (or more) characters as a macro name. A single starting dot followed by nothing is ignored. To place a `.` (dot character) at the beginning of an input line in some context other than a macro invocation, precede the `.` (dot) with the `\&` escape sequence which causes a non-printing input break, and is never displayed in the output.

In general, GNU `troff` macros accept an unlimited number of arguments (contrary to other versions of `troff` which can't handle more than nine arguments). In limited cases, arguments may be continued or extended on the next line (See **Extended Arguments** below). Almost all macros handle quoted arguments (see **Passing Space Characters in an Argument** below).

Most of the **mdoc** general text domain and manual domain macros are special in that their argument lists are *parsed* for callable macro names. This means an argument on the argument list which matches a general text or manual domain macro name (and which is defined to be callable) will be executed or called when it is processed. In this case the argument, although the name of a macro, is not preceded by a `.` (dot). This makes it possible to nest macros; for example the option macro, `.Op`, may *call* the flag and argument macros, `'Fl'` and `'Ar'`, to specify an optional flag with an argument:

```
[ -s bytes ] is produced by .Op Fl s Ar bytes
```

To prevent a string from being interpreted as a macro name, precede the string with the escape sequence `\&`:

```
[ Fl s Ar bytes ] is produced by .Op \&Fl s \&Ar bytes
```

Here the strings `'Fl'` and `'Ar'` are not interpreted as macros. Macros whose argument lists are parsed for callable arguments are referred to as *parsed* and macros which may be called from an argument list are referred to as *callable* throughout this document. This is a technical *faux pas* as almost all of the macros in **mdoc** are parsed, but as it was cumbersome to constantly refer to macros as being callable and being able to call other macros, the term *parsed* has been used.

In the following, we call an **mdoc** macro which starts a line (with a leading dot) a *command* if this distinction is necessary.

### Passing Space Characters in an Argument

Sometimes it is desirable to give as an argument a string containing one or more blank space characters, say, to specify arguments to commands which expect particular arrangement of items in the argument list. Additionally, it makes **mdoc** work faster. For example, the function command `.Fn` expects the first argument to be the name of a function and any remaining arguments to be function parameters. As ANSI C stipulates the

declaration of function parameters in the parenthesized parameter list, each parameter is guaranteed to be at minimum a two word string. For example, *int foo*.

There are two possible ways to pass an argument which contains an embedded space. One way of passing a string containing blank spaces is to use the hard or unpaddable space character ‘\ ’, that is, a blank space preceded by the escape character ‘\’. This method may be used with any macro but has the side effect of interfering with the adjustment of text over the length of a line. `troff` sees the hard space as if it were any other printable character and cannot split the string into blank or newline separated pieces as one would expect. This method is useful for strings which are not expected to overlap a line boundary. An alternative is to use ‘\~’, a paddable (i.e., stretchable), unbreakable space (this is a GNU `troff` extension). The second method is to enclose the string with double quotes.

For example:

```
fetch(char *str) is created by .Fn fetch char\ *str
```

```
fetch(char *str) can also be created by .Fn fetch "char *str"
```

If the ‘\’ before the space in the first example or double quotes in the second example were omitted, `.Fn` would see three arguments, and the result would be:

```
fetch(char, *str)
```

### Trailing Blank Space Characters

`troff` can be confused by blank space characters at the end of a line. It is a wise preventive measure to globally remove all blank spaces from ⟨blank-space⟩⟨end-of-line⟩ character sequences. Should the need arise to use a blank character at the end of a line, it may be forced with an unpaddable space and the ‘\&’ escape character. For example, *string\ \&*.

### Escaping Special Characters

Special characters like the newline character ‘\n’ are handled by replacing the ‘\’ with ‘\e’ (e.g. *\en*) to preserve the backslash.

### Other Possible Pitfalls

A warning is emitted when an empty input line is found outside of displays (see below). Use `.sp` instead. (It is even better to use `mdoc` macros to avoid the usage of low-level commands.)

Leading spaces will cause a break and are output directly. Avoid this behaviour if possible. Similarly, do not use more than one space character between words in an ordinary text line; contrary to other text formatters, they are *not* replaced with a single space.

You can’t pass “” directly as an argument. Use `\[dq]` instead.

By default, `troff` inserts two space characters after a punctuation mark ending a sentence; characters like ‘)’ or ‘.’ are treated transparently, not influencing the sentence-ending behaviour. To change this, insert ‘\&’ before or after the dot:

```
The
.Ql .
character.
.Pp
The
.Ql \&.
character.
.Pp
.No test .
test
```

```
.Pp
.No test.
test
```

gives

The ‘.’ character

The ‘.’ character.

test. test

test. test

As can be seen in the first and third line, **mdoc** handles punctuation characters specially in macro arguments. This will be explained in section **General Syntax** below. In the same way, you have to protect trailing full stops of abbreviations with a trailing non-printing input break: e.g. \&.

A comment in the source file of a man page can be either started with `.\` on a single line, `\'` after some input, or `\'#` anywhere (the last is a GNU `troff` extension); the rest of such a line is ignored.

### A manual page template

The body of a man page is easily constructed from a basic template:

```
.\ The following commands are required for all man pages.
.Dd date
.Dt document-title [section number] [architecture/volume]
.Os [package or operating system] [version/release]
.Sh Name
.Nm name
.Nd one line description of name
.\ This next command is for sections 2 and 3 only.
.\ .Sh Library
.Sh Synopsis
.Sh Description
.\ The following commands should be uncommented and
.\ used where appropriate.
.\ .Sh Implementation notes
.\ This next command is for sections 2, 3, and 9 only
.\ (function return values).
.\ .Sh Return values
.\ This next command is for sections 1, 6, 7, and 8 only.
.\ .Sh Environment
.\ .Sh Files
.\ This next command is for sections 1, 6, and 8 only
.\ (command return values to the shell).
.\ .Sh Exit status
.\ .Sh Examples
.\ This next command is for sections 1, 4, 6, 7, 8, and 9 only
.\ (fprintf/stderr type diagnostics).
.\ .Sh Diagnostics
.\ .Sh Compatibility
.\ This next command is for sections 2, 3, 4, and 9 only
.\ (settings of the errno variable).
.\ .Sh Errors
.\ .Sh See also
```

```

.\ " .Sh Standards
.\ " .Sh History
.\ " .Sh Authors
.\ " .Sh Caveats
.\ " .Sh Bugs

```

The first items in the template are the commands `.Dd`, `.Dt`, and `.Os`; the document date, the document title and section of the manual the page belongs in, and either the project or package supplying the page or the operating system it is developed or modified for. These commands identify the page and are discussed below in **Title macros**.

The remaining items in the template are section headers (`.Sh`); of which *Name*, *Synopsis*, and *Description* are mandatory. The headers are discussed in **Page structure domain**, after presentation of **Manual domain**. Several content macros are used to demonstrate page layout macros; reading about content macros before page layout macros is recommended.

### Conventions

In the description of all macros below, optional arguments are put into brackets. An ellipsis (`...`) represents zero or more additional arguments. Alternative values for a parameter are separated with `|`. If there are alternative values for a mandatory parameter, braces are used (together with `|`) to enclose the value set. Meta-variables are specified within angles.

Example:

```

.\xx <foo> {bar1 | bar2} [-test1 [-test2 | -test3]] ...

```

Except where explicitly stated, all macros are parsed and callable.

Note that a macro takes effect up to the next nested macro. For example, `.Ic foo Aq bar` doesn't produce `'foo <bar>'` but rather `'foo <bar>'`. Consequently, a warning message is emitted for most commands if the first argument is a macro itself since it cancels the effect of the calling command completely. `'foo <bar>'` is produced by `.Ic "foo <bar>"`.

Most macros have a default width value which can be used to specify a label width (`-width`) or offset (`-offset`) for the `.Bl` and `.Bd` macros. It is recommended not to use this rather obscure feature to avoid dependencies on local modifications of the **mdoc** package.

### Title macros

The title macros are part of the page structure domain but are presented first and separately for someone who wishes to start writing a man page yesterday. Three header macros designate the document title or manual page title, the operating system, and the date of authorship. These macros are called once at the very beginning of the document and are used to construct headers and footers only.

```

.Dt [<document title>] [<section number>] [<volume>]

```

The document title is the subject of the man page. If omitted, `'UNTITLED'` is used. The section number may be a number in the range 1, ..., 9 or `unass`, `draft`, or `paper`. If it is specified, and no volume name is given, a default volume name is used.

In this implementation, the following sections are defined:

- 1 BSD General Commands Manual
- 2 BSD System Calls Manual
- 3 BSD Library Functions Manual
- 4 BSD Kernel Interfaces Manual
- 5 BSD File Formats Manual
- 6 BSD Games Manual

- 7 BSD Miscellaneous Information Manual
- 8 BSD System Manager's Manual
- 9 BSD Kernel Developer's Manual

A volume name may be arbitrary or one of the following:

USD	User's Supplementary Documents
PS1	Programmer's Supplementary Documents
AMD	Ancestral Manual Documents
SMM	System Manager's Manual
URM	User's Reference Manual
PRM	Programmer's Manual
KM	Kernel Manual
IND	Manual Master Index
LOCAL	Local Manual
CON	Contributed Software Manual

For compatibility, `MMI` can be used for `IND`, and `LOC` for `LOCAL`. Values from the previous table will specify a new volume name. If the third parameter is a keyword designating a computer architecture, its value is prepended to the default volume name as specified by the second parameter. By default, the following architecture keywords are defined:

```
acorn26, acorn32, algor, alpha, amd64, amiga, amigappc, arc, arm, arm26, arm32, armish,
atari, aviion, beagle, bebox, cats, cesfic, cobalt, dreamcast, emips, evbarm, evbmips, evbppc,
evbsh3, ews4800mips, hp300, hp700, hpcarm, hpcmips, hpcsh, hppa, hppa64, i386, ia64,
ibmnws, iyonix, landisk, loongson, luna68k, luna88k, m68k, mac68k, macppc, mips,
mips64, mipsco, mmeye, mvme68k, mvme88k, mvmeppc, netwinder, news68k, newsmips,
next68k, ofppc, palm, pc532, playstation2, pmax, pmppc, powerpc, prep, rs6000, sandpoint,
sbmips, sgi, sgimips, sh3, shark, socppc, solbourne, sparc, sparc64, sun2, sun3, tahoe, vax,
x68k, x86_64, xen, zaurus
```

If the section number is neither a numeric expression in the range 1 to 9 nor one of the above described keywords, the third parameter is used verbatim as the volume name.

In the following examples, the left (which is identical to the right) and the middle part of the manual page header strings are shown. Note how `\&` prevents the digit 7 from being a valid numeric expression.

```
.Dt FOO 7          FOO(7) BSD Miscellaneous Information Manual
.Dt FOO 7 bar     FOO(7) BSD Miscellaneous Information Manual
.Dt FOO \&7 bar
                FOO(7) bar
.Dt FOO 2 i386   FOO(2) BSD/i386 System Calls Manual
.Dt FOO " " bar FOO bar
```

Local, OS-specific additions might be found in the file `mdoc.local`; look for strings named `volume-ds-XXX` (for the former type) and `volume-as-XXX` (for the latter type); `XXX` then denotes the keyword to be used with the `.Dt` macro.

This macro is neither callable nor parsed.

`.Os` [`<operating system or package name>`] [`<version or release>`]

This is the mandatory third macro of every `mdoc(7)` document. In man pages supplied by the base installation of an operating system, do not provide an argument. A portable software package maintaining its own man pages can supply its name and version number or release identifier as optional arguments. If the first parameter is empty, the default 'BSD' is used. This default may be overridden in the local configuration file, `mdoc.local`. Historically, the name of the operating system

was one of the common initialisms BSD or ATT. The release should be the standard release nomenclature for the system specified. In the following table, possible second arguments for some predefined operating systems are listed. Similarly to `.Dt`, local additions might be defined in `mdoc.local`; look for strings named `operating-system-XXX-YYY`, where `XXX` is the acronym for the operating system and `YYY` the release ID.

ATT	7th, 7, III, 3, V, V.2, V.3, V.4
BSD	3, 4, 4.1, 4.2, 4.3, 4.3t, 4.3T, 4.3r, 4.3R, 4.4
NetBSD	0.8, 0.8a, 0.9, 0.9a, 1.0, 1.0a, 1.1, 1.2, 1.2a, 1.2b, 1.2c, 1.2d, 1.2e, 1.3, 1.3a, 1.4, 1.4.1, 1.4.2, 1.4.3, 1.5, 1.5.1, 1.5.2, 1.5.3, 1.6, 1.6.1, 1.6.2, 1.6.3, 2.0, 2.0.1, 2.0.2, 2.0.3, 2.1, 3.0, 3.0.1, 3.0.2, 3.0.3, 3.1, 3.1.1, 4.0, 4.0.1, 5.0, 5.0.1, 5.0.2, 5.1, 5.1.2, 5.1.3, 5.1.4, 5.2, 5.2.1, 5.2.2, 6.0, 6.0.1, 6.0.2, 6.0.3, 6.0.4, 6.0.5, 6.0.6, 6.1, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.5, 7.0, 7.0.1, 7.0.2, 7.1, 7.1.1, 7.1.2, 7.2, 8.0, 8.1
FreeBSD	1.0, 1.1, 1.1.5, 1.1.5.1, 2.0, 2.0.5, 2.1, 2.1.5, 2.1.6, 2.1.7, 2.2, 2.2.1, 2.2.2, 2.2.5, 2.2.6, 2.2.7, 2.2.8, 2.2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 4.0, 4.1, 4.1.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.6.2, 4.7, 4.8, 4.9, 4.10, 4.11, 5.0, 5.1, 5.2, 5.2.1, 5.3, 5.4, 5.5, 6.0, 6.1, 6.2, 6.3, 6.4, 7.0, 7.1, 7.2, 7.3, 7.4, 8.0, 8.1, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 9.3, 10.0, 10.1, 10.2, 10.3, 10.4, 11.0, 11.1, 11.2, 11.3, 12.0, 12.1
OpenBSD	2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6
DragonFly	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.8.1, 1.9, 1.10, 1.11, 1.12, 1.12.2, 1.13, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.9.1, 2.10, 2.10.1, 2.11, 2.12, 2.13, 3.0, 3.0.1, 3.0.2, 3.1, 3.2, 3.2.1, 3.2.2, 3.3, 3.4, 3.4.1, 3.4.2, 3.4.3, 3.5, 3.6, 3.6.1, 3.6.2, 3.7, 3.8, 3.8.1, 3.8.2, 4.0, 4.0.1, 4.0.2, 4.0.3, 4.0.4, 4.0.5, 4.0.6, 4.1, 4.2, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.3, 4.4, 4.4.1, 4.4.2, 4.4.3, 4.5, 4.6, 4.6.1, 4.6.2, 4.7, 4.8, 4.8.1, 4.9, 5.0, 5.0.1, 5.0.2, 5.1, 5.2, 5.2.1, 5.2.2, 5.3, 5.4, 5.4.1, 5.4.2, 5.4.3, 5.5, 5.6, 5.6.1, 5.6.2
Darwin	8.0.0, 8.1.0, 8.2.0, 8.3.0, 8.4.0, 8.5.0, 8.6.0, 8.7.0, 8.8.0, 8.9.0, 8.10.0, 8.11.0, 9.0.0, 9.1.0, 9.2.0, 9.3.0, 9.4.0, 9.5.0, 9.6.0, 9.7.0, 9.8.0, 10.0.0, 10.1.0, 10.2.0, 10.3.0, 10.4.0, 10.5.0, 10.6.0, 10.7.0, 10.8.0, 11.0.0, 11.1.0, 11.2.0, 11.3.0, 11.4.0, 11.5.0, 12.0.0, 12.1.0, 12.2.0, 13.0.0, 13.1.0, 13.2.0, 13.3.0, 13.4.0, 14.0.0, 14.1.0, 14.2.0, 14.3.0, 14.4.0, 14.5.0, 15.0.0, 15.1.0, 15.2.0, 15.3.0, 15.4.0, 15.5.0, 15.6.0, 16.0.0, 16.1.0, 16.2.0, 16.3.0, 16.4.0, 16.5.0, 16.6.0, 17.0.0, 17.1.0, 17.2.0, 17.3.0, 17.4.0, 17.5.0, 17.6.0, 17.7.0, 18.0.0, 18.1.0, 18.2.0, 18.3.0, 18.4.0, 18.5.0, 18.6.0, 18.7.0, 19.0.0, 19.1.0, 19.2.0

For ATT, an unknown second parameter will be replaced with the string UNIX; for the other predefined acronyms it will be ignored and a warning message emitted. Unrecognized arguments are displayed as given in the page footer. For instance, a typical footer might be:

```
.Os BSD 4.3
```

giving 4.3 Berkeley Distribution, or for a locally produced set

```
.Os CS Department
```

which will produce CS Department.

If the `.Os` macro is not present, the bottom left corner of the manual page will be ugly.

This macro is neither callable nor parsed.

```
.Dd <Month> <day>, <year>
```

The document date for display in the page footer. This is the mandatory first macro of any **mdoc** manual. The <Month> is the full English month name, the <day> is an integer number without a leading zero, and the <year> is the full four-digit year, for example:

```
.Dd January 25, 2001
```

The arguments are concatenated, separated with space characters, even if they do not match the recommended format.

As a special exception, the format

```
.Dd $Mdocdate: <Month> <day> <year> $
```

is also recognized. It is used in OpenBSD manuals to automatically insert the current date when committing.

This macro is neither callable nor parsed.

## Introduction of manual and general text domains

### What's in a Name...

The manual domain macro names are derived from the day to day informal language used to describe commands, subroutines and related files. Slightly different variations of this language are used to describe the three different aspects of writing a man page. First, there is the description of **mdoc** macro command usage. Second is the description of a UNIX command *with* **mdoc** macros, and third, the description of a command to a user in the verbal sense; that is, discussion of a command in the text of a man page.

In the first case, **troff** macros are themselves a type of command; the general syntax for a **troff** command is:

```
.Xx argument1 argument2 ...
```

**.Xx** is a macro command, and anything following it are arguments to be processed. In the second case, the description of a UNIX command using the content macros is a bit more involved; a typical **Synopsis** command line might be displayed as:

```
filter [ -flag ] <infile> <outfile>
```

Here, **filter** is the command name and the bracketed string **-flag** is a *flag* argument designated as optional by the option brackets. In **mdoc** terms, <infile> and <outfile> are called *meta arguments*; in this example, the user has to replace the meta expressions given in angle brackets with real file names. Note that in this document meta arguments are used to describe **mdoc** commands; in most man pages, meta variables are not specifically written with angle brackets. The macros which formatted the above example:

```
.Nm filter
.Op Fl flag
.Ao Ar infile Ac Ao Ar outfile Ac
```

In the third case, discussion of commands and command syntax includes both examples above, but may add more detail. The arguments <infile> and <outfile> from the example above might be referred to as *operands* or *file arguments*. Some command-line argument lists are quite long:

```
make [ -eikngrstv ] [ -D variable ] [ -d flags ] [ -f makefile ] [ -I directory ]
[ -j max_jobs ] [ variable=value ] [ target ... ]
```

Here one might talk about the command **make** and qualify the argument, *makefile*, as an argument to the flag, **-f**, or discuss the optional file operand *target*. In the verbal context, such detail can prevent confusion, however the **mdoc** package does not have a macro for an argument *to* a flag. Instead the 'Ar' argument

macro is used for an operand or file argument like *target* as well as an argument to a flag like *variable*. The make command line was produced from:

```
.Nm make
.Op Fl eiknqrstv
.Op Fl D Ar variable
.Op Fl d Ar flags
.Op Fl f Ar makefile
.Op Fl I Ar directory
.Op Fl j Ar max_jobs
.Op Ar variable Ns = Ns Ar value
.Bk
.Op Ar target ...
.Ek
```

The `.Bk` and `.Ek` macros are explained in **Keeps**.

### General Syntax

The manual domain and general text domain macros share a similar syntax with a few minor deviations; most notably, `.Ar`, `.Fl`, `.Nm`, and `.Pa` differ only when called without arguments; and `.Fn` and `.Xr` impose an order on their argument lists. All content macros are capable of recognizing and properly handling punctuation, provided each punctuation character is separated by a leading space. If a command is given:

```
.Ar sptr, ptr),
```

The result is:

```
sptr, ptr),
```

The punctuation is not recognized and all is output in the font used by `.Ar`. If the punctuation is separated by a leading white space:

```
.Ar sptr , ptr ) ,
```

The result is:

```
sptr, ptr),
```

The punctuation is now recognized and output in the default font distinguishing it from the argument strings. To remove the special meaning from a punctuation character, escape it with `'\&'`.

The following punctuation characters are recognized by **mdoc**:

```
·      ,      :      ;      (
)      [      ]      ?      !
```

`troff` is limited as a macro language, and has difficulty when presented with a string containing certain mathematical, logical, or quotation character sequences:

```
{+, -, /, *, %, <, >, <=, >=, =, ==, &, `', ', " }
```

The problem is that `troff` may assume it is supposed to actually perform the operation or evaluation suggested by the characters. To prevent the accidental evaluation of these characters, escape them with `'\&'`. Typical syntax is shown in the first content macro displayed below, `.Ad`.

### Manual domain

#### Addresses

The address macro identifies an address construct.

Usage: `.Ad <address> ...`

```
.Ad addr1          addr1
.Ad addr1 .        addr1.
.Ad addr1 , file2  addr1,file2
.Ad f1 , f2 , f3 : f1,f2,f3:
.Ad addr ) ) ,    addr)),
```

The default width is 12n.

### Author Name

The `.An` macro is used to specify the name of the author of the item being documented, or the name of the author of the actual manual page.

Usage: `.An <author name> ...`

```
.An "Joe Author"      Joe Author
.An "Joe Author" ,    Joe Author,
.An "Joe Author" Aq nobody@FreeBSD.org
                      Joe Author <nobody@FreeBSD.org>
.An "Joe Author" ) ) , Joe Author)),
```

The default width is 12n.

In the *Authors* section, the `.An` command causes a line break allowing each new name to appear on its own line. If this is not desirable,

```
.An -nosplit
```

call will turn this off. To turn splitting back on, write

```
.An -split
```

### Arguments

The `.Ar` argument macro may be used whenever an argument is referenced. If called without arguments, the `'file ...'` string is output.

Usage: `.Ar [<argument>] ...`

```
.Ar          file ...
.Ar file1    file1
.Ar file1 .   file1.
.Ar file1 file2 file1 file2
.Ar f1 f2 f3 : f1 f2 f3:
.Ar file ) ) , file)),
```

The default width is 12n.

### Configuration Declaration (Section Four Only)

The `.Cd` macro is used to demonstrate a `config(8)` declaration for a device interface in a section four manual.

Usage: `.Cd <argument> ...`

```
.Cd "device le0 at scode?" device le0 at scode?
```

In the **Synopsis** section a `.Cd` command causes a line break before and after its arguments are printed.

The default width is 12n.

### Command Modifiers

The command modifier is identical to the `.Fl` (flag) command with the exception that the `.Cm` macro does not assert a dash in front of every argument. Traditionally flags are marked by the preceding dash, however, some commands or subsets of commands do not use them. Command modifiers may also be specified in conjunction with interactive commands such as editor commands. See **Flags**.

The default width is 10n.

### Defined Variables

A variable (or constant) which is defined in an include file is specified by the macro `.Dv`.

```
Usage: .Dv <defined-variable> ...

.Dv MAXHOSTNAMELEN MAXHOSTNAMELEN
.Dv TIOCGPGRP ) TIOCGPGRP)
```

The default width is 12n.

### Errnos

The `.Er` `errno` macro specifies the error return value for section 2, 3, and 9 library routines. The second example below shows `.Er` used with the `.Bq` general text domain macro, as it would be used in a section two manual page.

```
Usage: .Er <errno type> ...

.Er ENOENT ENOENT
.Er ENOENT ) ; ENOENT);
.Bq Er ENOTDIR [ENOTDIR]
```

The default width is 17n.

### Environment Variables

The `.Ev` macro specifies an environment variable.

```
Usage: .Ev <argument> ...

.Ev DISPLAY DISPLAY
.Ev PATH . PATH.
.Ev PRINTER ) ) , PRINTER)),
```

The default width is 15n.

### Flags

The `.Fl` macro handles command-line flags. It prepends a dash, ‘-’, to the flag. For interactive command flags, which are not prepended with a dash, the `.Cm` (command modifier) macro is identical, but without the dash.

```
Usage: .Fl <argument> ...

.Fl -
.Fl cfv -cfv
.Fl cfv . -cfv.
```

```
.Cm cfv .      cfv.
.Fl s v t     -s -v -t
.Fl - ,       --,
.Fl xyz ) ,   -xyz),
.Fl |         - |
```

The `.Fl` macro without any arguments results in a dash representing stdin/stdout. Note that giving `.Fl` a single dash will result in two dashes.

The default width is 12n.

### Function Declarations

The `.Fd` macro is used in the **Synopsis** section with section two or three functions. It is neither callable nor parsed.

Usage: `.Fd <argument> ...`

```
.Fd "#include <sys/types.h>" #include <sys/types.h>
```

In the **Synopsis** section a `.Fd` command causes a line break if a function has already been presented and a break has not occurred. This leaves a nice vertical space in between the previous function call and the declaration for the next function.

The `.In` macro, while in the **Synopsis** section, represents the `#include` statement, and is the short form of the above example. It specifies the C header file as being included in a C program. It also causes a line break.

While not in the **Synopsis** section, it represents the header file enclosed in angle brackets.

Usage: `.In <header file>`

```
.In stdio.h <stdio.h>
.In stdio.h <stdio.h>
```

### Function Types

This macro is intended for the **Synopsis** section. It may be used anywhere else in the man page without problems, but its main purpose is to present the function type in kernel normal form for the **Synopsis** of sections two and three (it causes a line break, allowing the function name to appear on the next line).

Usage: `.Ft <type> ...`

```
.Ft struct stat struct stat
```

### Functions (Library Routines)

The `.Fn` macro is modeled on ANSI C conventions.

Usage: `.Fn <function> [<parameter>] ...`

```
.Fn getchar                getchar()
.Fn strlen ) ,            strlen(),
.Fn align "char *ptr" , align(char *ptr),
```

Note that any call to another macro signals the end of the `.Fn` call (it will insert a closing parenthesis at that point).

For functions with many parameters (which is rare), the macros `.Fo` (function open) and `.Fc` (function close) may be used with `.Fa` (function argument).

Example:

```
.Ft int
.Fo res_mkquery
.Fa "int op"
.Fa "char *dname"
.Fa "int class"
.Fa "int type"
.Fa "char *data"
.Fa "int datalen"
.Fa "struct rrec *newrr"
.Fa "char *buf"
.Fa "int buflen"
.Fc
```

Produces:

```
int res_mkquery(int op, char *dname, int class, int type, char *data,
int datalen, struct rrec *newrr, char *buf, int buflen)
```

In the **Synopsis** section, the function will always begin at the beginning of line. If there is more than one function presented in the **Synopsis** section and a function type has not been given, a line break will occur, leaving a nice vertical space between the current function name and the one prior.

The default width values of `.Fn` and `.Fo` are 12n and 16n, respectively.

### Function Arguments

The `.Fa` macro is used to refer to function arguments (parameters) outside of the **Synopsis** section of the manual or inside the **Synopsis** section if the enclosure macros `.Fo` and `.Fc` instead of `.Fn` are used. `.Fa` may also be used to refer to structure members.

```
Usage: .Fa <function argument> ...

.Fa d_namlen ) ) , d_namlen)),
.Fa iov_len      iov_len
```

The default width is 12n.

### Return Values

The `.Rv` macro generates text for use in the **Return values** section.

```
Usage: .Rv [-std] [<function> ...]
```

For example, `.Rv -std atexit` produces:

```
The atexit() function returns the value 0 if successful; otherwise the value -1 is returned and the
global variable errno is set to indicate the error.
```

The `-std` option is valid only for manual page sections 2 and 3. Currently, this macro does nothing if used without the `-std` flag.

### Exit Status

The `.Ex` macro generates text for use in the **Diagnostics** section.

```
Usage: .Ex [-std] [<utility> ...]
```

For example, `.Ex -std cat` produces:

The **cat** utility exits 0 on success, and >0 if an error occurs.

The **-std** option is valid only for manual page sections 1, 6 and 8. Currently, this macro does nothing if used without the **-std** flag.

### Interactive Commands

The **.Ic** macro designates an interactive or internal command.

Usage: **.Ic** <argument> ...

```
.Ic :wq                :wq
.Ic "do while {...}"  do while {...}
.Ic setenv , unsetenv setenv, unsetenv
```

The default width is 12n.

### Library Names

The **.Lb** macro is used to specify the library where a particular function is compiled in.

Usage: **.Lb** <argument> ...

Available arguments to **.Lb** and their results are:

<b>libarchive</b>	Reading and Writing Streaming Archives Library ( <b>libarchive</b> , <b>-larchive</b> )
<b>libarm</b>	ARM Architecture Library ( <b>libarm</b> , <b>-larm</b> )
<b>libarm32</b>	ARM32 Architecture Library ( <b>libarm32</b> , <b>-larm32</b> )
<b>libbluetooth</b>	Bluetooth Library ( <b>libbluetooth</b> , <b>-lbluetooth</b> )
<b>libbsm</b>	Basic Security Module Library ( <b>libbsm</b> , <b>-lbsm</b> )
<b>libc</b>	Standard C Library ( <b>libc</b> , <b>-lc</b> )
<b>libc_r</b>	Reentrant C Library ( <b>libc_r</b> , <b>-lc_r</b> )
<b>libcalendar</b>	Calendar Arithmetic Library ( <b>libcalendar</b> , <b>-lcalendar</b> )
<b>libcam</b>	Common Access Method User Library ( <b>libcam</b> , <b>-lcam</b> )
<b>libcdk</b>	Curses Development Kit Library ( <b>libcdk</b> , <b>-lcdk</b> )
<b>libcipher</b>	FreeSec Crypt Library ( <b>libcipher</b> , <b>-lcipher</b> )
<b>libcompat</b>	Compatibility Library ( <b>libcompat</b> , <b>-lcompat</b> )
<b>libcrypt</b>	Crypt Library ( <b>libcrypt</b> , <b>-lcrypt</b> )
<b>libcurses</b>	Curses Library ( <b>libcurses</b> , <b>-lcurses</b> )
<b>libdevinfo</b>	Device and Resource Information Utility Library ( <b>libdevinfo</b> , <b>-ldevinfo</b> )
<b>libdevstat</b>	Device Statistics Library ( <b>libdevstat</b> , <b>-ldevstat</b> )
<b>libdisk</b>	Interface to Slice and Partition Labels Library ( <b>libdisk</b> , <b>-ldisk</b> )
<b>libdwarf</b>	DWARF Access Library ( <b>libdwarf</b> , <b>-ldwarf</b> )
<b>libedit</b>	Command Line Editor Library ( <b>libedit</b> , <b>-ledit</b> )
<b>libelf</b>	ELF Access Library ( <b>libelf</b> , <b>-lelf</b> )
<b>libevent</b>	Event Notification Library ( <b>libevent</b> , <b>-levent</b> )
<b>libfetch</b>	File Transfer Library for URLs ( <b>libfetch</b> , <b>-lfetch</b> )
<b>libform</b>	Curses Form Library ( <b>libform</b> , <b>-lform</b> )
<b>libgeom</b>	Userland API Library for kernel GEOM subsystem ( <b>libgeom</b> , <b>-lgeom</b> )
<b>libgpib</b>	General-Purpose Instrument Bus (GPIB) library ( <b>libgpib</b> , <b>-lgpib</b> )
<b>libi386</b>	i386 Architecture Library ( <b>libi386</b> , <b>-li386</b> )
<b>libintl</b>	Internationalized Message Handling Library ( <b>libintl</b> , <b>-lintl</b> )
<b>libipsec</b>	IPsec Policy Control Library ( <b>libipsec</b> , <b>-lipsec</b> )
<b>libipx</b>	IPX Address Conversion Support Library ( <b>libipx</b> , <b>-lipx</b> )
<b>libiscsi</b>	iSCSI protocol library ( <b>libiscsi</b> , <b>-liscsi</b> )

<code>libjail</code>	Jail Library ( <code>libjail</code> , <code>-ljail</code> )
<code>libkiconv</code>	Kernel side iconv library ( <code>libkiconv</code> , <code>-lkiconv</code> )
<code>libkse</code>	N:M Threading Library ( <code>libkse</code> , <code>-lkse</code> )
<code>libkvm</code>	Kernel Data Access Library ( <code>libkvm</code> , <code>-lkvm</code> )
<code>libm</code>	Math Library ( <code>libm</code> , <code>-lm</code> )
<code>libm68k</code>	m68k Architecture Library ( <code>libm68k</code> , <code>-lm68k</code> )
<code>libmagic</code>	Magic Number Recognition Library ( <code>libmagic</code> , <code>-lmagic</code> )
<code>libmd</code>	Message Digest (MD4, MD5, etc.) Support Library ( <code>libmd</code> , <code>-lmd</code> )
<code>libmemstat</code>	Kernel Memory Allocator Statistics Library ( <code>libmemstat</code> , <code>-lmemstat</code> )
<code>libmenu</code>	Curses Menu Library ( <code>libmenu</code> , <code>-lmenu</code> )
<code>libnetgraph</code>	Netgraph User Library ( <code>libnetgraph</code> , <code>-lnetgraph</code> )
<code>libnetpgp</code>	Netpgp signing, verification, encryption and decryption ( <code>libnetpgp</code> , <code>-lnetpgp</code> )
<code>libossaudio</code>	OSS Audio Emulation Library ( <code>libossaudio</code> , <code>-lossaudio</code> )
<code>libpam</code>	Pluggable Authentication Module Library ( <code>libpam</code> , <code>-lpam</code> )
<code>libpcap</code>	Packet Capture Library ( <code>libpcap</code> , <code>-lpcap</code> )
<code>libpci</code>	PCI Bus Access Library ( <code>libpci</code> , <code>-lpci</code> )
<code>libpmc</code>	Performance Counters Library ( <code>libpmc</code> , <code>-lpmc</code> )
<code>libposix</code>	POSIX Compatibility Library ( <code>libposix</code> , <code>-lposix</code> )
<code>libprop</code>	Property Container Object Library ( <code>libprop</code> , <code>-lprop</code> )
<code>libpthread</code>	POSIX Threads Library ( <code>libpthread</code> , <code>-lpthread</code> )
<code>libpuffs</code>	puffs Convenience Library ( <code>libpuffs</code> , <code>-lpuffs</code> )
<code>librefuse</code>	File System in Userspace Convenience Library ( <code>librefuse</code> , <code>-lrefuse</code> )
<code>libresolv</code>	DNS Resolver Library ( <code>libresolv</code> , <code>-lresolv</code> )
<code>librpcsec_gss</code>	RPC GSS-API Authentication Library ( <code>librpcsec_gss</code> , <code>-lrpcsec_gss</code> )
<code>librpcsvc</code>	RPC Service Library ( <code>librpcsvc</code> , <code>-lrpcsvc</code> )
<code>librt</code>	POSIX Real-time Library ( <code>librt</code> , <code>-lrt</code> )
<code>libsdp</code>	Bluetooth Service Discovery Protocol User Library ( <code>libsdp</code> , <code>-lsdp</code> )
<code>libssp</code>	Buffer Overflow Protection Library ( <code>libssp</code> , <code>-lssp</code> )
<code>libSystem</code>	System Library ( <code>libSystem</code> , <code>-lSystem</code> )
<code>libtermcap</code>	Termcap Access Library ( <code>libtermcap</code> , <code>-ltermcap</code> )
<code>libterminfo</code>	Terminal Information Library ( <code>libterminfo</code> , <code>-lterminfo</code> )
<code>libthr</code>	1:1 Threading Library ( <code>libthr</code> , <code>-lthr</code> )
<code>libufs</code>	UFS File System Access Library ( <code>libufs</code> , <code>-lufs</code> )
<code>libugidfw</code>	File System Firewall Interface Library ( <code>libugidfw</code> , <code>-lugidfw</code> )
<code>libulog</code>	User Login Record Library ( <code>libulog</code> , <code>-lulog</code> )
<code>libusbhid</code>	USB Human Interface Devices Library ( <code>libusbhid</code> , <code>-lusbhid</code> )
<code>libutil</code>	System Utilities Library ( <code>libutil</code> , <code>-lutil</code> )
<code>libvgl</code>	Video Graphics Library ( <code>libvgl</code> , <code>-lvgl</code> )
<code>libx86_64</code>	x86_64 Architecture Library ( <code>libx86_64</code> , <code>-lx86_64</code> )
<code>libz</code>	Compression Library ( <code>libz</code> , <code>-lz</code> )

Local, OS-specific additions might be found in the file `mdoc.local`; look for strings named `str-Lb-XXX`. XXX then denotes the keyword to be used with the `.Lb` macro.

In the *Library* section an `.Lb` command causes a line break before and after its arguments are printed.

### Literals

The `.Li` literal macro may be used for special characters, variable constants, etc. – anything which should be displayed as it would be typed.

Usage: `.Li` <argument> ...

```
.Li \en          \n
.Li M1 M2 M3 ;  M1 M2 M3;
.Li cntrl-D ) , cntrl-D),
.Li 1024 ...    1024 ...
```

The default width is 16n.

## Names

The `.Nm` macro is used for the document title or subject name. It has the peculiarity of remembering the first argument it was called with, which should always be the subject name of the page. When called without arguments, `.Nm` regurgitates this initial name for the sole purpose of making less work for the author. `.Nm` causes a line break within the **Synopsis** section.

Note: A section two or three document function name is addressed with the `.Nm` in the *Name* section, and with `.Fn` in the **Synopsis** and remaining sections. For interactive commands, such as the `while` command keyword in `cs(1)`, the `.Ic` macro should be used. While `.Ic` is nearly identical to `.Nm`, it can not recall the first argument it was invoked with.

Usage: `.Nm` [*argument*] ...

```
.Nm groff_mdoc groff_mdoc
.Nm \-mdoc     -mdoc
.Nm foo ) ) , foo),
.Nm :         groff_mdoc:
```

The default width is 10n.

## Options

The `.Op` macro places option brackets around any remaining arguments on the command line, and places any trailing punctuation outside the brackets. The macros `.Oo` and `.Oc` (which produce an opening and a closing option bracket respectively) may be used across one or more lines or to specify the exact position of the closing parenthesis.

Usage: `.Op` [*option*] ...

```
.Op                                     []
.Op Fl k                               [-k]
.Op Fl k ) .                            [-k)].
.Op Fl k Ar kookfile                   [-k kookfile]
.Op Fl k Ar kookfile ,                  [-k kookfile],
.Op Ar objfil Op Ar corfil              [objfil [corfil]]
.Op Fl c Ar objfil Op Ar corfil ,      [-c objfil [corfil]],
.Op word1 word2                         [word1 word2]
.Li .Op Oo Ao option Ac Oc ...         .Op [option] ...
```

Here a typical example of the `.Oo` and `.Oc` macros:

```
.Oo
.Op Fl k Ar kilobytes
.Op Fl i Ar interval
.Op Fl c Ar count
.Oc
```

Produces:

```
[[ -k kilobytes] [-i interval] [-c count]]
```

The default width values of `.Op` and `.Oo` are 14n and 10n, respectively.

### Pathnames

The `.Pa` macro formats path or file names. If called without arguments, the `'~'` string is output, which represents the current user's home directory.

```
Usage: .Pa [<pathname>] ...

.Pa ~
.Pa /usr/share /usr/share
.Pa /tmp/fooXXXXX ) . /tmp/fooXXXXX).
```

The default width is 32n.

### Standards

The `.St` macro replaces standard abbreviations with their formal names.

```
Usage: .St <abbreviation> ...
```

Available pairs for "Abbreviation/Formal Name" are:

#### ANSI/ISO C

```
-ansiC ANSI X3.159-1989 ("ANSI C89")
-ansiC-89 ANSI X3.159-1989 ("ANSI C89")
-isoC ISO/IEC 9899:1990 ("ISO C90")
-isoC-90 ISO/IEC 9899:1990 ("ISO C90")
-isoC-99 ISO/IEC 9899:1999 ("ISO C99")
-isoC-2011 ISO/IEC 9899:2011 ("ISO C11")
```

#### POSIX Part 1: System API

```
-iso9945-1-90 ISO/IEC 9945-1:1990 ("POSIX.1")
-iso9945-1-96 ISO/IEC 9945-1:1996 ("POSIX.1")
-p1003.1 IEEE Std 1003.1 ("POSIX.1")
-p1003.1-88 IEEE Std 1003.1-1988 ("POSIX.1")
-p1003.1-90 ISO/IEC 9945-1:1990 ("POSIX.1")
-p1003.1-96 ISO/IEC 9945-1:1996 ("POSIX.1")
-p1003.1b-93 IEEE Std 1003.1b-1993 ("POSIX.1")
-p1003.1c-95 IEEE Std 1003.1c-1995 ("POSIX.1")
-p1003.1g-2000 IEEE Std 1003.1g-2000 ("POSIX.1")
-p1003.1i-95 IEEE Std 1003.1i-1995 ("POSIX.1")
-p1003.1-2001 IEEE Std 1003.1-2001 ("POSIX.1")
-p1003.1-2004 IEEE Std 1003.1-2004 ("POSIX.1")
-p1003.1-2008 IEEE Std 1003.1-2008 ("POSIX.1")
```

#### POSIX Part 2: Shell and Utilities

```
-iso9945-2-93 ISO/IEC 9945-2:1993 ("POSIX.2")
-p1003.2 IEEE Std 1003.2 ("POSIX.2")
-p1003.2-92 IEEE Std 1003.2-1992 ("POSIX.2")
-p1003.2a-92 IEEE Std 1003.2a-1992 ("POSIX.2")
```

#### X/Open

```
-susv1 Version 1 of the Single UNIX Specification ("SUSv1")
```

-susv2	Version 2 of the Single UNIX Specification (“SUSv2”)
-susv3	Version 3 of the Single UNIX Specification (“SUSv3”)
-susv4	Version 4 of the Single UNIX Specification (“SUSv4”)
-svid4	System V Interface Definition, Fourth Edition (“SVID4”)
-xbd5	X/Open Base Definitions Issue 5 (“XBD5”)
-xcu5	X/Open Commands and Utilities Issue 5 (“XCU5”)
-xcurses4.2	X/Open Curses Issue 4, Version 2 (“XCURSES4.2”)
-xns5	X/Open Networking Services Issue 5 (“XNS5”)
-xns5.2	X/Open Networking Services Issue 5.2 (“XNS5.2”)
-xpg3	X/Open Portability Guide Issue 3 (“XPG3”)
-xpg4	X/Open Portability Guide Issue 4 (“XPG4”)
-xpg4.2	X/Open Portability Guide Issue 4, Version 2 (“XPG4.2”)
-xsh5	X/Open System Interfaces and Headers Issue 5 (“XSH5”)

#### Miscellaneous

-ieee754	IEEE Std 754-1985
-iso8601	ISO 8601
-iso8802-3	ISO/IEC 8802-3:1989

#### Variable Types

The `.Vt` macro may be used whenever a type is referenced. In the **Synopsis** section, it causes a line break (useful for old style variable declarations).

```
Usage: .Vt <type> ...

.Vt extern char *optarg ; extern char *optarg;
.Vt FILE * FILE *
```

#### Variables

Generic variable reference.

```
Usage: .Va <variable> ...

.Va count count
.Va settimer , settimer,
.Va "int *prt" ) : int *prt):
.Va "char s" ] ) ) , char s]),
```

The default width is 12n.

#### Manual Page Cross References

The `.Xr` macro expects the first argument to be a manual page name. The optional second argument, if a string (defining the manual section), is put into parentheses.

```
Usage: .Xr <man page name> [<section>] ...

.Xr mdoc mdoc
.Xr mdoc , mdoc,
.Xr mdoc 7 mdoc(7)
.Xr xinit 1x ; xinit(1x);
```

The default width is 10n.

**General text domain****AT&T Macro**

Usage: `.At` [`<version>`] ...

```
.At          AT&T UNIX
.At v6      . Version 6 AT&T UNIX.
```

The following values for `<version>` are possible:

```
32v, v1, v2, v3, v4, v5, v6, v7, III, V, V.1, V.2, V.3, V.4
```

**BSD Macro**

Usage: `.Bx` {`-alpha` | `-beta` | `-devel`} ...

```
.Bx [<version>] [<release>] ...

.Bx          BSD
.Bx 4.3      . 4.3BSD.
.Bx -devel   BSD (currently under development)
```

`<version>` will be prepended to the string 'BSD'. The following values for `<release>` are possible:

```
Reno, reno, Tahoe, tahoe, Lite, lite, Lite2, lite2
```

**NetBSD Macro**

Usage: `.Nx` [`<version>`] ...

```
.Nx          NetBSD
.Nx 1.4      . NetBSD 1.4.
```

For possible values of `<version>` see the description of the `.Os` command above in section **Title macros**.

**FreeBSD Macro**

Usage: `.Fx` [`<version>`] ...

```
.Fx          FreeBSD
.Fx 2.2      . FreeBSD 2.2.
```

For possible values of `<version>` see the description of the `.Os` command above in section **Title macros**.

**DragonFly Macro**

Usage: `.Dx` [`<version>`] ...

```
.Dx          DragonFly
.Dx 1.4      . DragonFly 1.4.
```

For possible values of `<version>` see the description of the `.Os` command above in section **Title macros**.

**OpenBSD Macro**

Usage: `.Ox` [`<version>`] ...

```
.Ox 1.0      OpenBSD 1.0
```

**BSD/OS Macro**

Usage: `.Bsx` [`<version>`] ...

```
.Bsx 1.0     BSD/OS 1.0
```

**UNIX Macro**

Usage: `.Ux . . .`

`.Ux UNIX`

**Emphasis Macro**

Text may be stressed or emphasized with the `.Em` macro. The usual font for emphasis is italic.

Usage: `.Em <argument> ...`

`.Em does not`                    *does not*  
`.Em exceed 1024 .`            *exceed 1024.*  
`.Em vide infra ) ) ,` *vide infra*)),

The default width is 10n.

**Font Mode**

The `.Bf` font mode must be ended with the `.Ef` macro (the latter takes no arguments). Font modes may be nested within other font modes.

`.Bf` has the following syntax:

`.Bf <font mode>`

`<font mode>` must be one of the following three types:

**Em** | **-emphasis** Same as if the `.Em` macro was used for the entire block of text.  
**Li** | **-literal** Same as if the `.Li` macro was used for the entire block of text.  
**Sy** | **-symbolic** Same as if the `.Sy` macro was used for the entire block of text.

Both macros are neither callable nor parsed.

**Enclosure and Quoting Macros**

The concept of enclosure is similar to quoting. The object being to enclose one or more strings between a pair of characters like quotes or parentheses. The terms quoting and enclosure are used interchangeably throughout this document. Most of the one-line enclosure macros end in small letter ‘q’ to give a hint of quoting, but there are a few irregularities. For each enclosure macro there is also a pair of open and close macros which end in small letters ‘o’ and ‘c’ respectively.

Quote	Open	Close	Function	Result
<code>.Aq</code>	<code>.Ao</code>	<code>.Ac</code>	Angle Bracket Enclosure	<code>&lt;string&gt;</code>
<code>.Bq</code>	<code>.Bo</code>	<code>.Bc</code>	Bracket Enclosure	<code>[string]</code>
<code>.Brq</code>	<code>.Bro</code>	<code>.Brc</code>	Brace Enclosure	<code>{string}</code>
<code>.Dq</code>	<code>.Do</code>	<code>.Dc</code>	Double Quote	<code>"string"</code>
<code>.Eq</code>	<code>.Eo</code>	<code>.Ec</code>	Enclose String (in XY)	<code>XstringY</code>
<code>.Pq</code>	<code>.Po</code>	<code>.Pc</code>	Parenthesis Enclosure	<code>(string)</code>
<code>.Ql</code>			Quoted Literal	<code>"string"</code> or <code>string</code>
<code>.Qq</code>	<code>.Qo</code>	<code>.Qc</code>	Straight Double Quote	<code>"string"</code>
<code>.Sq</code>	<code>.So</code>	<code>.Sc</code>	Single Quote	<code>'string'</code>

All macros ending with ‘q’ and ‘o’ have a default width value of 12n.

`.Eo`, `.Ec` These macros expect the first argument to be the opening and closing strings, respectively.

`.Es`, `.En` Due to the nine-argument limit in the original `troff` program two other macros have been implemented which are now rather obsolete: `.Es` takes the first and second parameter as the left and right enclosure string, which are then used to enclose the arguments of `.En`. The default width value is 12n for both macros.

- .Eq** The first and second arguments of this macro are the opening and closing strings respectively, followed by the arguments to be enclosed.
- .Ql** The quoted literal macro behaves differently in `troff` and `nroff` mode. If formatted with `nroff(1)`, a quoted literal is always quoted. If formatted with `troff`, an item is only quoted if the width of the item is less than three constant-width characters. This is to make short strings more visible where the font change to literal (constant-width) is less noticeable.
- The default width is 16n.
- .Pf** The prefix macro suppresses the whitespace between its first and second argument:
- ```
.Pf ( Fa name2 (name2
```
- The default width is 12n.
- The `.Ns` macro (see below) performs the analogous suffix function.
- .Ap** The `.Ap` macro inserts an apostrophe and exits any special text modes, continuing in `.No` mode.

Examples of quoting:

```
.Aq                               <>
.Aq Pa ctype.h ) ,               <ctype.h>,
.Bq                               []
.Bq Em Greek , French . [Greek, French].
.Dq                               ""
.Dq string abc .                 "string abc".
.Dq '\[ha][A-Z]'                 "'^[A-Z]'"
.Ql man mdoc                      man mdoc
.Qq                               ""
.Qq string ) ,                   "string"),
.Qq string Ns ) ,                 "string),"
.Sq                               `
.Sq string                         'string'
.Em or Ap ing                     or'ing
```

For a good example of nested enclosure macros, see the `.Op` option macro. It was created from the same underlying enclosure macros as those presented in the list above. The `.Xo` and `.Xc` extended argument list macros are discussed below.

### No-Op or Normal Text Macro

The `.No` macro can be used in a macro command line for parameters which should *not* be formatted. Be careful to add `'\&'` to the word `'No'` if you really want that English word (and not the macro) as a parameter.

Usage: `.No <argument> ...`

```
.No test Ta with Ta tabs test      with      tabs
```

The default width is 12n.

### No-Space Macro

The `.Ns` macro suppresses insertion of a space between the current position and its first parameter. For example, it is useful for old style argument lists where there is no space between the flag and argument:

Usage: `. . . <argument> Ns [<argument>] ...`  
`.Ns <argument> ...`

```
.Op Fl I Ns Ar directory [-Idirectory]
```

Note: The `.Ns` macro always invokes the `.No` macro after eliminating the space unless another macro name follows it. If used as a command (i.e., the second form above in the ‘Usage’ line), `.Ns` is identical to `.No`.

### Section Cross References

The `.Sx` macro designates a reference to a section header within the same document.

```
Usage: .Sx <section reference> ...
```

```
.Sx Files Files
```

The default width is 16n.

### Symbolics

The symbolic emphasis macro is generally a boldface macro in either the symbolic sense or the traditional English usage.

```
Usage: .Sy <symbol> ...
```

```
.Sy Important Notice Important Notice
```

The default width is 6n.

### Mathematical Symbols

Use this macro for mathematical symbols and similar things.

```
Usage: .Ms <math symbol> ...
```

```
.Ms sigma sigma
```

The default width is 6n.

### References and Citations

The following macros make a modest attempt to handle references. At best, the macros make it convenient to manually drop in a subset of `refer(1)` style references.

```
.Rs      Reference start (does not take arguments). Causes a line break in the See also section and
        begins collection of reference information until the reference end macro is read.
.Re      Reference end (does not take arguments). The reference is printed.
.%A     Reference author name; one name per invocation.
.%B     Book title.
.%C     City/place.
.%D     Date.
.%I     Issuer/publisher name.
.%J     Journal name.
.%N     Issue number.
.%O     Optional information.
.%P     Page number.
.%Q     Corporate or foreign author.
.%R     Report name.
.%T     Title of article.
.%U     Optional hypertext reference.
.%V     Volume.
```

Macros beginning with ‘%’ are not callable but accept multiple arguments in the usual way. Only the `.Tn` macro is handled properly as a parameter; other macros will cause strange output. `.%B` and `.%T` can be used outside of the `.Rs` / `.Re` environment.

Example:

```
.Rs
.%A "Matthew Bar"
.%A "John Foo"
.%T "Implementation Notes on foobar(1) "
.%R "Technical Report ABC-DE-12-345"
.%Q "Drofnats College"
.%C "Nowhere"
.%D "April 1991"
.Re
```

produces

Matthew Bar and John Foo, *Implementation Notes on foobar(1)*, Technical Report ABC-DE-12-345, Drofnats College, Nowhere, April 1991.

### Trade Names (or Acronyms and Type Names)

The trade name macro prints its arguments in a smaller font. Its intended use is to imitate a small caps font for uppercase acronyms.

```
Usage: .Tn <symbol> ...
      .Tn DEC DEC
      .Tn ASCII ASCII
```

The default width is 10n.

### Extended Arguments

The `.Xo` and `.Xc` macros allow one to extend an argument list on a macro boundary for the `.It` macro (see below). Note that `.Xo` and `.Xc` are implemented similarly to all other macros opening and closing an enclosure (without inserting characters, of course). This means that the following is true for those macros also.

Here is an example of `.Xo` using the space mode macro to turn spacing off:

```
.Sm off
.It Xo Sy I Ar operation
.No \en Ar count No \en
.Xc
.Sm on
```

produces

**I**operation\ncount\n

Another one:

```
.Sm off
.It Cm S No / Ar old_pattern Xo
.No / Ar new_pattern
.No / Op Cm g
.Xc
.Sm on
```

produces

```
s/old_pattern/new_pattern/[g]
```

Another example of `.Xo` and enclosure macros: Test the value of a variable.

```
.It Xo
.Ic .ifndef
.Oo \&! Oc Ns Ar variable Oo
.Ar operator variable ...
.Oc Xc
```

produces

```
.ifndef [!]variable [operator variable ...]
```

## Page structure domain

### Section Headers

The following `.Sh` section header macros are required in every man page. The remaining section headers are recommended at the discretion of the author writing the manual page. The `.Sh` macro is parsed but not generally callable. It can be used as an argument in a call to `.Sh` only; it then reactivates the default font for `.Sh`.

The default width is 8n.

- |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>.Sh Name</code>        | The <code>.Sh Name</code> macro is mandatory. If not specified, headers, footers and page layout defaults will not be set and things will be rather unpleasant. The <i>Name</i> section consists of at least three items. The first is the <code>.Nm</code> name macro naming the subject of the man page. The second is the name description macro, <code>.Nd</code> , which separates the subject name from the third item, which is the description. The description should be the most terse and lucid possible, as the space available is small.<br><br><code>.Nd</code> first prints <code>'-'</code> , then all its arguments.                                                                                                                                                                                |
| <code>.Sh Library</code>     | This section is for section two and three function calls. It should consist of a single <code>.Lb</code> macro call; see <b>Library Names</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <code>.Sh Synopsis</code>    | The <b>Synopsis</b> section describes the typical usage of the subject of a man page. The macros required are either <code>.Nm</code> , <code>.Cd</code> , or <code>.Fn</code> (and possibly <code>.Fo</code> , <code>.Fc</code> , <code>.Fd</code> , and <code>.Ft</code> ). The function name macro <code>.Fn</code> is required for manual page sections 2 and 3; the command and general name macro <code>.Nm</code> is required for sections 1, 5, 6, 7, and 8. Section 4 manuals require a <code>.Nm</code> , <code>.Fd</code> or a <code>.Cd</code> configuration device usage macro. Several other macros may be necessary to produce the synopsis line as shown below:<br><br><pre>cat [-benstuv] [-] file ...</pre><br>The following macros were used:<br><br><pre>.Nm cat .Op Fl benstuv .Op Fl .Ar</pre> |
| <code>.Sh Description</code> | In most cases the first text in the <b>Description</b> section is a brief paragraph on the command, function or file, followed by a lexical list of options and respective explanations. To create such a list, the <code>.Bl</code> (begin list), <code>.It</code> (list item) and <code>.El</code> (end list) macros are used (see <b>Lists and Columns</b> below).                                                                                                                                                                                                                                                                                                                                                                                                                                                |

- .Sh Implementation notes  
Implementation specific information should be placed here.
- .Sh Return values Sections 2, 3 and 9 function return values should go here. The .Rv macro may be used to generate text for use in the **Return values** section for most section 2 and 3 library functions; see **Return Values**.

The following .Sh section headers are part of the preferred manual page layout and must be used appropriately to maintain consistency. They are listed in the order in which they would be used.

- .Sh Environment The *Environment* section should reveal any related environment variables and clues to their behavior and/or usage.
- .Sh Files Files which are used or created by the man page subject should be listed via the .Pa macro in the **Files** section.
- .Sh Examples There are several ways to create examples. See the **Examples and Displays** section below for details.
- .Sh Diagnostics Diagnostic messages from a command should be placed in this section. The .Ex macro may be used to generate text for use in the **Diagnostics** section for most section 1, 6 and 8 commands; see **Exit Status**.
- .Sh Compatibility Known compatibility issues (e.g. deprecated options or parameters) should be listed here.
- .Sh Errors Specific error handling, especially from library functions (man page sections 2, 3, and 9) should go here. The .Er macro is used to specify an error (errno).
- .Sh See also References to other material on the man page topic and cross references to other relevant man pages should be placed in the **See also** section. Cross references are specified using the .Xr macro. Currently refer(1) style references are not accommodated.

It is recommended that the cross references be sorted by section number, then alphabetically by name within each section, then separated by commas. Example:

```
ls(1), ps(1), group(5), passwd(5)
```

- .Sh Standards If the command, library function, or file adheres to a specific implementation such as IEEE Std 1003.2 (“POSIX.2”) or ANSI X3.159-1989 (“ANSI C89”) this should be noted here. If the command does not adhere to any standard, its history should be noted in the *History* section.
- .Sh History Any command which does not adhere to any specific standards should be outlined historically in this section.
- .Sh Authors Credits should be placed here. Use the .An macro for names and the .Aq macro for email addresses within optional contact information. Explicitly indicate whether the person authored the initial manual page or the software or whatever the person is being credited for.
- .Sh Bugs Blatant problems with the topic go here.

User-specified .Sh sections may be added; for example, this section was set with:

```
.Sh "Page structure domain"
```

### Subsection Headers

Subsection headers have exactly the same syntax as section headers: `.Ss` is parsed but not generally callable. It can be used as an argument in a call to `.Ss` only; it then reactivates the default font for `.Ss`.

The default width is 8n.

### Paragraphs and Line Spacing

`.Pp` The `.Pp` paragraph command may be used to specify a line space where necessary. The macro is not necessary after a `.Sh` or `.Ss` macro or before a `.B1` or `.Bd` macro (which both assert a vertical distance unless the **-compact** flag is given).

The macro is neither callable nor parsed and takes no arguments; an alternative name is `.Lp`.

### Keeps

The only keep that is implemented at this time is for words. The macros are `.Bk` (begin keep) and `.Ek` (end keep). The only option that `.Bk` accepts currently is **-words** (this is also the default if no option is given) which is useful for preventing line breaks in the middle of options. In the example for the make command-line arguments (see **What's in a Name**), the keep prevents `nrOFF` from placing the flag and the argument on separate lines.

Neither macro is callable or parsed.

More work needs to be done on the keep macros; specifically, a **-line** option should be added.

### Examples and Displays

There are seven types of displays.

`.D1` (This is D-one.) Display one line of indented text. This macro is parsed but not callable.

**-ldghfstru**

The above was produced by: `.D1 F1 ldghfstru`.

`.D1` (This is D-ell.) Display one line of indented *literal* text. The `.D1` example macro has been used throughout this file. It allows the indentation (display) of one line of text. Its default font is set to constant width (literal). `.D1` is parsed but not callable.

```
% ls -ldg /usr/local/bin
```

The above was produced by: `.D1 % ls \-ldg /usr/local/bin`.

`.Bd` Begin display. The `.Bd` display must be ended with the `.Ed` macro. It has the following syntax:

```
.Bd {-literal | -filled | -unfilled | -ragged | -centered} [-offset <string>] [-file <file name>]
[-compact]
```

|                          |                                                                                                                                                                                                                                                    |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>-ragged</b>           | Fill, but do not adjust the right margin (only left-justify).                                                                                                                                                                                      |
| <b>-centered</b>         | Center lines between the current left and right margin. Note that each single line is centered.                                                                                                                                                    |
| <b>-unfilled</b>         | Do not fill; display a block of text as typed, using line breaks as specified by the user. This can produce overlong lines without warning messages.                                                                                               |
| <b>-filled</b>           | Display a filled block. The block of text is formatted (i.e., the text is justified on both the left and right side).                                                                                                                              |
| <b>-literal</b>          | Display block with literal font (usually fixed-width). Useful for source code or simple tabbed or spaced text.                                                                                                                                     |
| <b>-file</b> <file name> | The file whose name follows the <b>-file</b> flag is read and displayed before any data enclosed with <code>.Bd</code> and <code>.Ed</code> , using the selected display type. Any <code>trOFF/mdoc</code> commands in the file will be processed. |

**-offset** *<string>* If **-offset** is specified with one of the following strings, the string is interpreted to indicate the level of indentation for the forthcoming block of text:

|                   |                                                                                                                                                                                                                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>left</i>       | Align block on the current left margin; this is the default mode of <code>.Bd</code> .                                                                                                                                                                                                                          |
| <i>center</i>     | Supposedly center the block. At this time unfortunately, the block merely gets left aligned about an imaginary center margin.                                                                                                                                                                                   |
| <i>indent</i>     | Indent by one default indent value or tab. The default indent value is also used for the <code>.D1</code> and <code>.Dl</code> macros, so one is guaranteed the two types of displays will line up. The indentation value is normally set to 6n or about two thirds of an inch (six constant width characters). |
| <i>indent-two</i> | Indent two times the default indent value.                                                                                                                                                                                                                                                                      |
| <i>right</i>      | This <i>left</i> aligns the block about two inches from the right side of the page. This macro needs work and perhaps may never do the right thing within <code>troff</code> .                                                                                                                                  |

If *<string>* is a valid numeric expression instead (*with a scaling indicator other than 'u'*), use that value for indentation. The most useful scaling indicators are 'm' and 'n', specifying the so-called *Em* and *En square*. This is approximately the width of the letters 'm' and 'n' respectively of the current font (for `nrOFF` output, both scaling indicators give the same values). If *<string>* isn't a numeric expression, it is tested whether it is an **mdoc** macro name, and the default offset value associated with this macro is used. Finally, if all tests fail, the width of *<string>* (typeset with a fixed-width font) is taken as the offset.

**-compact** Suppress insertion of vertical space before begin of display.

`.Ed` End display (takes no arguments).

### Lists and Columns

There are several types of lists which may be initiated with the `.B1` begin-list macro. Items within the list are specified with the `.It` item macro, and each list must end with the `.E1` macro. Lists may be nested within themselves and within displays. The use of columns inside of lists or lists inside of columns is untested.

In addition, several list attributes may be specified such as the width of a tag, the list offset, and compactness (blank lines between items allowed or disallowed). Most of this document has been formatted with a tag style list (**-tag**).

It has the following syntax forms:

```
.B1 {-hang | -ohang | -tag | -diag | -inset} [-width <string>] [-offset <string>] [-compact]
.B1 -column [-offset <string>] <string1> <string2> ...
.B1 {-item | -enum [-nested] | -bullet | -hyphen | -dash} [-offset <string>] [-compact]
```

And now a detailed description of the list types.

**-bullet** A bullet list.

```
.B1 -bullet -offset indent -compact
.It
Bullet one goes here.
.It
```

```
Bullet two here.
.E1
```

Produces:

- Bullet one goes here.
- Bullet two here.

**-dash** (or **-hyphen**)

A dash list.

```
.Bl -dash -offset indent -compact
.It
Dash one goes here.
.It
Dash two here.
.E1
```

Produces:

- Dash one goes here.
- Dash two here.

**-enum** An enumerated list.

```
.Bl -enum -offset indent -compact
.It
Item one goes here.
.It
And item two here.
.E1
```

The result:

1. Item one goes here.
2. And item two here.

If you want to nest enumerated lists, use the **-nested** flag (starting with the second-level list):

```
.Bl -enum -offset indent -compact
.It
Item one goes here
.Bl -enum -nested -compact
.It
Item two goes here.
.It
And item three here.
.E1
.It
And item four here.
.E1
```

Result:

1. Item one goes here.
  - 1.1. Item two goes here.

- 1.2. And item three here.
2. And item four here.

**-item** A list of type **-item** without list markers.

```
.Bl -item -offset indent
.It
Item one goes here.
Item one goes here.
Item one goes here.
.It
Item two here.
Item two here.
Item two here.
.El
```

Produces:

```
Item one goes here. Item one goes here. Item one goes here.
Item two here. Item two here. Item two here.
```

**-tag** A list with tags. Use **-width** to specify the tag width.

```
SL    sleep time of the process (seconds blocked)
PAGEIN
      number of disk I/O operations resulting from references by the process to pages
      not loaded in core.
UID   numerical user-id of process owner
PPID  numerical id of parent of process priority (non-positive when in non-interruptible
      wait)
```

The raw text:

```
.Bl -tag -width "PPID" -compact -offset indent
.It SL
sleep time of the process (seconds blocked)
.It PAGEIN
number of disk I/O operations resulting from references
by the process to pages not loaded in core.
.It UID
numerical user-id of process owner
.It PPID
numerical id of parent of process priority
(non-positive when in non-interruptible wait)
.El
```

**-diag** Diag lists create section four diagnostic lists and are similar to inset lists except callable macros are ignored. The **-width** flag is not meaningful in this context.

Example:

```
.Bl -diag
.It You can't use Sy here.
The message says all.
.El
```

produces

**You can't use Sy here.** The message says all.

**-hang** A list with hanging tags.

*Hanged* labels appear similar to tagged lists when the label is smaller than the label width.

*Longer hanged list labels* blend into the paragraph unlike tagged paragraph labels.

And the unformatted text which created it:

```
.Bl -hang -offset indent
.It Em Hanged
labels appear similar to tagged lists when the
label is smaller than the label width.
.It Em Longer hanged list labels
blend into the paragraph unlike
tagged paragraph labels.
.El
```

**-ohang** Lists with overhanging tags do not use indentation for the items; tags are written to a separate line.

**SL**

sleep time of the process (seconds blocked)

**PAGEIN**

number of disk I/O operations resulting from references by the process to pages not loaded in core.

**UID**

numerical user-id of process owner

**PPID**

numerical id of parent of process priority (non-positive when in non-interruptible wait)

The raw text:

```
.Bl -ohang -offset indent
.It Sy SL
sleep time of the process (seconds blocked)
.It Sy PAGEIN
number of disk I/O operations resulting from references
by the process to pages not loaded in core.
.It Sy UID
numerical user-id of process owner
.It Sy PPID
numerical id of parent of process priority
(non-positive when in non-interruptible wait)
.El
```

**-inset** Here is an example of inset labels:

*Tag* The tagged list (also called a tagged paragraph) is the most common type of list used in the Berkeley manuals. Use a **-width** attribute as described below.

*Diag* *Diag* lists create section four diagnostic lists and are similar to inset lists except callable macros are ignored.

*Hang* *Hanged* labels are a matter of taste.

*Ohang* *Overhanging* labels are nice when space is constrained.

*Inset* *Inset* labels are useful for controlling blocks of paragraphs and are valuable for converting **mdoc** manuals to other formats.

Here is the source text which produced the above example:

```
.Bl -inset -offset indent
.It Em Tag
The tagged list (also called a tagged paragraph)
is the most common type of list used in the
Berkeley manuals.
.It Em Diag
Diag lists create section four diagnostic lists
and are similar to inset lists except callable
macros are ignored.
.It Em Hang
Hanged labels are a matter of taste.
.It Em Ohang
Overhanging labels are nice when space is constrained.
.It Em Inset
Inset labels are useful for controlling blocks of
paragraphs and are valuable for converting
.Nm mdoc
manuals to other formats.
.El
```

**-column** This list type generates multiple columns. The number of columns and the width of each column is determined by the arguments to the **-column** list,  $\langle string1 \rangle$ ,  $\langle string2 \rangle$ , etc. If  $\langle stringN \rangle$  starts with a '.' (dot) immediately followed by a valid **mdoc** macro name, interpret  $\langle stringN \rangle$  and use the width of the result. Otherwise, the width of  $\langle stringN \rangle$  (typeset with a fixed-width font) is taken as the *N*th column width.

Each `.It` argument is parsed to make a row, each column within the row is a separate argument separated by a tab or the `.Ta` macro.

The table:

| String | Nroff | Troff |
|--------|-------|-------|
| <=     | <=    | ≤     |
| >=     | >=    | ≥     |

was produced by:

```
.Bl -column -offset indent ".Sy String" ".Sy Nroff" ".Sy Troff"
.It Sy String Ta Sy Nroff Ta Sy Troff
.It Li <= Ta <= Ta \*(<=
.It Li >= Ta >= Ta \*(>=
.El
```

Don't abuse this list type! For more complicated cases it might be far better and easier to use `tbl(1)`, the table preprocessor.

Other keywords:

**-width** *<string>* If *<string>* starts with a ‘.’ (dot) immediately followed by a valid **mdoc** macro name, interpret *<string>* and use the width of the result. Almost all lists in this document use this option.

Example:

```
.Bl -tag -width ".Fl test Ao Ar string Ac"
.It Fl test Ao Ar string Ac
This is a longer sentence to show how the
.Fl width
flag works in combination with a tag list.
.El
```

gives:

**-test** *<string>* This is a longer sentence to show how the **-width** flag works in combination with a tag list.

(Note that the current state of **mdoc** is saved before *<string>* is interpreted; afterwards, all variables are restored again. However, boxes (used for enclosures) can't be saved in GNU `troff(1)`; as a consequence, arguments must always be *balanced* to avoid nasty errors. For example, do not write `.Ao Ar string` but `.Ao Ar string Xc` instead if you really need only an opening angle bracket.)

Otherwise, if *<string>* is a valid numeric expression (*with a scaling indicator other than ‘u’*), use that value for indentation. The most useful scaling indicators are ‘m’ and ‘n’, specifying the so-called *Em* and *En square*. This is approximately the width of the letters ‘m’ and ‘n’ respectively of the current font (for `nroff` output, both scaling indicators give the same values). If *<string>* isn't a numeric expression, it is tested whether it is an **mdoc** macro name, and the default width value associated with this macro is used. Finally, if all tests fail, the width of *<string>* (typeset with a fixed-width font) is taken as the width.

If a width is not specified for the tag list type, ‘6n’ is used.

**-offset** *<string>* If *<string>* is *indent*, a default indent value (normally set to 6n, similar to the value used in `.Dl` or `.Bd`) is used. If *<string>* is a valid numeric expression (*with a scaling indicator other than ‘u’*), use that value for indentation. The most useful scaling indicators are ‘m’ and ‘n’, specifying the so-called *Em* and *En square*. This is approximately the width of the letters ‘m’ and ‘n’ respectively of the current font (for `nroff` output, both scaling indicators give the same values). If *<string>* isn't a numeric expression, it is tested whether it is an **mdoc** macro name, and the default offset value associated with this macro is used. Finally, if all tests fail, the width of *<string>* (typeset with a fixed-width font) is taken as the offset.

**-compact** Suppress insertion of vertical space before the list and between list items.

### Miscellaneous macros

Here a list of the remaining macros which do not fit well into one of the above sections. We couldn't find real examples for the following macros: `.Me` and `.Ot`. They are documented here for completeness—if you know how to use them properly, please send a mail to `groff@gnu.org` (including an example).

`.Bt` prints

is currently in beta test.

It is neither callable nor parsed and takes no arguments.

`.Fr`

Usage: `.Fr` <function return value> ...

Don't use this macro. It allows a break right before the return value (usually a single digit) which is bad typographical behaviour. Use `'\~'` to tie the return value to the previous word.

`.Hf` Use this macro to include a (header) file literally. It first prints `File:` followed by the file name, then the contents of <file>.

Usage: `.Hf` <file>

It is neither callable nor parsed.

`.Lk` Embed hyperlink.

Usage: `.Lk` *uri* [*link-text*]

`.Me` Exact usage unknown. The documentation in the `mdoc` source file describes it as a macro for "menu entries".

Its default width is 6n.

`.Mt` Embed email address.

Usage: `.Mt` *email-address*

`.Ot` Exact usage unknown. The documentation in the `mdoc` source file describes it as "old function type (fortran)".

`.Sm` Activate (toggle) space mode.

Usage: `.Sm` [on | off] ...

If space mode is off, no spaces between macro arguments are inserted. If called without a parameter (or if the next parameter is neither 'on' nor `off`, `.Sm` toggles space mode.

`.Ud` prints

currently under development.

It is neither callable nor parsed and takes no arguments.

### Predefined strings

The following strings are predefined for compatibility with legacy `mdoc` documents. Contemporary ones should use the alternatives shown in the `Prefer` column below.

| String             | 7-bit              | 8-bit              | UCS            | Prefer               | Meaning                  |
|--------------------|--------------------|--------------------|----------------|----------------------|--------------------------|
| <code>&lt;=</code> | <code>&lt;=</code> | <code>&lt;=</code> | <code>≤</code> | <code>\(&lt;=</code> | less than or equal to    |
| <code>&gt;=</code> | <code>&gt;=</code> | <code>&gt;=</code> | <code>≥</code> | <code>\(&gt;=</code> | greater than or equal to |
| <code>Rq</code>    | <code>"</code>     | <code>"</code>     | <code>”</code> | <code>\(rq</code>    | right double quote       |
| <code>Lq</code>    | <code>"</code>     | <code>"</code>     | <code>“</code> | <code>\(lq</code>    | left double quote        |
| <code>ua</code>    | <code>^</code>     | <code>^</code>     | <code>↑</code> | <code>\(ua</code>    | vertical arrow up        |
| <code>aa</code>    | <code>'</code>     | <code>´</code>     | <code>´</code> | <code>\(aa</code>    | acute accent             |
| <code>ga</code>    | <code>`</code>     | <code>`</code>     | <code>`</code> | <code>\(ga</code>    | grave accent             |
| <code>q</code>     | <code>"</code>     | <code>"</code>     | <code>"</code> | <code>\(dq</code>    | neutral double quote     |

|    |            |            |            |      |                          |
|----|------------|------------|------------|------|--------------------------|
| Pi | pi         | pi         | $\pi$      | \(*p | lowercase pi             |
| Ne | !=         | !=         | $\neq$     | \(!= | not equals               |
| Le | <=         | <=         | $\leq$     | \(<= | less than or equal to    |
| Ge | >=         | >=         | $\geq$     | \(>= | greater than or equal to |
| Lt | <          | <          | <          | <    | less than                |
| Gt | >          | >          | >          | >    | greater than             |
| Pm | +−         | ±          | ±          | \(+− | plus or minus            |
| If | infinity   | infinity   | $\infty$   | \(if | infinity                 |
| Am | &          | &          | &          | &    | ampersand                |
| Na | <i>NaN</i> | <i>NaN</i> | <i>NaN</i> | NaN  | not a number             |
| Ba |            |            |            |      | bar                      |

The names of the columns are shorthand for standard character encodings; “7-bit” for ISO 646:1991 IRV (US-ASCII), “8-bit” for ISO 8859-1 (Latin-1) and IBM code page 1047, and “UCS” for ISO 10646 (Unicode character set). The strings were originally defined (circa 1989) such that the best available representation would be used. For example, a Unicode-enabled terminal device using a well-chosen font will have optimal glyph representations for all of the above, whereas a Latin-1 terminal’s only advantage over an ASCII one (for these glyphs) is the plus-minus sign. Old typesetters lacked directional double quotes, and would produce repeated directional single quotes, “like this”; early versions of **mdoc** in fact defined the ‘Lq’ and ‘Rq’ strings this way. In the years since, output drivers have taken on the responsibility of glyph substitution; they are the part of the formatting process with relevant knowledge of the available repertoire.

String names which consist of two characters can be written as \\*(xx; string names which consist of one character can be written as \\*x. A general syntax for a string name of any length is \\*[xxx] (this is a GNU `troff(1)` extension).

### Diagnostics

The debugging macro `.Db` available in previous versions of **mdoc** has been removed since GNU `troff(1)` provides better facilities to check parameters; additionally, many error and warning messages have been added to this macro package, making it both more robust and verbose.

The only remaining debugging macro is `.Rd` which yields a register dump of all global registers and strings. A normal user will never need it.

### Formatting with groff, troff, and nroff

By default, the package inhibits page breaks, headers, and footers in the midst of the document text if it is being displayed with a terminal device such as ‘latin1’ or ‘utf8’, to enable more efficient viewing of the page. This behavior can be changed to format the page as if for 66-line Teletype output by setting the continuous rendering register ‘cR’ to zero while calling `groff(1)`.

```
groff -Tlatin1 -rcR=0 -mdoc foo.man > foo.txt
```

Section headings (defined with `.Sh`) and page titles in headers (defined with `.Dt`) can be presented in full capitals by setting the registers ‘CS’ and ‘CT’, respectively, to 1. These transformations are off by default because they discard case distinction information.

Setting register ‘D’ to 1 enables double-sided page layout, which is only distinct when not continuously rendering. It places the page number at the bottom right on odd-numbered (recto) pages, and at the bottom left on even-numbered (verso) pages, swapping places with the arguments to `.Os`.

```
groff -Tps -rD1 -mdoc foo.man > foo.ps
```

To change the document font size to 11pt or 12pt, set register ‘S’ accordingly:

```
groff -Tdvi -rS11 -mdoc foo.man > foo.dvi
```

Register ‘S’ is ignored for TTY devices.

The line and title length can be changed by setting the registers ‘LL’ and ‘LT’, respectively:

```
groff -Tutf8 -rLL=100n -rLT=100n -mdoc foo.man | less
```

If not set, both registers default to 78n for terminal devices and 6.5i otherwise.

Normally, automatic hyphenation is enabled using a mode appropriate to the **groff** locale; see section “Localization” of *groff(7)*. It can be disabled by setting the ‘HY’ register to zero.

```
groff -Tutf8 -rHY=0 -mdoc foo.man | less
```

The ‘AD’ and ‘HF’ strings, and ‘FT’, ‘IN’, ‘P’, ‘SN’, and ‘X’ registers, are reserved for potential future compatibility with *groff\_man(7)* page rendering options.

## Files

|                               |                                                                                                                                                         |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>doc.tmac</code>         | The main manual macro package.                                                                                                                          |
| <code>mdoc.tmac</code>        | A wrapper file to call <code>doc.tmac</code> .                                                                                                          |
| <code>mdoc/doc-common</code>  | Common strings, definitions, stuff related typographic output.                                                                                          |
| <code>mdoc/doc-nroff</code>   | Definitions used for a TTY output device.                                                                                                               |
| <code>mdoc/doc-ditroff</code> | Definitions used for all other devices.                                                                                                                 |
| <code>mdoc.local</code>       | Local additions and customizations.                                                                                                                     |
| <code>andoc.tmac</code>       | Use this file if you don’t know whether the <b>mdoc</b> or the <b>man</b> package should be used. Multiple man pages (in either format) can be handled. |

## See also

The *mandoc*: <https://mandoc.bsd.lv/> project maintains an independent implementation of the `mdoc` language and a renderer that directly parses its markup as well as that of `man`.

*groff(1)*, *man(1)*, *troff(1)*, *groff\_man(7)*, *mdoc(7)*

## Bugs

Section 3f has not been added to the header routines.

The font used by `.Nm` should be changed in the *Name* section.

`.Fn` needs to have a check to prevent splitting up the line if its length is too short. Occasionally it separates the last parenthesis, and sometimes looks ridiculous if output lines are being filled.

The list and display macros do not do any keeps and certainly should be able to.

**Name**

groff\_me – “me” macro package for formatting documents with GNU roff

**Synopsis**

**groff -me** [*option* ...] [*file* ...]

**groff -m me** [*option* ...] [*file* ...]

**Description**

The GNU implementation of the *me* macro package is part of the *groff* document formatting system. The *me* package of macro definitions for the *roff* language provides a convenient facility for preparing technical papers in various formats. This version is based on the *me* distributed with 4.4BSD and can be used with the GNU *troff* formatter as well as those descended from AT&T *troff*.

Some formatter requests are unsafe in conjunction with this package; however, the following may be used with impunity after the first call to a paragraphing macro like **lp** or **pp**. Some arguments are optional; see [groff\(7\)](#) for details, particularly of requests whose argument list is designated with an ellipsis. An asterisk \* marks *groff* extensions.

|           |              |                                                                      |
|-----------|--------------|----------------------------------------------------------------------|
| <b>ad</b> | <i>c</i>     | set text adjustment mode to <i>c</i>                                 |
| <b>af</b> | <i>r f</i>   | assign format <i>f</i> to register <i>r</i>                          |
| <b>am</b> | <i>m e</i>   | append to macro <i>m</i> until <i>e</i> called                       |
| <b>as</b> | <i>s t</i>   | append rest of line <i>t</i> to string <i>s</i>                      |
| <b>bp</b> | <i>n</i>     | begin new page numbered <i>n</i>                                     |
| <b>br</b> |              | break output line                                                    |
| <b>ce</b> | <i>n</i>     | center next <i>n</i> output lines                                    |
| <b>cp</b> | <i>n</i>     | en-/disable AT&T <i>troff</i> compatibility mode*                    |
| <b>de</b> | <i>m e</i>   | define macro <i>m</i> until <i>e</i> called                          |
| <b>do</b> | <i>t</i>     | interpret input <i>t</i> with compatibility mode off*                |
| <b>ds</b> | <i>s t</i>   | define rest of line <i>t</i> as string <i>s</i>                      |
| <b>el</b> | <i>t</i>     | interpret <i>t</i> if corresponding <b>ie</b> false                  |
| <b>fc</b> | <i>c d</i>   | set field delimiter <i>c</i> and padding glyph <i>d</i>              |
| <b>fi</b> |              | enable filling                                                       |
| <b>hc</b> | <i>c</i>     | set hyphenation character to <i>c</i>                                |
| <b>hy</b> | <i>m</i>     | set automatic hyphenation mode to <i>m</i>                           |
| <b>ie</b> | <i>p t</i>   | as <b>if</b> , but enable interpretation of later <b>el</b>          |
| <b>if</b> | <i>p t</i>   | if condition <i>p</i> , interpret rest of line <i>t</i>              |
| <b>in</b> | <i>h</i>     | set indentation to distance <i>h</i>                                 |
| <b>lc</b> | <i>c</i>     | set leader repetition glyph to <i>c</i>                              |
| <b>ls</b> | <i>n</i>     | set line spacing to <i>n</i>                                         |
| <b>mc</b> | <i>c h</i>   | set (right) margin glyph to <i>c</i> at distance <i>h</i>            |
| <b>mk</b> | <i>r</i>     | mark vertical position in register <i>r</i>                          |
| <b>na</b> |              | disable adjustment of text                                           |
| <b>ne</b> | <i>v</i>     | need vertical space of distance <i>v</i>                             |
| <b>nf</b> |              | disable filling                                                      |
| <b>nh</b> |              | disable automatic hyphenation                                        |
| <b>nr</b> | <i>r n i</i> | assign register <i>r</i> value <i>n</i> with auto-increment <i>i</i> |
| <b>ns</b> |              | begin no-space mode                                                  |
| <b>pl</b> | <i>v</i>     | set page length to <i>v</i>                                          |
| <b>pn</b> | <i>n</i>     | set next page number to <i>n</i>                                     |
| <b>po</b> | <i>h</i>     | set page offset to <i>h</i>                                          |
| <b>rj</b> | <i>n</i>     | right-align next <i>n</i> output lines*                              |
| <b>rm</b> | <i>m</i>     | remove macro, string, or request <i>m</i>                            |
| <b>rn</b> | <i>m n</i>   | rename macro, string, or request <i>m</i> to <i>n</i>                |
| <b>rr</b> | <i>r</i>     | remove register <i>r</i>                                             |
| <b>rs</b> |              | resume spacing (end no-space mode)                                   |
| <b>rt</b> | <i>v</i>     | return to vertical position set by <b>mk</b> , or <i>v</i>           |

|           |          |                                                        |
|-----------|----------|--------------------------------------------------------|
| <b>so</b> | <i>f</i> | source (interpolate) input file <i>f</i>               |
| <b>sp</b> | <i>n</i> | insert <i>n</i> lines of vertical space                |
| <b>ta</b> | ...      | set tab stops                                          |
| <b>tc</b> | <i>c</i> | set tab repetition glyph to <i>c</i>                   |
| <b>ti</b> | <i>h</i> | set temporary indentation (next line only) to <i>h</i> |
| <b>tl</b> | ...      | output three-part title                                |
| <b>tr</b> | ...      | translate characters                                   |
| <b>ul</b> | <i>n</i> | underline next <i>n</i> output lines                   |

Except on title pages (produced by calling **tp**), *me* suppresses the output of vertical space at the tops of pages; the **sp** request will thus not work there. You can instead call **bl** or enclose the desired spacing request in a diversion, for instance by calling (**b** and **)b**. *me* also intercepts the **ll** request; see the “*me* Reference Manual” for details.

Output of the *grn*, *pic*, *eqn*, *refer*, and *tbl* preprocessors is acceptable as input.

### Name space

Objects in *me* follow a rigid naming convention. To avoid conflict, any user-defined register, string, or macro names should be single numerals or uppercase letters, or any longer sequence of letters and numerals with at least one uppercase letter. (For portability between BSD and *groff me*, limit names to two characters, and avoid the name **[** (left square bracket).) The names employed by any preprocessors in use should also not be repurposed.

### Macros

|            |                                 |
|------------|---------------------------------|
| <b>\$0</b> | post-section heading hook       |
| <b>\$1</b> | pre-section depth 1 hook        |
| <b>\$2</b> | pre-section depth 2 hook        |
| <b>\$3</b> | pre-section depth 3 hook        |
| <b>\$4</b> | pre-section depth 4 hook        |
| <b>\$5</b> | pre-section depth 5 hook        |
| <b>\$6</b> | pre-section depth 6 hook        |
| <b>\$C</b> | post-chapter title hook         |
| <b>\$H</b> | page/column heading hook        |
| <b>\$c</b> | output chapter number and title |
| <b>\$f</b> | output footer                   |
| <b>\$h</b> | output header                   |
| <b>\$p</b> | output section heading          |
| <b>\$s</b> | output footnote area separator  |
| <b>(b</b>  | begin block                     |
| <b>(c</b>  | begin centered block            |
| <b>(d</b>  | begin delayed text              |
| <b>(f</b>  | begin footnote                  |
| <b>(l</b>  | begin list                      |
| <b>(q</b>  | begin long quotation            |
| <b>(x</b>  | begin index entry               |
| <b>(z</b>  | begin floating keep             |
| <b>)b</b>  | end block                       |
| <b>)c</b>  | end centered block              |
| <b>)d</b>  | end delayed text                |
| <b>)f</b>  | end footnote                    |
| <b>)l</b>  | end list                        |
| <b>)q</b>  | end long quotation              |
| <b>)x</b>  | end index entry                 |
| <b>)z</b>  | end floating keep               |
| <b>++</b>  | set document segment type       |
| <b>+c</b>  | begin chapter                   |

|           |                                                          |
|-----------|----------------------------------------------------------|
| <b>1c</b> | end multi-column layout                                  |
| <b>2c</b> | begin multi-column layout                                |
| <b>EN</b> | end <i>eqn</i> equation                                  |
| <b>EQ</b> | begin <i>eqn</i> equation                                |
| <b>GE</b> | end <i>grn</i> picture with drawing position at bottom   |
| <b>GF</b> | end <i>grn</i> picture with drawing position at top      |
| <b>GS</b> | start <i>grn</i> picture                                 |
| <b>IE</b> | end <i>ideal</i> picture with drawing position at bottom |
| <b>IF</b> | end <i>ideal</i> picture with drawing position at top    |
| <b>IS</b> | start <i>ideal</i> picture                               |
| <b>PE</b> | end <i>pic</i> picture with drawing position at bottom   |
| <b>PF</b> | end <i>pic</i> picture with drawing position at top      |
| <b>PS</b> | start <i>pic</i> picture                                 |
| <b>TE</b> | end <i>tbl</i> table                                     |
| <b>TH</b> | end heading for multi-page <i>tbl</i> table              |
| <b>TS</b> | start <i>tbl</i> table                                   |
| <b>b</b>  | embolden argument                                        |
| <b>ba</b> | set base indentation                                     |
| <b>bc</b> | begin new column                                         |
| <b>bi</b> | embolden and italicize argument                          |
| <b>bx</b> | box argument                                             |
| <b>ef</b> | set even-numbered page footer                            |
| <b>eh</b> | set even-numbered page header                            |
| <b>ep</b> | end page                                                 |
| <b>fo</b> | set footer                                               |
| <b>he</b> | set header                                               |
| <b>hl</b> | draw horizontal line                                     |
| <b>hx</b> | suppress next page's headers/footers                     |
| <b>i</b>  | italicize argument                                       |
| <b>ip</b> | begin indented paragraph                                 |
| <b>ld</b> | reset localization and date registers and strings*       |
| <b>ll</b> | set line length                                          |
| <b>lp</b> | begin fully left-aligned paragraph                       |
| <b>np</b> | begin numbered paragraph                                 |
| <b>of</b> | set odd-numbered page footer                             |
| <b>oh</b> | set odd-numbered page header                             |
| <b>pd</b> | output delayed text                                      |
| <b>pp</b> | begin first-line indented paragraph                      |
| <b>q</b>  | quote argument                                           |
| <b>r</b>  | set argument in roman                                    |
| <b>re</b> | reset tab stops                                          |
| <b>sh</b> | begin numbered section                                   |
| <b>sm</b> | set argument at smaller type size                        |
| <b>sx</b> | change section depth                                     |
| <b>sz</b> | set type size and vertical spacing                       |
| <b>tp</b> | begin title page                                         |
| <b>u</b>  | underline argument                                       |
| <b>uh</b> | begin unnumbered section                                 |
| <b>xl</b> | set line length (local)                                  |
| <b>xp</b> | output index                                             |

Some macros are provided for “old” *roff*(1) compatibility. The “*me* Reference Manual” describes alternatives for modern documents.

|           |                                                 |
|-----------|-------------------------------------------------|
| <b>ar</b> | use Arabic numerals for page numbers            |
| <b>bl</b> | insert space (even at page top; cf. <b>sp</b> ) |
| <b>ix</b> | set indentation without break                   |
| <b>m1</b> | set page top to header distance                 |
| <b>m2</b> | set header to text distance                     |
| <b>m3</b> | set text to footer distance                     |
| <b>m4</b> | set footer to page bottom distance              |
| <b>n1</b> | begin output line numbering                     |
| <b>n2</b> | end or alter output line numbering              |
| <b>pa</b> | begin page                                      |
| <b>ro</b> | use Roman numerals for page numbers             |
| <b>sk</b> | skip next page                                  |

**Registers**

|            |                                                     |
|------------|-----------------------------------------------------|
| <b>\$0</b> | section depth                                       |
| <b>\$1</b> | first section number component                      |
| <b>\$2</b> | second section number component                     |
| <b>\$3</b> | third section number component                      |
| <b>\$4</b> | fourth section number component                     |
| <b>\$5</b> | fifth section number component                      |
| <b>\$6</b> | sixth section number component                      |
| <b>\$c</b> | current column number                               |
| <b>\$d</b> | delayed text number                                 |
| <b>\$f</b> | footnote number                                     |
| <b>\$i</b> | paragraph base indentation                          |
| <b>\$l</b> | column width                                        |
| <b>\$m</b> | number of available columns                         |
| <b>\$p</b> | numbered paragraph number                           |
| <b>\$s</b> | column spacing (indentation)                        |
| <b>bi</b>  | display (block) indentation                         |
| <b>bm</b>  | distance from text area to page bottom              |
| <b>bs</b>  | display (block) pre/post space                      |
| <b>bt</b>  | block threshold for keeps                           |
| <b>ch</b>  | current chapter number                              |
| <b>df</b>  | display font                                        |
| <b>dv</b>  | vertical spacing of displayed text (as percentage)* |
| <b>es</b>  | equation pre/post space                             |
| <b>ff</b>  | footnote font                                       |
| <b>fi</b>  | footnote indentation (first line only)              |
| <b>fm</b>  | footer margin                                       |
| <b>fp</b>  | footnote type size in points                        |
| <b>fs</b>  | footnote prespace                                   |
| <b>fu</b>  | footnote indent (right indentation)                 |
| <b>hm</b>  | header margin                                       |
| <b>ii</b>  | indented paragraph indentation                      |
| <b>no</b>  | line numbering offset*                              |
| <b>pf</b>  | paragraph font                                      |
| <b>pi</b>  | paragraph indentation                               |
| <b>po</b>  | page offset                                         |
| <b>pp</b>  | paragraph type size in points                       |
| <b>ps</b>  | paragraph prespace                                  |
| <b>qi</b>  | long quotation left/right indentation               |
| <b>qp</b>  | long quotation type size in points                  |
| <b>qs</b>  | long quotation pre/post space                       |

|           |                                           |
|-----------|-------------------------------------------|
| <b>sf</b> | section title font                        |
| <b>si</b> | section indentation per level of depth    |
| <b>so</b> | additional section title offset           |
| <b>sp</b> | section title type size in points         |
| <b>ss</b> | section prespace                          |
| <b>sx</b> | super/subscript line height increase*     |
| <b>tf</b> | title font                                |
| <b>tm</b> | distance from page top to text area       |
| <b>tp</b> | title type size in points                 |
| <b>tv</b> | vertical spacing of text (as percentage)* |
| <b>xs</b> | index entry prespace                      |
| <b>xu</b> | index undent (right indentation)          |
| <b>y2</b> | year of the century*                      |
| <b>y4</b> | year*                                     |
| <b>yr</b> | year minus 1900                           |
| <b>zs</b> | floating keep pre/post space              |

**Strings**

|             |                                          |
|-------------|------------------------------------------|
| <b>#</b>    | delayed text marker                      |
| <b>\$n</b>  | concatenated section number              |
| <b>*</b>    | footnote marker                          |
| <b>–</b>    | em dash                                  |
| <b>&lt;</b> | begin subscripting                       |
| <b>&gt;</b> | end subscripting                         |
| <b>dw</b>   | weekday name                             |
| <b>lq</b>   | left double quotation mark               |
| <b>mo</b>   | month name                               |
| <b>rq</b>   | right double quotation mark              |
| <b>td</b>   | date                                     |
| <b>wa</b>   | term for “appendix” used by <b>.\$c*</b> |
| <b>wc</b>   | term for “chapter” used by <b>.\$c*</b>  |
| <b>{</b>    | begin superscripting                     |
| <b>}</b>    | end superscripting                       |

**Files**

*/usr/local/share/groff/1.23.0/tmac/e.tmac*  
implements the package.

*/usr/local/share/groff/1.23.0/tmac/refer-me.tmac*  
implements *refer(1)* support for *me*.

*/usr/local/share/groff/1.23.0/tmac/me.tmac*  
is a wrapper enabling the package to be loaded with “**groff -m me**”.

**Notes**

Early *roff* macro packages limited themselves to a single-letter namespace (*mm*, *ms*, *mv*, *mn*, and so on). The “e” in “me” stands for “Eric P. Allman”, who wrote the macro package and the original technical papers documenting it while an undergraduate at the University of California.

**See also**

Two manuals are available in source and rendered form. On your system, they may be compressed and/or available in additional formats.

*/usr/local/share/doc/groff-1.23.0/meintro.me*  
*/usr/local/share/doc/groff-1.23.0/meintro.ps*

is “Writing Papers with *Groff* Using *-me*”, by Eric P. Allman, adapted for *groff* by James Clark.

*/usr/local/share/doc/groff-1.23.0/meref.me*

*/usr/local/share/doc/groff-1.23.0/meref.ps*

is the “*me* Reference Manual”, by Eric P. Allman, adapted for *groff* by James Clark and G. Branden Robinson.

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “`info groff`”.

For preprocessors supported by *me*, see [eqn\(1\)](#), [grn\(1\)](#), [pic\(1\)](#), [refer\(1\)](#), and [tbl\(1\)](#).

[groff\(1\)](#), [troff\(1\)](#), [groff\(7\)](#)

**Name**

groff\_mm – memorandum macros for GNU roff

**Synopsis**

**groff -mm** [*option* ...] [*file* ...]

**groff -m mm** [*option* ...] [*file* ...]

**Description**

The GNU implementation of the *mm* macro package is part of the *groff* document formatting system. The *mm* package is suitable for the composition of letters, memoranda, reports, and books.

*groff mm* is intended to be compatible with the *mm* implementation found in the AT&T Documenter's Workbench (DWB), with the following limitations.

- No Bell Labs localisms are implemented.
- The macros **OK** and **PM** are not implemented.
- Cut marks are not supported.

**Localization**

*groff mm* is designed to be easily localized. For languages other than English, strings that can appear in output are collected in the file `/usr/local/share/groff/1.23.0/tmac/xx.tmac`, where *xx* is an ISO 639 two-letter language identifier. For Swedish, this is *sv.tmac*; “sv”, not “se”.

This package can also be localized by site or territory; for example, `/usr/local/share/groff/1.23.0/tmac/mse.tmac` illustrates how to adapt the output to a national standard using its ISO 3166 territory code. Such a package can define a string that causes a macro file `/usr/local/share/groff/1.23.0/tmac/mm/territory_locale` to be loaded at package initialization. If this mechanism is not used, `/usr/local/share/groff/1.23.0/tmac/mm/locale` is loaded instead. No diagnostic is produced if these files do not exist.

**Registers and strings**

The behavior of many macros can be configured by registers and strings. A register is assigned with the **nr** request.

**.nr** *ident* [ $\pm$ ]*n* [*i*]

*ident* is the name of the register, and *n* is the value to be assigned. *n* can be prefixed with a plus or minus sign if incrementation or decrementation (respectively) of the register's existing value by *n* is desired. If assignment of a (possibly) negative *n* is required, further prefix it with a zero or enclose it in parentheses. If *i* is specified, the register is automatically modified by *i* prior to interpolation if a plus or minus sign is included in the escape sequence as follows.

$\backslash n[\pm][i]ident$

*i* can be negative; it combines algebraically with the sign in the interpolation escape sequence.

Strings are defined with the **ds** request.

**.ds** *ident string*

The string is assigned everything up to the end of the line, including trailing spaces. It is a good practice to end *string* with a comment escape sequence ( $\backslash''$ ) so that extraneous spaces do not intrude during document maintenance. To include leading spaces in *string*, prefix it with a double quote. Strings are interpolated with the  $\backslash*$  escape sequence.

$\backslash*[i]ident$

Register and string name spaces are distinct, but strings and macros share a name space. Defining a string with the same name as an *mm* macro is not supported and may cause incorrect rendering, the emission of diagnostic messages, and an error exit status from *troff*.

**Register format**

A register is interpolated using Arabic numerals if no other format has been assigned to it. Assign a format to a register with the **af** request.

**.af** *R c*

*R* is the name of the register, and *c* is the format. If *c* is a sequence of Arabic numerals, their quantity defines a zero-padded minimum width for the interpolated register value.

| Form | Sequence                           |
|------|------------------------------------|
| 1    | 0, 1, 2, 3, ..., 10, ...           |
| 001  | 000, 001, 002, 003, ..., 1000, ... |
| i    | 0, i, ii, iii, iv, ...             |
| I    | 0, I, II, III, IV, ...             |
| a    | 0, a, b, c, ..., z, aa, ab, ...    |
| A    | 0, A, B, C, ..., Z, AA, AB, ...    |

**Fonts**

In *groff mm*, the fonts (or rather, font styles) **R** (roman), **I** (italic), and **B** (bold) are mounted at font positions **1**, **2**, and **3**, respectively. Internally, font positions are used for backwards compatibility. From a practical point of view, it doesn't make a big difference—a different font family can still be selected by invoking *groff*'s **fam** request or using its **-f** command-line option. On the other hand, if you want to replace just, for example, font **I** with Zapf Chancery Medium italic (available on *groff*'s **pdf** and **ps** output devices), you have to use the **fp** request, replacing the font at position 2 with **“.fp 2 ZCMI”**. Because the cover sheet, memorandum type, and *refer(1)* integration macros explicitly request fonts named **B**, **I**, and **R**, you will also need to remap these font names with the **ft** request, for instance with **“.ft R I ZCMI”**.

**Macros****)E** *level text*

Add heading text *text* to the table of contents with *level*, which is either 0 or in the range 1 to 7. See also **.H**. This macro is used for customized tables of contents.

**1C** [**1**] Begin one-column processing. A **1** as an argument disables the page break. Use wide footnotes, small footnotes may be overprinted.

**2C** Begin two-column processing. Splits the page in two columns. It is a special case of **MC**. See also **1C**.

**AE** Abstract end, see **AS**.

**AF** [*name-of-firm*]

Author's firm, should be called before **AU**, see also **COVER**.

**AL** [*type* [*text-indent* [**1**]]]

Start auto-increment list. Items are numbered beginning with one. The *type* argument controls the format of numbers.

| Arg | Description              |
|-----|--------------------------|
| 1   | Arabic (the default)     |
| A   | Upper-case letters (A–Z) |
| a   | Lower-case letters (a–z) |
| I   | Upper-case roman         |
| i   | Lower-case roman         |

*text-indent* sets the indentation and overrides **Li**. A third argument prohibits printing of a blank line before each item.

**APP** *name text*

Begin an appendix with name *name*. Automatic naming occurs if *name* is **""**. The appendices start with **A** if automatic naming is used. A new page is ejected, and a header is also produced if the register **Aph** is non-zero. This is the default. The appendix always appears in the “List of contents” with correct page numbers. The name “APPENDIX” can be changed by setting the string **App** to the desired text. The string **Apptxt** contains the current appendix text.



**BS** Bottom block start. Begins the definition of a text block which is printed at the bottom of each page. The block ends with **BE**.

**BVL** *text-indent* [*mark-indent* [**1**]]

Start of broken variable-item list. Broken variable-item list has no fixed mark, it assumes that every **LI** has a mark instead. The text always begins at the next line after the mark. *text-indent* sets the indentation to the text, and *mark-indent* the distance from the current indentation to the mark. A third argument prohibits printing of a blank line before each item.

**COVER** [*style*]

Begin a cover sheet description. It is important that **.COVER** appear before any of the body text (or main matter) of a document. The argument *style* is used to construct the file name `/usr/local/share/groff/1.23.0/tmac/mm/style.cov` and load it with the **mso** request. Therefore it is possible to create unlimited types of cover sheets. The default *style* is **ms**; it structures a cover sheet to resemble that used by the *ms* package. **.COVER** requires a **.COVEND** at the end of the cover description. Always use the following ordering of the cover sheet macros.

```
.COVER
.TL
.AF
.AU
.AT
.AS
.AE
.COVEND
```

Only **.TL** and **.AU** are required.

**COVEND**

End the cover description and output the cover page. This macro is defined in the cover sheet macro file.

**DE** Display end. Ends a block of text or display that begins with **DS** or **DF**.

**DF** [*format* [*fill* [*rindent*]]]

Begin floating display (no nesting allowed). A floating display is saved in a queue and is printed in the order entered. *Format*, *fill*, and *rindent* are the same as in **DS**. Floating displays are controlled by the registers **De** and **Df**.

**De** register

- 0 Nothing special, this is the default.
- 1 A page eject occurs after each printed display, giving only one display per page and no text following it.

**Df** register

- 0 Displays are printed at the end of each section (when section-page numbering is active) or at the end of the document.
- 1 A new display is printed on the current page if there is enough space, otherwise it is printed at the end of the document.
- 2 One display is printed at the top of each page (or column, in multi-column mode).
- 3 Print one display if there is enough space for it, otherwise it is printed at the top of the next page or column.
- 4 Print as many displays as possible in a new page or column. A page break occurs between each display if **De** is not zero.
- 5 Fill the current page with displays and the rest beginning at a new page or column. (This is the default.) A page break occurs between each display if **De** is not zero.

**DL** [*text-indent* [**1** [**1**]]]

Dash list start. Begins a list where each item is printed after a dash. *text-indent* changes the default indentation of the list items set by register **Pi**. A second argument prevents an empty line be-

tween each list item. See **LI**. A third argument prohibits printing of a blank line before each item.

**DS** [*format* [*fill* [*rindent*]]]

Static display start. Begins collection of text until **DE**. The text is printed together on the same page, unless it is longer than the height of the page. **DS** can be nested arbitrarily.

**format**

|      |                                                    |
|------|----------------------------------------------------|
| ""   | No indentation.                                    |
| none | No indentation.                                    |
| L    | No indentation.                                    |
| I    | Indent text with the value of register <b>Si</b> . |
| C    | Center each line.                                  |
| CB   | Center the whole display as a block.               |
| R    | Right-adjust the lines.                            |
| RB   | Right-adjust the whole display as a block.         |

The values “L”, “I”, “C”, and “CB” can also be specified as “0”, “1”, “2”, and “3”, respectively, for compatibility reasons.

**fill**

|      |                          |
|------|--------------------------|
| ""   | Line-filling turned off. |
| none | Line-filling turned off. |
| N    | Line-filling turned off. |
| F    | Line-filling turned on.  |

“N” and “F” can also be specified as “0” and “1”, respectively.

By default, an empty line is printed before and after the display. Setting register **Ds** to 0 prevents this. *rindent* shortens the line length by that amount.

**EC** [*title* [*override* [*flag* [*refname*]]]]

Equation title. Sets a title for an equation. The *override* argument changes the numbering.

**flag**

|      |                                            |
|------|--------------------------------------------|
| none | <i>override</i> is a prefix to the number. |
| 0    | <i>override</i> is a prefix to the number. |
| 1    | <i>override</i> is a suffix to the number. |
| 2    | <i>override</i> replaces the number.       |

**EC** uses the register **Ec** as a counter. It is possible to use **.af** to change the format of the number. If register **Of** is 1, the format of title uses a dash instead of a dot after the number.

The string **Le** controls the title of the List of Equations; default is “LIST OF EQUATIONS”. The List of Equations is printed only if register **Le** is 1. The default is 0. The string **Liec** contains the word “Equation”, which is printed before the number. If *refname* is used, then the equation number is saved with **.SETR**, and can be retrieved with “**.GETST refname**”.

Special handling of the title occurs if **EC** is used inside **DS/DE**; it is not affected by the format of **DS**.

**EF** [*arg*]

Even-page footer, printed just above the normal page footer on even pages. See **PF**.

This macro defines string **EOPef**.

**EH** [*arg*]

Even-page header, printed just below the normal page header on even pages. See **PH**.

This macro defines string **TPeh**.

**EN** Equation end, see **EQ**.

**EOP** End-of-page user-defined macro. This macro is called instead of the normal printing of the footer. The macro is executed in a separate environment, without any trap active. See **TP**.

**Strings available to EOP**

EOPf argument of **PF**  
 EOPef argument of **EF**  
 EOPof argument of **OF**

**EPIC** [-L] *width height [name]*

Draw a box with the given *width* and *height*. It also prints the text *name* or a default string if *name* is not specified. This is used to include external pictures; just give the size of the picture. **-L** left-aligns the picture; the default is to center. See **PIC**.

**EQ** [*label*]

Equation start. **EQ/EN** are the delimiters for equations written for *eqn(1)*. **EQ/EN** must be inside of a **DS/DE** pair, except if **EQ** is used to set options for *eqn* only. The *label* argument appears at the right margin of the equation, centered vertically within the **DS/DE** block, unless register **Eq** is 1. Then the label appears at the left margin.

If there are multiple **EQ/EN** blocks within a single **DS/DE** pair, only the last equation label (if any) is printed.

**EX** [*title [override [flag [refname]]]]*]

Exhibit title. The arguments are the same as for **EC**. **EX** uses the register **Ex** as a counter. The string **Lx** controls the title of the List of Exhibits; default is "LIST OF EXHIBITS". The List of Exhibits is printed only if register **Lx** is 1, which is the default. The string **Liex** contains the word "Exhibit", which is printed before the number. If *refname* is used, the exhibit number is saved with **.SETR**, and can be retrieved with **.GETST refname**.

Special handling of the title occurs if **EX** is used inside **DS/DE**; it is not affected by the format of **DS**.

**FC** [*closing*]

Print "Yours very truly," as a formal closing of a letter or memorandum. The argument replaces the default string. The default is stored in the string **Letfc**.

**FD** [*arg [1]*]

Footnote default format. Controls the hyphenation (**hyphen**), adjustment to the right margin (**adjust**), and indentation of footnote text (**indent**). It can also change the label justification (**ljust**).

| <b>arg</b> | <b>hyphen</b> | <b>adjust</b> | <b>indent</b> | <b>ljust</b> |
|------------|---------------|---------------|---------------|--------------|
| 0          | no            | yes           | yes           | left         |
| 1          | yes           | yes           | yes           | left         |
| 2          | no            | no            | yes           | left         |
| 3          | yes           | no            | yes           | left         |
| 4          | no            | yes           | no            | left         |
| 5          | yes           | yes           | no            | left         |
| 6          | no            | no            | no            | left         |
| 7          | yes           | no            | no            | left         |
| 8          | no            | yes           | yes           | right        |
| 9          | yes           | yes           | yes           | right        |
| 10         | no            | no            | yes           | right        |
| 11         | yes           | no            | yes           | right        |

An argument greater than or equal to 11 is considered as value 0. The default for *mm* is 10.

**FE** Footnote end.

**FG** [*title [override [flag [refname]]]]*]

Figure title. The arguments are the same as for **EC**. **FG** uses the register **Fg** as a counter. The string **Lf** controls the title of the List of Figures; default is "LIST OF FIGURES". The List of Fig-

ures is printed only if register **Lf** is 1, which is the default. The string **Lifg** contains the word “Figure”, which is printed before the number. If *refname* is used, then the figure number is saved with **.SETR**, and can be retrieved with “**.GETST refname**”.

Special handling of the title occurs if **FG** is used inside **DS/DE**, it is not affected by the format of **DS**.

#### **FS** [*label*]

Footnote start. The footnote is ended by **FE**. By default, footnotes are automatically numbered; the number is available in string **F**. Just add **\\*F** in the text. By adding *label*, it is possible to have other number or names on the footnotes. Footnotes in displays are now possible. An empty line separates footnotes; the height of the line is controlled by register **Fs**, default value is 1.

#### **GETHN** *refname* [*varname*]

Include the header number where the corresponding “**.SETR refname**” was placed. This is displayed as “X.X.X.” in pass 1. See **INITR**. If *varname* is used, **GETHN** sets the string *varname* to the header number.

#### **GETPN** *refname* [*varname*]

Include the page number where the corresponding “**.SETR refname**” was placed. This is displayed as “9999” in pass 1. See **INITR**. If *varname* is used, **GETPN** sets the string *varname* to the page number.

#### **GETR** *refname*

Combine **GETHN** and **GETPN** with the text “chapter” and “, page”. The string **Qrf** contains the text for the cross reference:

```
.ds Qrf See chapter \*[Qrfh], page \*[Qrfp].
```

**Qrf** may be changed to support other languages. Strings **Qrfh** and **Qrfp** are set by **GETR** and contain the page and header number, respectively.

#### **GETST** *refname* [*varname*]

Include the string saved with the second argument to **.SETR**. This is a dummy string in pass 1. If *varname* is used, **GETST** sets it to the saved string. See **INITR**.

#### **H level** [*heading-text* [*heading-suffix*]]

Numbered section heading. Section headers can have a level between 1 and 14; level 1 is the top level. The text is given in *heading-text*, and must be surrounded by double quotes if it contains spaces. *heading-suffix* is added to the header in the text but not in the table of contents. This is normally used for footnote marks and similar things. Don’t use **\\*F** in *heading-suffix*, it doesn’t work. A manual label must be used, see **FS**.

A call to the paragraph macro **P** directly after **H** is ignored. **H** takes care of spacing and indentation.

#### **Page ejection before heading**

Register **Ej** controls page ejection before the heading. By default, a level-one heading gets two blank lines before it; higher levels only get one. A new page is ejected before each first-level heading if register **Ej** is 1. All levels below or equal the value of **Ej** get a new page. Default value for **Ej** is 0.

#### **Heading break level**

A line break occurs after the heading if the heading level is less or equal to register **Hb**. Default value is 2.

#### **Heading space level**

A blank line is inserted after the heading if the heading level is less or equal to register **Hs**. Default value is 2.



**;0** (register)

Contains the position of the text after the heading. 0 means that the text should follow the heading on the same line, 1 means that a line break should occur before the text, and 2 means that a blank line should separate the heading and the text.

**}2** (string)

Contains two spaces if register **;0** is 0. It is used to separate the heading from the text. The string is empty if **;0** is non-zero.

**;3** (register)

Contains the needed space in units after the heading. Default is 2v. Can be used to change things like numbering (**J0**), vertical spacing (**J2**), and the needed space after the heading.

**HY** *dlevel rlevel heading-text*

This macro is called after size and font calculations and might be used to change indentation.

**HZ** *dlevel rlevel heading-text*

This macro is called after the printing of the heading, just before **H** or **HU** exits. Can be used to change the page header according to the section heading.

**HC** [*hyphenation-character*]

Set hyphenation character. Default value is “\%”. Resets to the default if called without argument. Hyphenation can be turned off by setting register **Hy** to 0 at the beginning of the file.

**HM** [*arg1 [arg2 [... [arg14]]]]*]

Heading mark style. Controls the type of marking for printing of the heading counters. Default is 1 for all levels.

**Argument**

|      |                                                   |
|------|---------------------------------------------------|
| 1    | Arabic numerals.                                  |
| 0001 | Arabic numerals with leading zeroes, one or more. |
| A    | upper-case alphabetic                             |
| a    | lower-case alphabetic                             |
| I    | upper-case roman numerals                         |
| i    | lower-case roman numerals                         |
| ""   | Arabic numerals.                                  |

**HU** *heading-text*

Unnumbered section header. **HU** behaves like **H** at the level in register **Hu**. See **H**.

**HX** *dlevel rlevel heading-text*

User-defined heading exit. Called just before printing the header. See **H**.

**HY** *dlevel rlevel heading-text*

User-defined heading exit. Called just before printing the header. See **H**.

**HZ** *dlevel rlevel heading-text*

User-defined heading exit. Called just after printing the header. See **H**.

**I** [*italic-text [previous-font-text]] ...*

Join *italic-text* in italics with *previous-font-text* in the previous font, without space between the arguments. If no arguments, switch font to italic style.

**IA** [*addressee-name [title]*]

Begin specification of the addressee and addressee’s address in letter style. Several names can be specified with empty **IA/IE**-pairs, but only one address. See **LT**.

**IB** [*italic-text* [**bold-text**]] . . .

Join *italic-text* in italics with **bold-text** in boldface, without space between the arguments.

**IE** End the address specification after **IA**.

**INITI** *type filename* [*macro*]

Initialize the new index system and set the filename to collect index lines in with **IND**. Argument *type* selects the type of index: page number, header marks or both. The default is page numbers.

It is also possible to create a macro that is responsible for formatting each row; just add the name of the macro as a third argument. The macro is then called with the index as argument(s).

**type**

N Page numbers

H Header marks

B Both page numbers and header marks, separated with a tab character.

**INTR** *filename*

Initialize the cross reference macros. Cross references are written to stderr and are supposed to be redirected into file *filename.qrf*. Requires two passes with groff; this is handled by a separate program called *mmroff(1)*. This program exists because *groff(1)* by default deactivates the unsafe operations that are required by **INTR**. The first pass looks for cross references, and the second one includes them. **INTR** can be used several times, but it is only the first occurrence of **INTR** that is active.

See also **SETR**, **GETPN**, and **GETHN**.

**IND** *arg1* [*arg2* [. . .]]

Write a line in the index file selected by **INITI** with all arguments and the page number or header mark separated by tabs.

**Examples**

*arg1*\t*page number*

*arg1*\t*targ2*\t*page number*

*arg1*\t*header mark*

*arg1*\t*page number*\t*header mark*

**INDP** Print the index by running the command specified by the string **Indcmd**, which has “**sort -t**” as the default value. **INDP** reads the output from the command to form the index, by default in two columns (this can be changed by defining **TYIND**). The index is printed with the string **Index** as header; the default is “INDEX”. One-column processing is reactivated after the list. **INDP** calls the user-defined macros **TXIND**, **TYIND**, and **TZIND** if defined. **TXIND** is called before printing the string “INDEX”, **TYIND** is called instead of printing “INDEX”, and **TZIND** is called after the printing and should take care of restoring to normal operation again.

**IR** [*italic-text* [*roman-text*]] . . .

Join *italic-text* in italics with *roman-text* in roman style, without space between the arguments.

**ISODATE** [0]

Use ISO 8601 format for the date string **DT** used by some cover sheet and memorandum types; that is, *YYYY-MM-DD*. Must be called before **ND** to be effective. If given an argument of **0**, the traditional date format for the *groff* locale is used; this is also the default.

**LB** *text-indent mark-indent pad type* [*mark* [*LI-space* [*LB-space*]]]

List-begin macro. This is the common macro used for all lists. *text-indent* is the number of spaces to indent the text from the current indentation.

*pad* and *mark-indent* control where to put the mark. The mark is placed within the mark area, and *mark-indent* sets the number of spaces before this area. By default it is 0. The mark area ends where the text begins. The start of the text is still controlled by *text-indent*.

The mark is left-justified within the mark area if *pad* is 0. If *pad* is greater than 0, *mark-indent* is ignored, and the mark is placed *pad* spaces before the text. This right-justifies the mark.

If *type* is 0 the list either has a hanging indentation or, if argument *mark* is given, the string *mark* as a mark.

If *type* is greater than 0 automatic numbering occurs, using arabic numbers if *mark* is empty. *mark* can then be any of “1”, “A”, “a”, “I”, or “i”.

*type* selects one of six possible ways to display the mark.

**type**

- |   |     |
|---|-----|
| 1 | x.  |
| 2 | x)  |
| 3 | (x) |
| 4 | [x] |
| 5 | <x> |
| 6 | {x} |

Every item in the list gets *LI-space* number of blank lines before them. Default is 1.

**LB** itself prints *LB-space* blank lines. Default is 0.

**LC** [*list-level*]

List-status clear. Terminates all current active lists down to *list-level*, or 0 if no argument is given. This is used by **H** to clear any active list.

**LE** [**1**] List end. Terminates the current list. **LE** outputs a blank line if an argument is given.

**LI** [*mark* [**1**|**2**]]

List item preceding every item in a list. Without argument, **LI** prints the mark determined by the current list type. By giving **LI** one argument, it uses that as the mark instead. Two arguments to **LI** makes *mark* a prefix to the current mark. There is no separating space between the prefix and the mark if the second argument is “2” instead of “1”. This behaviour can also be achieved by setting register **Limsp** to zero. A zero length *mark* makes a hanging indentation instead.

A blank line is printed before the list item by default. This behaviour can be controlled by register **Ls**. Pre-spacing occurs for each list level less than or equal to **Ls**. Default value is 99. There is no nesting limit.

The indentation can be changed through register **Li**. Default is 6.

All lists begin with a list initialization macro, **LB**. There are, however, seven predefined list types to make lists easier to use. They all call **LB** with different default values.

- |            |                                |
|------------|--------------------------------|
| <b>AL</b>  | Automatically Incremented List |
| <b>ML</b>  | Marked List                    |
| <b>VL</b>  | Variable-Item List             |
| <b>BL</b>  | Bullet List                    |
| <b>DL</b>  | Dash List                      |
| <b>RL</b>  | Reference List                 |
| <b>BVL</b> | Broken Variable List.          |

These lists are described at other places in this manual. See also **LB**.

**LT** [*arg*]

Format a letter in one of four different styles depending on the argument. Also see section “Internals” below.

**Arg**    **Style**

- |           |                                                                                                                                              |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BL</b> | Blocked. Date line, return address, writer’s address and closing begins at the center of the line. All other lines begin at the left margin. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|

- SB Semi-blocked. Same as blocked, except that the first line in every paragraph is indented five spaces.
- FB Full-blocked. All lines begin at the left margin.
- SP Simplified. As full-blocked, but the salutation is replaced by a fully-capitalized subject, any formal closing is omitted, and the author's signature is presented on a single line in full capitals.

**LO** *type* [*arg*]

Specify options in letter (see **.LT**). This is a list of the standard options:

- CN Confidential notation. Prints "CONFIDENTIAL" on the second line below the date line. Any argument replaces "CONFIDENTIAL". See also string **LetCN**.
- RN Reference notation. Prints "In reference to:" and the argument two lines below the date line. See also string **LetRN**.
- AT Attention. Prints "ATTENTION:" and the argument below the inside address. See also string **LetAT**.
- SA Salutation. Prints "To Whom It May Concern:" or the argument if it was present. The salutation is printed two lines below the inside address. See also string **LetSA**.
- SJ Subject line. Prints the argument as subject prefixed with "SUBJECT:" two lines below the inside address, except in letter type "SP", where the subject is printed in all-capital without any prefix. See also string **LetSJ**.

**MC** *column-size* [*column-separation*]

Begin multiple columns. Return to normal with **1C**. **MC** creates as many columns as the current line length permits. *column-size* is the width of each column, and *column-separation* is the space between two columns. Default separation is *column-size*/15. See also **1C**.

**ML** *mark* [*text-indent* [**1**]]

Marked list start. The *mark* argument is printed before each list item. *text-indent* sets the indent and overrides **Li**. A third argument prohibits printing of a blank line before each item.

**MT** [*number* [*addressee*]]

Memorandum type. The argument *number* is used to construct the file name */usr/local/share/groff/1.23.0/tmac/mm/number.MT* and load it with the **mso** request. Memorandum types 0 to 5 are supported; any other value of *number* is mapped to type 6. If *number* is omitted, **0** is implied. *addressee* sets a string analogous to one used by AT&T cover sheet macros that are not implemented in *groff mm*.

- 0** Normal memorandum, no type printed.
- 1** Memorandum with "MEMORANDUM FOR FILE" printed.
- 2** Memorandum with "PROGRAMMER'S NOTES" printed.
- 3** Memorandum with "ENGINEER'S NOTES" printed.
- 4** Released paper style.
- 5** External letter style.

See also **COVER/COVEND**, a more flexible type of cover page.

**MOVE** *y-pos* [*x-pos* [*line-length*]]

Move to a position, setting page offset to *x-pos*. If *line-length* is not given, the difference between current and new page offset is used. Use **PGFORM** without arguments to return to normal.

**MULB** *cw1 space1* [*cw2 space2*] ... *cwn*

Begin alternative multi-column mode. All column widths must be specified, as must the amount of space between each column pair. The default unit for the width and space arguments is "n". **.MULB** uses a diversion and operates in a separate environment.

**MULN** Begin next column in alternative column mode.

**MULE** End alternative multi-column mode and emit the columns.

**nP** [*type*]

Print numbered paragraph with header level two. See **.P**.

**NCOL** Force printing to the next column. Don't use this together with the **MUL\*** macros, see **2C**.

**NS** [*arg* [**1**]]

Print different types of notations. The argument selects between the predefined type of notations. If the second argument is available, then the argument becomes the entire notation. If the argument doesn't select a predefined type, it is printed as "Copy (*arg*) to". It is possible to add more standard notations; see the strings **Letns** and **Letnsdef**.

| <b>Arg</b>  | <b>Notation</b>           |
|-------------|---------------------------|
| <i>none</i> | Copy To                   |
| ""          | Copy To                   |
| 1           | Copy To (with att.) to    |
| 2           | Copy To (without att.) to |
| 3           | Att.                      |
| 4           | Atts.                     |
| 5           | Enc.                      |
| 6           | Encs.                     |
| 7           | Under separate cover      |
| 8           | Letter to                 |
| 9           | Memorandum to             |
| 10          | Copy (with atts.) to      |
| 11          | Copy (without atts.) to   |
| 12          | Abstract Only to          |
| 13          | Complete Memorandum to    |
| 14          | CC                        |

**ND** *new-date*

New date. Overrides the current date. Date is not printed if *new-date* is an empty string.

**OF** [*arg*]

Odd-page footer, a line printed just above the normal footer. See **EF** and **PF**.

This macro defines string **EOPof**.

**OH** [*arg*]

Odd-page header, a line printed just below the normal header. See **EH** and **PH**.

This macro defines string **TPoh**.

**OP**

Make sure that the following text is printed at the top of an odd-numbered page. Does not output an empty page if currently at the top of an odd page.

**P** [*type*]

Begin new paragraph. **P** without argument produces left-justified text, even the first line of the paragraph. This is the same as setting *type* to 0. If the argument is 1, the first line of text following **P** is indented by the number of spaces in register **Pi**, by default 5.

Instead of giving an argument to **P** it is possible to set the paragraph type in register **Pt**. Using 0 and 1 is the same as adding that value to **P**. A value of 2 indents all paragraphs, except after headings, lists, and displays (this value can't be used as an argument to **P** itself).

The space between two paragraphs is controlled by register **Ps**, and is 1 by default (one blank line).

**PGFORM** [*linelength* [*pagelength* [*pageoffset* [**1**]]]]

Set line length, page length, and/or page offset. This macro can be used for special formatting, like letter heads and other. It is normally the first macro call in a file, though it is not necessary.

**PGFORM** can be used without arguments to reset everything after a **MOVE** call. A line break is

done unless the fourth argument is given. This can be used to avoid the page number on the first page while setting new width and length. (It seems as if this macro sometimes doesn't work too well. Use the command-line arguments to change line length, page length, and page offset instead.)

**PGNH** No header is printed on the next page. Used to get rid of the header in letters or other special texts. This macro must be used before any text to inhibit the page header on the first page.

**PIC** [-B] [-L] [-C] [-R] [-I *n*] *filename* [*width* [*height*]]

Include a PostScript file in the document. The macro depends on *mmroff*(1) and **INITR**. The arguments **-L**, **-C**, **-R**, and **-I** *n* adjust the picture or indent it. With no flag the picture is adjusted to the left. Adding **-B** draws a box around the picture. The optional *width* and *height* can also be given to resize the picture.

**PE** Picture end. Ends a picture for *pic*(1).

**PF** [*arg*]

Page footer. **PF** sets the line to be printed at the bottom of each page. Empty by default. See **PH** for the argument specification.

This macro defines string **EOPf**.

**PH** [*arg*]

Page header, a line printed at the top of each page. The argument should be specified as

```
"left-part'center-part'right-part"
```

where *left-part*, *center-part*, and *right-part* are printed left-justified, centered, and right justified, respectively. Within the argument to **PH**, the character “%” is changed to the current page number. The default argument is

```
""- %- ""
```

which gives the page number between two dashes.

This macro defines string **TPh**.

**PS** Picture start (from pic). Begins a picture for *pic*(1).

**PX** Page header user-defined exit. This macro is called just after the printing of the page header in *no-space* mode.

**R** [*roman-text* [*previous-font-text*]] ...

Join *roman-text* in roman style with *previous-font-text* in the previous font, without space between the arguments. If no arguments, switch font to roman style.

**RB** [*roman-text* [*bold-text*]] ...

Join *roman-text* in roman style with *bold-text* in boldface, without space between the arguments.

**RD** [*prompt* [*diversion* [*string*]]]

Read from standard input to diversion and/or string. The text is saved in a diversion named *diversion*. Recall the text by writing the name of the diversion after a dot on an empty line. A string is also defined if *string* is given. *Diversion* and/or *prompt* can be empty (“”).

**RF** Reference end. Ends a reference definition and returns to normal processing. See **RS**.

**RI** [*roman-text* [*italic-text*]] ...

Join *roman-text* in roman style with *italic-text* in italics, without space between the arguments.

**RL** [*text-indent*[1]]

Reference list start. Begins a list where each item is preceded with an automatically incremented number between square brackets. *text-indent* changes the default indentation.

**RP** [*arg1* [*arg2*]]

Produce reference page. This macro can be used if a reference page is wanted somewhere in the document. It is not needed if **TC** is used to produce a table of contents. The reference page is

then printed automatically.

The reference counter is not reset if *arg1* is 1.

*arg2* tells **RP** whether to eject a page or not.

**arg2**

- 0 The reference page is printed on a separate page.
- 1 Do not eject page after the list.
- 2 Do not eject page before the list.
- 3 Do not eject page before and after the list.

The reference items are separated by a blank line. Setting register **Ls** to 0 suppresses the line.

The string **Rp** contains the reference page title and is set to “REFERENCES” by default. The register **Rpe** holds the default value for the second argument of **RP**; it is initially set to 0.

**RS** [*string-name*]

Begin an automatically numbered reference definition. Put the string **\\*(Rf** where the reference mark should be and write the reference between **RS/RF** at next new line after the reference mark. The reference number is stored in register **:R**. If *string-name* is given, a string with that name is defined and contains the current reference mark. The string can be referenced as **\\*[string-name]** later in the text.

**S** [*size* [*spacing*]]

Set point size and vertical spacing. If any argument is equal to “P”, the previous value is used. A “C” means the current value, and “D” the default value. If “+” or “-” is used before the value, the current value is incremented or decremented, respectively.

**SA** [*arg*]

Set right-margin justification. Justification is turned on by default. No argument or value “0” turns off justification, and “1” turns on justification.

**SETR** *refname* [*string*]

Remember the current header and page number as *refname*. Saves *string* if *string* is defined. *string* is retrieved with **.GETST**. See **INTR**.

**SG** [*arg* [**1**]]

Signature line. Prints the authors name(s) after the formal closing. The argument is appended to the reference data, printed at either the first or last author. The reference data is the location, department, and initials specified with **.AU**. It is printed at the first author if the second argument is given, otherwise at the last. No reference data is printed if the author(s) is specified through **.WA/WE**. See section “Internals” below.

**SK** [*pages*]

Skip pages. If *pages* is 0 or omitted, a skip to the next page occurs unless it is already at the top of a page. Otherwise it skips *pages* pages.

**SM** *string1* [*string2* [*string3*]]

Make a string smaller. If *string2* is given, *string1* is made smaller and *string2* stays at normal size, concatenated with *string1*. With three arguments, everything is concatenated, but only *string2* is made smaller.

**SP** [*lines*]

Space vertically. *lines* can have any scaling factor, like “3i” or “8v”. Several **SP** calls in a line only produces the maximum number of lines, not the sum. **SP** is ignored also until the first text line in a page. Add **\&** before a call to **SP** to avoid this.

**TAB** Reset tabs to every 5n. Normally used to reset any previous tab positions.

**TB** [*title* [*override* [*flag* [*refname*]]]]

Table title. The arguments are the same as for **EC**. **TB** uses the register **Tb** as a counter. The string **Lt** controls the title of the List of Tables; default value is “LIST OF TABLES”. The List of

Tables is printed only if register **Lt** is 1, which is the default. The string **Litb** contains the word “TABLE”, which is printed before the number.

Special handling of the title occurs if **TB** is used inside **DS/DE**, it is not affected by the format of **DS**.

**TC** [*slevel* [*spacing* [*tlevel* [*tab* [*h1* [*h2* [*h3* [*h4* [*h5*]]]]]]]]]]]

Table of contents. This macro is normally used as the last line of the document. It generates a table of contents with headings up to the level controlled by register **Cl**. Note that **Cl** controls the saving of headings, it has nothing to do with **TC**. Headings with a level less than or equal to *slevel* get *spacing* number of lines before them. Headings with a level less than or equal to *tlevel* have their page numbers right-justified with dots or spaces separating the text and the page number. Spaces are used if *tab* is greater than zero, dots otherwise. Other headings have the page number directly at the end of the heading text (*ragged-right*).

The rest of the arguments is printed, centered, before the table of contents.

The user-defined macros **TX** and **TY** are used if **TC** is called with at most four arguments. **TX** is called before the printing of the string “CONTENTS”, and **TY** is called instead of printing “CONTENTS”.

Equivalent macros can be defined for list of figures, tables, equations and exhibits by defining **TX<sub>xx</sub>** or **TY<sub>xx</sub>**, where *xx* is “Fg”, “TB”, “EC”, or “EX”, respectively.

String **Ci** can be set to control the indentations for each heading-level. It must be scaled, like

```
.ds Ci .25i .5i .75i 1i 1i
```

By default, the indentation is controlled by the maximum length of headings in each level.

The strings **Lifg**, **Litb**, **Liex**, **Liec**, and **Licon** contain “Figure”, “TABLE”, “Exhibit”, “Equation”, and “CONTENTS”, respectively. These can be redefined to other languages.

**TE** Table end. See **TS**.

**TH** [**N**] Table header. See **TS**. **TH** ends the header of the table. This header is printed again if a page break occurs. Argument “N” isn’t implemented yet.

**TL** [*charging-case-number* [*filing-case-number*]]

Begin title of memorandum. All text up to the next **AU** is included in the title. *charging-case-number* and *filing-case-number* are saved for use in the front page processing.

**TM** [*num1* [*num2* [. . .]]]

Technical memorandum numbers used in **.MT**. An unlimited number of arguments may be given.

**TP** Top-of-page user-defined macro. This macro is called instead of the normal page header. It is possible to get complete control over the header. Note that the header and the footer are printed in a separate environment. Line length is preserved, though. See **EOP**.

#### strings available to TP

TPh argument of **PH**

TPeh argument of **EH**

TPoh argument of **OH**

**TS** [**H**] Table start. This is the start of a table specification to *tbl(1)*. **TS** ends with **TE**. Argument “H” tells *mm* that the table has a header. See **TH**.

**TX** User-defined table of contents exit. This macro is called just before **TC** prints the word “CONTENTS”. See **TC**.

**TY** User-defined table of contents exit. This macro is called instead of printing “CONTENTS”. See **TC**.

**VERBON** [*flag* [*point-size* [*font*]]]

Begin verbatim output using Courier font. Usually for printing programs. All characters have equal width. The point size can be changed with the second argument. By specifying a third argument it is possible to use another font instead of Courier. *flag* controls several special features. Its value is the sum of all wanted features.

| Arg | Description                                                                                                                                                                                                                                                    |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Disable the escape character (\). This is normally turned on during verbose output.                                                                                                                                                                            |
| 2   | Add an empty line before the verbose text.                                                                                                                                                                                                                     |
| 4   | Add an empty line after the verbose text.                                                                                                                                                                                                                      |
| 8   | Print the verbose text with numbered lines. This adds four digit-sized spaces in the beginning of each line. Finer control is available through the string <b>Verbnm</b> . It contains all arguments to the <i>troff(1)</i> command <b>.nm</b> , normally "1". |
| 16  | Indent the verbose text by "5n". This is controlled by the register <b>Verbin</b> (in units).                                                                                                                                                                  |

**VERBOFF**

End verbatim output.

**VL** *text-indent* [*mark-indent* [**1**]]

Variable-item list. It has no fixed mark, it assumes that every **LI** has a mark instead. *text-indent* sets the indent to the text, and *mark-indent* the distance from the current indentation to the mark. A third argument prohibits printing of a blank line before each item.

**VM** [**-T**] [*top* [*bottom*]]

Vertical margin. Increase the top and bottom margin by *top* and *bottom*, respectively. If option **-T** is specified, set those margins to *top* and *bottom*. If no argument is given, reset the margin to zero, or to the default ("7v 5v") if **-T** is used. It is highly recommended that macros **TP** and/or **EOP** are defined if using **-T** and setting top and/or bottom margin to less than the default.

**WA** [*writer-name* [*title*]]

Begin specification of the writer and writer's address. Several names can be specified with empty **WA/WE** pairs, but only one address.

**WE** End the address specification after **.WA**.**WC** [*format1*] [*format2*] [. . .]

Footnote and display width control.

|     |                                                                                                             |
|-----|-------------------------------------------------------------------------------------------------------------|
| N   | Set default mode which is equal to using the options <b>-WF</b> , <b>-FF</b> , <b>-WD</b> , and <b>FB</b> . |
| WF  | Wide footnotes, wide also in two-column mode.                                                               |
| -WF | Normal footnote width, follow column mode.                                                                  |
| FF  | All footnotes gets the same width as the first footnote encountered.                                        |
| -FF | Normal footnotes, width follows <b>WF</b> and <b>-WF</b> .                                                  |
| WD  | Wide displays, wide also in two-column mode.                                                                |
| -WD | Normal display width, follow column mode.                                                                   |
| FB  | Floating displays generates a line break when printed on the current page.                                  |
| -FB | Floating displays does not generate line break.                                                             |

**Strings**

**App** A string containing the word "APPENDIX".

**Apptxt** The current appendix text.

**DT** The date; set by the **ND** macro (defaults to the date the document is formatted). The format is the conventional one for the *groff* locale, but see the **ISODATE** macro and **iso** register.

**EM** Em dash string

- H1txt** Updated by **.H** and **.HU** to the current heading text. Also updated in table of contents & friends.
- HF** Font list for headings, “2 2 2 2 2 2” by default. Non-numeric font names may also be used.
- HP** Point size list for headings. By default, this is “0 0 0 0 0 0” which is the same as “10 10 10 10 10 10”.
- Index** Contains the string “INDEX”.
- Indcmd**  
Contains the index command. Default value is “**sort -t**”.
- Lifg** String containing “Figure”.
- Litb** String containing “TABLE”.
- Liex** String containing “Exhibit”.
- Liec** String containing “Equation”.
- Licon** String containing “CONTENTS”.
- Lf** Contains the string “LIST OF FIGURES”.
- Lt** Contains the string “LIST OF TABLES”.
- Lx** Contains the string “LIST OF EXHIBITS”.
- Le** Contains the string “LIST OF EQUATIONS”.
- Letfc** Contains the string “Yours very truly,” used in **.FC**.
- Letapp** Contains the string “APPROVED:”, used in **.AV**.
- Letdate**  
Contains the string “Date”, used in **.AV**.
- LetCN** Contains the string “CONFIDENTIAL”, used in **.LO CN**.
- LetSA** Contains the string “To Whom It May Concern:”, used in **.LO SA**.
- LetAT** Contains the string “ATTENTION:”, used in **.LO AT**.
- LetSJ** Contains the string “SUBJECT:”, used in **.LO SJ**.
- LetRN** Contains the string “In reference to:”, used in **.LO RN**.
- Letns** is an array containing the different strings used in **.NS**. Since *roff* languages lack true array types, it is implemented as a set of strings prefixed with **Letns!**. If the argument doesn’t exist, it is included between () with **Letns!copy** as a prefix and **Letns!to** as a suffix. Observe the space after “Copy” and before “to”.

| Name     | Value                   |
|----------|-------------------------|
| Letns!0  | Copy to                 |
| Letns!1  | Copy (with att.) to     |
| Letns!2  | Copy (without att.) to  |
| Letns!3  | Att.                    |
| Letns!4  | Atts.                   |
| Letns!5  | Enc.                    |
| Letns!6  | Encs.                   |
| Letns!7  | Under separate cover    |
| Letns!8  | Letter to               |
| Letns!9  | Memorandum to           |
| Letns!10 | Copy (with atts.) to    |
| Letns!11 | Copy (without atts.) to |
| Letns!12 | Abstract Only to        |
| Letns!13 | Complete Memorandum to  |

|            |                                     |
|------------|-------------------------------------|
| Letns!14   | CC                                  |
| Letns!copy | Copy ( <i>with trailing space</i> ) |
| Letns!to   | to ( <i>note leading space</i> )    |

**Letnsdef**

Define the standard notation used when no argument is given to **.NS**. Default is 0.

**MO1 – MO12**

Strings containing the month names “January” through “December”.

**Qrf** String containing “See chapter \\*[Qrfh], page \n[Qrfp].”.

**Rp** Contains the string “REFERENCES”.

**Tcst** Contains the current status of the table of contents and list of figures, etc. Empty outside of **.TC**. Useful in user-defined macros like **.TP**.

| Value | Meaning           |
|-------|-------------------|
| co    | Table of contents |
| fg    | List of figures   |
| tb    | List of tables    |
| ec    | List of equations |
| ex    | List of exhibits  |
| ap    | Appendix          |

**Tm** Contains the string “\ (tm)”, the trade mark symbol.

**Verbnm**

Argument to **.nm** in the **.VERBON** macro. Default is 1.

**Registers**

**Aph** Print an appendix page for every new appendix if this register is non-zero. No output occurs if **Aph** is zero, but there is always an appendix entry in the “List of contents”.

**Cl** Contents level (in the range 0 to 14). The contents is saved if a heading level is lower than or equal to the value of **Cl**. Default is 2.

**Cp** Eject page between list of table, list of figure, etc., if the value of **Cp** is zero. Default is 0.

**D** Debug flag. Values greater than zero produce debug information of increasing verbosity. A value of 1 gives information about the progress of formatting. Default is 0.

**De** If set to 1, eject after floating display is output. Default is 0.

**Dsp** If defined, it controls the space output before and after static displays. Otherwise the value of **Lsp** is used.

**Df** Control floating keep output. This is a number in the range 0 to 5, with a default value of 5. See **.DF**.

**Ds** If set to 1, use the amount of space stored in register **Lsp** before and after display. Default is 1.

**Ej** If set to 1, eject page before each first-level heading. Default is 0.

**Eq** Equation labels are left-aligned if set to 0 and right-aligned if set to 1. Default is 0.

**Fs** Footnote spacing. Default is 1.

**H1 – H7**

Heading counters

**H1dot** Append a dot after the level-one heading number if value is greater than zero. Default is 1.

**H1h** A copy of register **H1**, but it is incremented just before the page break. Useful in user-defined header macros.

- Hb** Heading break level. A number in the range 0 to 14, with a default value of 2. See **.H**.
- Hc** Heading centering level. A number in the range 0 to 14, with a default value of 0. See **.H**.
- Hi** Heading temporary indent. A number in the range 0 to 2, with a default value of 1.
- 0 no indentation, left margin
  - 1 indent to the right, similar to “**.P 1**”
  - 2 indent to line up with text part of preceding heading
- Hps** Heading pre-space level. If the heading level is less than or equal to **Hps**, two lines precede the section heading instead of one. Default is first level only. The real amount of lines is controlled by the registers **Hps1** and **Hps2**.
- Hps1** Number of lines preceding **.H** if the heading level is greater than **Hps**. Value is in units, default is 0.5.
- Hps2** Number of lines preceding **.H** if the heading level is less than or equal to **Hps**. Value is in units, default is 1.
- Hs** Heading space level. A number in the range 0 to 14, with a default value of 2. See **.H**.
- Hss** Number of lines following **.H** if the heading level is less than or equal to **Hs**. Value is in units, default is 1.
- Ht** Heading numbering type.
- 0 multiple levels (1.1.1, 1.1.2, etc.)
  - 1 single level
- Default is 0.
- Hu** Unnumbered heading level. Default is 2.
- Hy** Hyphenation status of text body.
- 0 no hyphenation
  - 1 hyphenation on, set to value 6
- Default is 0.
- Iso** Define this register (to any value) on the command line to use ISO 8601 date format (e.g., “**-rIso=1**”). See macro **ISODATE** above.
- L** Page length, only for command-line settings.
- Letwam** Maximum lines in return-address, used in **.WA/.WE**. Default is 14.
- Lf, Lt, Lx, Le** Enable (1) or disable (0) the printing of List of figures, List of tables, List of exhibits and List of equations, respectively. Default values are Lf=1, Lt=1, Lx=1, and Le=0.
- Li** List indentation, used by **.AL**. Default is 6.
- Limsp** A flag controlling the insertion of space between prefix and mark in automatic lists (**.AL**).
- 0 no space
  - 1 emit space
- Ls** List space threshold. If current list level is greater than **Ls** no spacing occurs around lists. Default is 99.
- Lsp** The vertical space used by an empty line. The default is 0.5v in troff mode and 1v in nroff mode.
- N** Page numbering style.
- 0 normal header for all pages.
  - 1 header replaces footer on first page, header is empty.

- 2 page header is removed on the first page.
- 3 “section-page” numbering style enabled.
- 4 page header is removed on the first page.
- 5 “section-page” and “section-figure” numbering style enabled.

Default is 0. See also the registers **Sectf** and **Sectp**.

**Np** A flag to control whether paragraphs are numbered.

- 0 not numbered
- 1 numbered in first-level headings.

Default is 0.

**O** Page offset, only for command-line settings.

**Of** Format of figure, table, exhibit, and equation titles.

- 0 ". "
- 1 " - "

Default is 0.

**P** Current page number, normally the same as “%” unless “section-page” numbering style is enabled.

**Pi** Paragraph indentation. Default is 5.

**Pgps** A flag to control whether header and footer point size should follow the current settings or just change when the header and footer are defined.

- 0 Point size only changes to the current setting when **.PH**, **.PF**, **.OH**, **.EH**, **.OF**, or **.OE** is executed.
- 1 Point size changes after every **.S**. This is the default.

**Ps** Paragraph spacing. Default is 1.

**Pt** Paragraph type.

- 0 left-justified
- 1 indented paragraphs
- 2 indented paragraphs except after **.H**, **.DE**, or **.LE**.

Default is 0.

**Rpe** Set default value for second argument of **.RP**. Default is 0.

**Sectf** A flag controlling “section-figures” numbering style. A non-zero value enables this. See also register **N**.

**Sectp** A flag controlling “section-page” numbering style. A non-zero value enables this. See also register **N**.

**Si** Display indentation. Default is 5.

**Verbin** Indentation for **.VERBON**. Default is 5n.

**W** Line length, only for command-line settings.

**.mgm** Always 1.

## Internals

The letter macros use different submacros depending on the letter type. The name of the submacro has the letter type as suffix. It is therefore possible to define other letter types, either in the territory-specific macro file, or as local additions. **.LT** sets the registers **Pt** and **Pi** to 0 and 5, respectively. The following strings and macros must be defined for a new letter type.

**let@init\_type**

This macro is called directly by **.LT**. It is supposed to initialize registers and other stuff.

**let@head\_type**

This macro prints the letter head, and is called instead of the normal page header. It is supposed to remove the alias **let@header**, otherwise it is called for all pages.

**let@sg\_type name title n is-surname [SG-arg . . .]**

**.SG** calls this macro only for letters; memoranda have their own processing. *name* and *title* are specified through **.WA/.WB**. *n* is the index of the *n*th author, and *is-surname* is true for the last name. Further **.SG** arguments are appended to the signature line.

**let@fc\_type closing**

This macro is called by **.FC**, and has the formal closing as the argument.

**.LO** is implemented as a general option-macro. It demands that a string named **Lettype** is defined, where *type* is the letter type. **.LO** then assigns the argument to the string **let\*lo-type**.

**Files**

*/usr/local/share/groff/1.23.0/tmac/m.tmac*

is the *groff* implementation of the memorandum macros.

*/usr/local/share/groff/1.23.0/tmac/mm.tmac*

is wrapper to load *m.tmac*.

*/usr/local/share/groff/1.23.0/tmac/refer-mm.tmac*

implements [refer\(1\)](#) support for *mm*.

*/usr/local/share/groff/1.23.0/tmac/mm/ms.cov*

implements an *ms*-like cover sheet.

*/usr/local/share/groff/1.23.0/tmac/mm/0.MT*

implements memorandum types 0–3 and 6.

*/usr/local/share/groff/1.23.0/tmac/mm/4.MT*

implements memorandum type 4.

*/usr/local/share/groff/1.23.0/tmac/mm/5.MT*

implements memorandum type 5.

*/usr/local/share/groff/1.23.0/tmac/mm/locale*

performs any (further) desired necessary localization; empty by default.

**Authors**

The GNU version of the *mm* macro package was written by Jörgen Hägg (jh@axis.se) of Lund, Sweden.

**See also**

*MM – A Macro Package for Generating Documents* (<https://tkurtbond.github.io/troff/mm-all.pdf>), the DWB 3.3 *mm* manual, introduces the package but does not document *groff mm* extensions.

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

[groff\(1\)](#), [troff\(1\)](#), [tbl\(1\)](#), [pic\(1\)](#), [eqn\(1\)](#), [refer\(1\)](#), [groff\\_mmse\(7\)](#)

**Namn**

groff\_mmse – svenska ”memorandum” makro för GNU roff

**Syntax**

**groff -mmse** [*flaggor ...*] [*filer ...*]  
**groff -m mmse** [*flaggor ...*] [*filer ...*]

**Beskrivning**

*mmse* är en svensk variant av *mm*. Alla texter är översatta. En A4 sida får text som är 13 cm bred, 3,5 cm indragning samt är 28,5 cm hög. Det finns stöd för brevuppställning enligt svensk standard för vänster och högerjusterad text.

**COVER** kan använda *se\_ms* som argument. Detta ger ett svenskt försättsblad. Se [groff\\_mm\(7\)](#) för övriga detaljer.

**Brev**

Tillgängliga brevtyper:

**.LT SVV**

Vänsterställd löptext med adressat i position T0 (vänsterställt).

**.LT SVH**

Högerställd löptext med adressat i position T4 (passar fönsterkuvert).

Följande extra LO-variabler används.

**.LO DNAMN** *namn*

Anger dokumentets namn.

**.LO MDAT** *datum*

Mottagarens datum, anges under **Ert datum: (LetMDAT)**.

**.LO BIL** *sträng*

Anger bilaga, nummer eller sträng med **Bilaga (LetBIL)** som prefix.

**.LO KOMP** *text*

Anger kompletteringsuppgift.

**.LO DBET** *beteckning*

Anger dokumentbeteckning eller dokumentnummer.

**.LO BET** *beteckning*

Anger beteckning (ärendebeteckning i form av diarienummer eller liknande).

**.LO SIDOR** *antal*

Anger totala antalet sidor och skrivs ut efter sidnumret inom parenteser.

Om makrot **.TP** är definierat anropas det efter utskrift av brevhuvudet. Där lägger man lämpligen in postadress och annat som brevfoot.

**Skrivet av**

Jörgen Hägg, Lund, Sweden <Jorgen.Hagg@axis.se>

**Filer**

*/usr/local/share/groff/1.23.0/tmac/mse.tmac*

*/usr/local/share/groff/1.23.0/tmac/mm/se\_\*.cov*

**Se också**

[groff\\_mm\(7\)](#)

**Name**

groff\_mom – modern macros for document composition with GNU roff

**Synopsis**

**groff -mom** [*option ...*] [*file ...*]

**groff -m mom** [*option ...*] [*file ...*]

**Calling mom**

**mom** is a macro set for **groff**, designed primarily to format documents for *PDF* and *PostScript* output.

**mom** provides two categories of macros: macros for typesetting, and macros for document processing. The typesetting macros provide access to groff's typesetting capabilities in ways that are simpler to master than groff's primitives. The document processing macros provide highly customizable markup tags that allow the user to design and output professional-looking documents with a minimum of typesetting intervention.

Files processed with *pdfmom(1)* with or without the *-Tps* option, produce *PDF* documents. The documents include a *PDF* outline that appears in the 'Contents' panel of document viewers, and may contain clickable internal and external links.

When *-Tps* is absent, **groff's** native *PDF* driver, **gropdf**, is used to generate the output. When given, the output is still *PDF*, but processing is passed over to **pdfroff**, which uses **groff's** PostScript driver, **grops**. Not all *PDF* features are available when *-Tps* is given; its primary use is to allow processing of files with embedded *PostScript* images.

Files processed with **groff -mom** (or **-m mom**) produce PostScript output by default.

**mom** comes with her own very complete documentation in *HTML* format. A separate *PDF manual*, *Producing PDFs with groff and mom*, covers full **mom** or *PDF* usage.

**Files**

*/usr/local/share/groff/1.23.0/tmac/om.tmac*

– the main macro file

*/usr/local/share/groff/1.23.0/tmac/mom.tmac*

– a wrapper file that calls om.tmac directly.

*/usr/local/share/doc/groff-1.23.0/html/mom/toc.html*

– entry point to the HTML documentation

*/usr/local/share/doc/groff-1.23.0/pdf/mom-pdf.pdf*

– the PDF manual, *Producing PDFs with groff and mom*

*/usr/local/share/doc/groff-1.23.0/examples/mom/\*.mom*

– example files using mom

**Documentation in alphabetical order**

This part of the man page contains information just as in groff(7), *mom macros* and *mom escape sequences* in alphabetical order.

The logical order of *mom macros* and *mom escape sequences* is very well documented in

*/usr/local/share/doc/groff-1.23.0/html/mom/toc.html*

– entry point to the HTML documentation

That document is quite good for beginners, but other users should be happy to have some documentation in reference style.

So we restrict this part to the alphabetical order of macros and escape sequences. But, so far, we took all documentation details from the *toc.html* file, just in a more useful alphabetical order. So this part of the man page is nothing new, but only a logical arrangement.

**Quick reference****Quick reference of inline escape sequences in alphabetical order**

`\*[<colorname>]`

begin using an initialized colour inline

- \\*[BCK *n*]**  
move backwards in a line
- \\*[BOLDER]**  
invoke pseudo bold inline (related to macro **.SETBOLDER**)
- \\*[BOLDERX]**  
off pseudo bold inline (related to macro **.SETBOLDER**)
- \\*[BU *n*]**  
move characters pairs closer together inline (related to macro **.KERN**)
- \\*[COND]**  
invoke pseudo condensing inline (related to macro **.CONDENSE**)
- \\*[CONDX]**  
off pseudo condensing inline (related to macro **.CONDENSE**)
- \\*[CONDSUP].. \\*[CONDSUPX]**  
pseudo-condensed superscript
- \\*[DOWN *n*]**  
temporarily move downwards in a line
- \\*[EN-MARK]**  
mark initial line of a range of line numbers (for use with line numbered endnotes)
- \\*[EXT]**  
invoke pseudo extending inline (related to macro **.EXTEND**)
- \\*[EXTX]**  
off pseudo condensing inline (related to macro **.EXTEND**)
- \\*[EXTSUP].. \\*[EXTSUPX]**  
pseudo extended superscript
- \\*[FU *n*]**  
move characters pairs further apart inline (related to macro **.KERN**)
- \\*[FWD *n*]**  
move forward in a line
- \\*[LEADER]**  
insert leaders at the end of a line
- \\*[RULE]**  
draw a full measure rule
- \\*[SIZE *n*]**  
change the point size inline (related to macro **.PT\_SIZE**)
- \\*[SLANT]**  
invoke pseudo italic inline (related to macro **.SETSLANT**)
- \\*[SLANTX]**  
off pseudo italic inline (related to macro **.SETSLANT**)
- \\*[ST<*n*>].. \\*[ST<*n*>X]**  
string tabs (mark tab positions inline)
- \\*[SUP].. \\*[SUPX]**  
superscript
- \\*[TB+]**  
inline escape for **.TN** (*Tab Next*)

**\\*[UL].. \\*[ULX]**  
 invoke underlining inline (fixed width fonts only)

**\\*[UP *n*]**  
 temporarily move upwards in a line

### Quick reference of macros in alphabetical order

**.AUTOLEAD**  
 set the linespacing relative to the point size

**.B\_MARGIN**  
 set a bottom margin

**.BR** break a justified line

**.CENTER**  
 set line-by-line quad centre

**.CONDENSE**  
 set the amount to pseudo condense

**.EL** break a line without advancing on the page

**.EXTEND**  
 set the amount to pseudo extend

**.FALLBACK\_FONT**  
 establish a fallback font (for missing fonts)

**.FAM** alias to **.FAMILY**

**.FAMILY** *<family>*  
 set the *family type*

**.FT** set the font style (roman, italic, etc.)

**.HI** [ *<measure>* ]  
 hanging indent

**.HY** automatic hyphenation on/off

**.HY\_SET**  
 set automatic hyphenation parameters

**.JB** [ *<left measure>* *<right measure>* ]  
 indent both

**.JBX** [ **CLEAR** ]  
 exit indent both

**.JL** [ *<measure>* ]  
 indent left

**.JLX** [ **CLEAR** ]  
 exit indent left

**.JQ** [ **CLEAR** ]  
 quit any/all indents

**.JR** [ *<measure>* ]  
 indent right

**.JRX** [ **CLEAR** ]  
 exit indent right

**.JUSTIFY**  
 justify text to both margins

- .KERN**  
automatic character pair kerning on/off
- .L\_MARGIN**  
set a left margin (page offset)
- .LEFT** set line-by-line quad left
- .LL** set a line length
- .LS** set a linespacing (leading)
- .PAGE** set explicit page dimensions and margins
- .PAGewidth**  
set a custom page width
- .PAGELENGTH**  
set a custom page length
- .PAPER** *<paper\_type>*  
set common paper sizes (letter, A4, etc)
- .PT\_SIZE**  
set the point size
- .QUAD**  
"justify" text left, centre, or right
- .R\_MARGIN**  
set a right margin
- .RIGHT**  
set line-by-line quad right
- .SETBOLDER**  
set the amount of emboldening
- .SETSLANT**  
set the degree of slant
- .SPREAD**  
force justify a line
- .SS** set the sentence space size
- .T\_MARGIN**  
set a top margin
- .TI** [ *<measure>* ]  
temporary left indent
- .WS** set the minimum word space size

## Documentation of details

### Details of inline escape sequences in alphabetical order

- \\*[<colorname>]**  
begin using an initialized colour inline
  - \\*[BCK *n*]**  
move wards in a line
  - \\*[BOLDER]**
  - \\*[BOLDERX]**  
Embodening on/off
- \\*[BOLDER]** begins emboldening type. **\\*[BOLDERX]** turns the feature off. Both are inline escape sequences; therefore, they should not appear as separate lines, but rather be embedded in text

lines, like this:

```
Not \*[BOLDER]everything\*[BOLDERX] is as it seems.
```

Alternatively, if you wanted the whole line emboldened, you should do

```
\*[BOLDER]Not everything is as it seems.\*[BOLDERX]
```

Once \\*[BOLDER] is invoked, it remains in effect until turned off.

Note: If you're using the document processing macros with **.PRINTSTYLE TYPEWRITE**, **mom** ignores \\*[BOLDER] requests.

\\*[BU *n*]

move characters pairs closer together inline (related to macro **.KERN**)

\\*[COND]

\\*[CONDX]

Pseudo-condensing on/off

\\*[COND] begins pseudo-condensing type. \\*[CONDX] turns the feature off. Both are inline escape sequences; therefore, they should not appear as separate lines, but rather be embedded in text lines, like this:

```
\*[COND]Not everything is as it seems.\*[CONDX]
```

\\*[COND] remains in effect until you turn it off with \\*[CONDX].

**IMPORTANT:** You must turn \\*[COND] off before making any changes to the point size of your type, either via the **.PT\_SIZE** macro or with the **\s** inline escape sequence. If you wish the new point size to be pseudo-condensed, simply reinvoke \\*[COND] afterwards. Equally, \\*[COND] must be turned off before changing the condense percentage with **.CONDENSE**.

Note: If you're using the document processing macros with **.PRINTSTYLE TYPEWRITE**, **mom** ignores \\*[COND] requests.

\\*[CONDSUP].. \\*[CONDSUPX]

pseudo-condensed superscript

\\*[DOWN *n*]

temporarily move downwards in a line

\\*[EN-MARK]

mark initial line of a range of line numbers (for use with line numbered endnotes)

\\*[EXT]

\\*[EXTX]

Pseudo-extending on/off

\\*[EXT] begins pseudo-extending type. \\*[EXTX] turns the feature off. Both are inline escape sequences; therefore, they should not appear as separate lines, but rather be embedded in text lines, like this:

```
\*[EXT]Not everything is as it seems.\*[EXTX]
```

\\*[EXT] remains in effect until you turn it off with \\*[EXTX].

**IMPORTANT:** You must turn \\*[EXT] off before making any changes to the point size of your type, either via the **.PT\_SIZE** macro or with the **\s** inline escape sequence. If you wish the new point size to be *pseudo-extended*, simply reinvoke \\*[EXT] afterwards. Equally, \\*[EXT] must be turned off before changing the extend percentage with **.EXTEND**.

Note: If you are using the document processing macros with **.PRINTSTYLE TYPEWRITE**, **mom** ignores \\*[EXT] requests.

\\*[EXTSUP].. \\*[EXTSUPX]

pseudo extended superscript

\\*[FU *n*]

move characters pairs further apart inline (related to macro **.KERN**)

**\\*[FWD *n*]**

move forward in a line

**\\*[LEADER]**

insert leaders at the end of a line

**\\*[RULE]**

draw a full measure rule

**\\*[SIZE *n*]**

change the point size inline (related to macro **.PT\_SIZE**)

**\\*[SLANT]**

**\\*[SLANTX]**

Pseudo italic on/off

**\\*[SLANT]** begins *pseudo-italicizing type*. **\\*[SLANTX]** turns the feature off. Both are inline escape sequences; therefore, they should not appear as separate lines, but rather be embedded in text lines, like this:

Not **\\*[SLANT]**everything**\\*[SLANTX]** is as it seems.

Alternatively, if you wanted the whole line *pseudo-italicized*, you'd do

**\\*[SLANT]**Not everything is as it seems.**\\*[SLANTX]**

Once **\\*[SLANT]** is invoked, it remains in effect until turned off.

Note: If you're using the document processing macros with **.PRINTSTYLE TYPEWRITE**, **mom** underlines pseudo-italics by default. To change this behaviour, use the special macro **.SLANT\_MEANS\_SLANT**.

**\\*[ST<number>].. \\*[ST<number>X]**

Mark positions of string tabs

The *quad* direction must be **LEFT** or **JUSTIFY** (see **.QUAD** and **.JUSTIFY**) or the *no-fill mode* set to **LEFT** in order for these inlines to function properly. Please see **IMPORTANT**, below.

String tabs need to be marked off with inline escape sequences before being set up with the **.ST** macro. Any input line may contain string tab markers. *<number>*, above, means the numeric identifier of the tab.

The following shows a sample input line with string tab markers.

**\\*[ST1]**De minimus**\\*[ST1X]**non curat**\\*[ST2]**lex**\\*[ST2X]** .

String *tab 1* begins at the start of the line and ends after the word *time*. String *tab 2* starts at *good* and ends after *men*. *Inline escape sequences* (e.g., *font* or *point size changes*, or horizontal movements, including padding) are taken into account when **mom** determines the *position* and *length* of string tabs.

Up to nineteen string tabs may be marked (not necessarily all on the same line, of course), and they must be numbered between 1 and 19.

Once string tabs have been marked in input lines, they have to be *set* with **.ST**, after which they may be called, by number, with **.TAB**.

Note: Lines with string tabs marked off in them are normal input lines, i.e. they get printed, just like any input line. If you want to set up string tabs without the line printing, use the **.SILENT** macro.

**IMPORTANT**: Owing to the way **groff** processes input lines and turns them into output lines, it is not possible for **mom** to *guess* the correct starting position of string tabs marked off in lines that are centered or set flush right.

Equally, she cannot guess the starting position if a line is fully justified and broken with **.SPREAD**.

In other words, in order to use string tabs, **LEFT** must be active, or, if **.QUAD LEFT** or

**JUSTIFY** are active, the line on which the *string tabs* are marked must be broken *manually* with **.BR** (but not **.SPREAD**).

To circumvent this behaviour, I recommend using the **PAD** to set up string tabs in centered or flush right lines. Say, for example, you want to use a *string tab* to *underscore* the text of a centered line with a rule. Rather than this,

```
.CENTER
\[ST1]A line of text\[ST1X]\c
.EL
.ST 1
.TAB 1
.PT_SIZE 24
.ALD 3p
\[RULE]
.RLD 3p
.TQ
```

you should do:

```
.QUAD CENTER
.PAD "#\[ST1]A line of text\[ST1X]#"
.EL
.ST 1
.TAB 1
.PT_SIZE 24
.ALD 3p
\" You can't use \[UP] or \[DOWN] with \[RULE].
.RLD 3p
.TQ
```

\[SUP]..\[SUPX]

superscript

\[TB+]

Inline escape for **.TN** (*Tab Next*)

\[UL]..\[ULX]

invoke underlining inline (fixed width fonts only)

\[UP *n*]

temporarily move upwards in a line

#### Details of macros in alphabetical order

**.AUTOLEAD**

set the linespacing relative to the point size

**.B\_MARGIN** <*bottom margin*>

Bottom Margin

Requires a unit of measure

**.B\_MARGIN** sets a nominal position at the bottom of the page beyond which you don't want your type to go. When the bottom margin is reached, **mom** starts a new page. **.B\_MARGIN requires a unit of measure.** Decimal fractions are allowed. To set a nominal bottom margin of 3/4 inch, enter

```
.B_MARGIN .75i
```

Obviously, if you haven't spaced the type on your pages so that the last lines fall perfectly at the bottom margin, the margin will vary from page to page. Usually, but not always, the last line of type that fits on a page before the bottom margin causes **mom** to start a new page.

Occasionally, owing to a peculiarity in *groff*, an extra line will fall below the nominal bottom margin. If you're using the document processing macros, this is unlikely to happen; the document

processing macros are very hard-nosed about aligning bottom margins.

Note: The meaning of **.B\_MARGIN** is slightly different when you're using the document processing macros.

**.FALLBACK\_FONT** <*fallback font*> [ **ABORT** | **WARN** ]

Fallback Font

In the event that you pass an invalid argument to **.FAMILY** (i.e. a non-existent *family*), **mom**, by default, uses the *fallback font*, **Courier Medium Roman (CR)**, in order to continue processing your file.

If you'd prefer another *fallback font*, pass **.FALLBACK\_FONT** the full *family+font name* of the *font* you'd like. For example, if you'd rather the *fallback font* were **Times Roman Medium Roman**,

```
.FALLBACK_FONT TR
```

would do the trick.

**Mom** issues a warning whenever a *font style set* with **.FT** does not exist, either because you haven't registered the style or because the *font style* does not exist in the current *family set* with **.FAMILY**. By default, **mom** then aborts, which allows you to correct the problem.

If you'd prefer that **mom** not abort on non-existent *fonts*, but rather continue processing using a *fallback font*, you can pass **.FALLBACK\_FONT** the argument **WARN**, either by itself, or in conjunction with your chosen *fallback font*.

Some examples of invoking **.FALLBACK\_FONT**:

**.FALLBACK\_FONT WARN**

**mom** will issue a warning whenever you try to access a non-existent *font* but will continue processing your file with the default *fallback font*, **Courier Medium Roman**.

**.FALLBACK\_FONT TR WARN**

**mom** will issue a warning whenever you try to access a non-existent *font* but will continue processing your file with a *fallback font* of **Times Roman Medium Roman**; additionally, **TR** will be the *fallback font* whenever you try to access a *family* that does not exist.

**.FALLBACK\_FONT TR ABORT**

**mom** will abort whenever you try to access a non-existent **font**, and will use the *fallback font* **TR** whenever you try to access a *family* that does not exist. If, for some reason, you want to revert to **ABORT**, just enter **".FALLBACK\_FONT ABORT"** and **mom** will once again abort on *font errors*.

**.FAM** <*family*>

Type Family, alias of **.FAMILY**

**.FAMILY** <*family*>

Type Family, alias **.FAM**

**.FAMILY** takes one argument: the name of the *family* you want. *Groff* comes with a small set of basic families, each identified by a 1-, 2- or 3-letter mnemonic. The standard families are:

```
A   = Avant Garde
BM  = Bookman
H   = Helvetica
HN  = Helvetica Narrow
N   = New Century Schoolbook
P   = Palatino
T   = Times Roman
ZCM = Zapf Chancery
```

The argument you pass to **.FAMILY** is the identifier at left, above. For example, if you want **Helvetica**, enter

```
.FAMILY H
```

Note: The font macro (**.FT**) lets you specify both the type *family* and the desired font with a single macro. While this saves a few keystrokes, I recommend using **.FAMILY** for *family*, and **.FT** for *font*, except where doing so is genuinely inconvenient. **ZCM**, for example, only exists in one style: **Italic (I)**.

Therefore,

```
.FT ZCMI
```

makes more sense than setting the *family* to **ZCM**, then setting the *font* to **I**.

Additional note: If you are running a version of groff lower than 1.19.2, you must follow all **.FAMILY** requests with a **.FT** request, otherwise **mom** will set all type up to the next **.FT** request in the fallback font.

If you are running a version of groff greater than or equal to 1.19.2, when you invoke the **.FAMILY** macro, **mom** remembers the font style (Roman, **Italic**, etc) currently in use (if the font style exists in the new *family*) and will continue to use the same font style in the new family. For example:

```
.FAMILY BM \" Bookman family
.FT I \" Medium Italic
<some text> \" Bookman Medium Italic
.FAMILY H \" Helvetica family
<more text> \" Helvetica Medium Italic
```

However, if the font style does not exist in the new family, **mom** will set all subsequent type in the fallback font (by default, **Courier Medium Roman**) until she encounters a **.FT** request that's valid for the *family*.

For example, assuming you don't have the font **Medium Condensed Roman** (**mom** extension **CD**) in the *Helvetica* family:

```
.FAMILY UN \" Univers family
.FT CD \" Medium Condensed
<some text> \" Univers Medium Condensed
.FAMILY H \" Helvetica family
<more text> \" Courier Medium Roman!
```

In the above example, you must follow **.FAMILY H** with a **.FT** request that's valid for **Helvetica**.

Please see the Appendices, *Adding fonts to groff*, for information on adding fonts and families to groff, as well as to see a list of the extensions **mom** provides to groff's basic **R**, **I**, **B**, **BI** styles.

Suggestion: When adding *families to groff*, I recommend following the established standard for the naming families and fonts. For example, if you add the **Garamond** family, name the font files

```
GARAMONDR
GARAMONDI
GARAMONDB
GARAMONDBI
```

**GARAMOND** then becomes a valid *family name* you can pass to **.FAMILY**. (You could, of course, shorten **GARAMOND** to just **G**, or **GD**.) **R**, **I**, **B**, and **BI** after **GARAMOND** are the *roman*, *italic*, *bold* and *bold-italic* fonts respectively.

```
.FONT R | B | BI | <any other valid font style>
```

Alias to **.FT**

```
.FT R | B | BI | <any other valid font style>
```

Set font

By default, *groff* permits **.FT** to take one of four possible arguments specifying the desired font:

```
R = (Medium) Roman
I = (Medium) Italic
B = Bold (Roman)
BI = Bold Italic
```

For example, if your *family* is **Helvetica**, entering

**.FT B**

will give you the *Helvetica bold font*. If your *family* were **Palatino**, you'd get the *Palatino bold font*.

**Mom** considerably extends the range of arguments you can pass to **.FT**, making it more convenient to add and access fonts of differing weights and shapes within the same family.

Have a look here for a list of the weight/style arguments **mom** allows. Be aware, though, that you must have the fonts, correctly installed and named, in order to use the arguments. (See *Adding fonts to groff* for instructions and information.) Please also read the *ADDITIONAL NOTE* found in the description of the **.FAMILY** macro.

How **mom** reacts to an invalid argument to **.FT** depends on which version of groff you're using. If your *groff version* is greater than or equal to 1.19.2, **mom** will issue a warning and, depending on how you've set up the fallback font, either continue processing using the fallback font, or abort (allowing you to correct the problem). If your *groff version* is less than 1.19.2, **mom** will silently continue processing, using either the fallback font or the font that was in effect prior to the invalid **.FT** call.

**.FT** will also accept, as an argument, a full *family* and *font name*.

For example,

**.FT HB**

will set subsequent type in *Helvetica Bold*.

However, I strongly recommend keeping *family* and *font* separate except where doing so is genuinely inconvenient.

For inline control of *fonts*, see *Inline Escapes*, font control.

#### **.HI** [ <measure> ]

Hanging indent — the optional argument requires a unit of measure.

A hanging indent looks like this:

```
The thousand injuries of Fortunato I had borne as best I
could, but when he ventured upon insult, I vowed
revenge. You who so well know the nature of my soul
will not suppose, however, that I gave utterance to a
threat, at length I would be avenged...
```

The first line of text *hangs* outside the *left margin*.

In order to use *hanging indents*, you must first have a *left indent* active (set with either **.IL** or **.IB**). **Mom** will not hang text outside the *left margin set* with **.L\_MARGIN** or outside the *left margin* of a *tab*.

The first time you invoke **.HI**, you must give it a **measure**. If you want the first line of a paragraph to *hang by*, say, *1 pica*, do

**.IL 1P**

**.HI 1P**

Subsequent invocations of **.HI** do not require you to supply a *measure*; **mom** keeps track of the last measure you gave it.

Generally speaking, you should invoke **.HI** immediately prior to the line you want hung (i.e. without any intervening control lines). And because *hanging indents* affect only one line, there's no need to turn them off.

*IMPORTANT:* Unlike **IL**, **IR** and **IB**, measures given to **.HI** are NOT additive. Each time you pass a measure to **.HI**, the measure is treated literally. *Recipe:* A numbered list using *hanging indents*

*Note:* **mom** has macros for setting lists. This recipe exists to demonstrate the use of *hanging indents* only.

```
.PAGE 8.5i 11i 1i 1i 1i 1i
.FAMILY T
.FT R
.PT_SIZE 12
.LS 14
.JUSTIFY
.KERN
.SS 0
.IL \w'\0\0.'
.HI \w'\0\0.'
1.\0The most important point to be considered is whether
the answer to the meaning of Life, the Universe, and
Everything really is 42. We have no one's word on the
subject except Mr. Adams's.
.HI
2.\0If the answer to the meaning of Life, the Universe,
and Everything is indeed 42, what impact does this have on
the politics of representation? 42 is, after all not a
prime number. Are we to infer that prime numbers don't
deserve equal rights and equal access in the universe?
.HI
3.\0If 42 is deemed non-exclusionary, how do we present
it as the answer and, at the same time, forestall debate
on its exclusionary implications?
```

First, we invoke a left indent with a measure equal to the width of 2 figures spaces plus a period (using the `\w` inline escape). At this point, the left indent is active; text afterwards would normally be indented. However, we invoke a hanging indent of exactly the same width, which hangs the first line (and first line only!) to the left of the indent by the same distance (in this case, that means “out to the left margin”). Because we begin the first line with a number, a period, and a figure space, the actual text (*The most important point...*) starts at exactly the same spot as the indented lines that follow.

Notice that subsequent invocations of `.HI` don't require a *measure* to be given.

Paste the example above into a file and preview it with

```
pdfmom filename.mom | ps2pdf - filename.pdf
```

to see hanging indents in action.

**.IB** [ *<left measure>* *<right measure>* ]

Indent both — the optional argument requires a unit of measure

**.IB** allows you to set or invoke a left and a right indent at the same time.

At its first invocation, you must supply a measure for both indents; at subsequent invocations when you wish to supply a measure, both must be given again. As with **.IL** and **.JR**, the measures are added to the values previously passed to the macro. Hence, if you wish to change just one of the values, you must give an argument of zero to the other.

*A word of advice:* If you need to manipulate left and right indents separately, use a combination of **.IL** and **.JR** instead of **.IB**. You'll save yourself a lot of grief.

A *minus sign* may be prepended to the arguments to subtract from their current values. The `\w` inline escape may be used to specify text-dependent measures, in which case no unit of measure is required. For example,

```
.IB \w'margarine' \w'jello'
```

left indents text by the width of the word *margarine* and right indents by the width of *jello*.

Like **.IL** and **.JR**, **.IB** with no argument indents by its last active values. See the brief explanation of how mom handles indents for more details.

*Note:* Calling a *tab* (with **.TAB <n>**) automatically cancels any active indents.

*Additional note:* Invoking **.IB** automatically turns off **.IL** and **.IR**.

### **.IL** [ <measure> ]

Indent left — the optional argument requires a unit of measure

**.IL** indents text from the left margin of the page, or if you're in a *tab*, from the left edge of the *tab*. Once *IL* is on, the *left indent* is applied uniformly to every subsequent line of text, even if you change the line length.

The first time you invoke **.IL**, you must give it a measure. Subsequent invocations with a measure add to the previous measure. A minus sign may be prepended to the argument to subtract from the current measure. The `\w` inline escape may be used to specify a text-dependent measure, in which case no unit of measure is required. For example,

```
.IL \w'margarine'
```

indents text by the width of the word *margarine*.

With no argument, **.IL** indents by its last active value. See the brief explanation of how **mom** handles indents for more details.

*Note:* Calling a *tab* (with **.TAB <n>**) automatically cancels any active indents.

*Additional note:* Invoking **.IL** automatically turns off **IB**.

### **.IQ** [ <measure> ]

**IQ** — quit any/all indents

**IMPORTANT NOTE:** The original macro for quitting all indents was **.IX**. This usage has been deprecated in favour of **.IQ**. **.IX** will continue to behave as before, but **mom** will issue a warning to *stderr* indicating that you should update your documents.

As a consequence of this change, **.ILX**, **.IRX** and **.IBX** may now also be invoked as **.ILQ**, **.IRQ** and **.IBQ**. Both forms are acceptable.

Without an argument, the macros to quit indents merely restore your original margins and line length. The measures stored in the indent macros themselves are saved so you can call them again without having to supply a measure.

If you pass these macros the optional argument **CLEAR**, they not only restore your original left margin and line length, but also clear any values associated with a particular indent style. The next time you need an indent of the same style, you have to supply a measure again.

**.IQ CLEAR**, as you'd suspect, quits and clears the values for all indent styles at once.

### **.IR** [ <measure> ]

Indent right — the optional argument requires a unit of measure

**.IR** indents text from the *right margin* of the page, or if you're in a *tab*, from the end of the *tab*.

The first time you invoke **.IR**, you must give it a measure. Subsequent invocations with a measure add to the previous indent measure. A *minus sign* may be prepended to the argument to subtract from the current indent measure. The `\w` inline escape may be used to specify a text-dependent measure, in which case no *unit of measure* is required. For example,

```
.IR \w'jello'
```

indents text by the width of the word *jello*.

With no argument, **.IR** indents by its last active value. See the brief explanation of how **mom** handles indents for more details.

*Note:* Calling a *tab* (with **.TAB <n>**) automatically cancels any active indents.

*Additional note:* Invoking **.IR** automatically turns off **IB**.



using the document processing macros, top margin and bottom margin mean something slightly different than when you're using just the typesetting macros (see Top and bottom margins in document processing).

**.PAGE** lets you establish paper dimensions and page margins with a single macro. The only required argument is page width. The rest are optional, but they must appear in order and you can't skip over any. `<lm>`, `<rm>`, `<tm>` and `<bm>` refer to the left, right, top and bottom margins respectively.

Assuming your page dimensions are 11 inches by 17 inches, and that's all you want to set, enter

```
.PAGE 11i 17i
```

If you want to set the left margin as well, say, at 1 inch, **PAGE** would look like this:

```
.PAGE 11i 17i 1i
```

Now suppose you also want to set the top margin, say, at 1-1/2 inches. `<tm>` comes after `<rm>` in the optional arguments, but you can't skip over any arguments, therefore to set the top margin, you must also give a right margin. The **.PAGE** macro would look like this:

```
.PAGE 11i 17i 1i 1i 1.5i
```

```

      |      |
required right----+ +----top margin
      margin

```

Clearly, **.PAGE** is best used when you want a convenient way to tell **mom** just the dimensions of your printer sheet (width and length), or when you want to tell her everything about the page (dimensions and all the margins), for example

```
.PAGE 8.5i 11i 45p 45p 45p 45p
```

This sets up an 8½ by 11 inch page with margins of 45 points (5/8-inch) all around.

Additionally, if you invoke **.PAGE** with a top margin argument, any macros you invoke after **.PAGE** will almost certainly move the baseline of the first line of text down by one linespace. To compensate, do

```
.RLD 1v
```

immediately before entering any text, or, if it's feasible, make **.PAGE** the last macro you invoke prior to entering text.

Please read the *Important note* on page dimensions and papersize for information on ensuring groff respects your **.PAGE** dimensions and margins.

#### **.PAGELENGTH** *<length of printer sheet>*

tells **mom** how long your printer sheet is. It works just like **.PAGEWIDTH**.

Therefore, to tell **mom** your printer sheet is 11 inches long, you enter

```
.PAGELENGTH 11i
```

Please read the important note on page dimensions and papersize for information on ensuring groff respects your **PAGELENGTH**.

#### **.PAGEWIDTH** *<width of printer sheet>*

The argument to **.PAGEWIDTH** is the width of your printer sheet.

**.PAGEWIDTH** requires a unit of measure. Decimal fractions are allowed. Hence, to tell **mom** that the width of your printer sheet is 8½ inches, you enter

```
.PAGEWIDTH 8.5i
```

Please read the Important note on page dimensions and papersize for information on ensuring groff respects your **PAGEWIDTH**.

#### **.PAPER** *<paper type>*

provides a convenient way to set the page dimensions for some common printer sheet sizes. The argument *<paper type>* can be one of: **LETTER**, **LEGAL**, **STATEMENT**, **TABLOID**, **LEDGER**, **FOLIO**, **QUARTO**, **EXECUTIVE**, **10x14**, **A3**, **A4**, **A5**, **B4**, **B5**.

**.PRINTSTYLE****.PT\_SIZE** <size of type in points>

Point size of type, does not require a *unit of measure*.

**.PT\_SIZE** (*Point Size*) takes one argument: the *size of type in points*. Unlike most other macros that establish the *size* or *measure* of something, **.PT\_SIZE** does not require that you supply a *unit of measure* since it's a near universal convention that *type size* is measured in *points*. Therefore, to change the *type size* to, say, *11 points*, enter

```
.PT_SIZE 11
```

Point sizes may be *fractional* (e.g., *10.25* or *12.5*).

You can prepend a *plus* or a *minus sign* to the argument to **.PT\_SIZE**, in which case the *point size* will be changed by + or – the original value. For example, if the *point size* is *12*, and you want *14*, you can do

```
.PT_SIZE +2
```

then later reset it to *12* with

```
.PT_SIZE -2
```

The *size of type* can also be changed inline.

*Note:* It is unfortunate that the **pic** preprocessor has already taken the name, **PS**, and thus *mom*'s macro for setting *point sizes* can't use it. However, if you aren't using **pic**, you might want to alias **.PT\_SIZE** as **.PS**, since there'd be no conflict. For example

```
.ALIAS PS PT_SIZE
```

would allow you to set *point sizes* with **.PS**.

**.R\_MARGIN** <right margin>

Right Margin

Requires a unit of measure.

IMPORTANT: **.R\_MARGIN**, if used, must come after **.PAPER**, **.PAGEWIDTH**, **.L\_MARGIN**, and/or **.PAGE** (if a right margin isn't given to **PAGE**). The reason is that **.R\_MARGIN** calculates line length from the overall page dimensions and the left margin.

Obviously, it can't make the calculation if it doesn't know the page width and the left margin.

**.R\_MARGIN** establishes the amount of space you want between the end of typeset lines and the right hand edge of the printer sheet. In other words, it sets the line length. **.R\_MARGIN** requires a unit of measure. Decimal fractions are allowed.

The line length macro (**LL**) can be used in place of **.R\_MARGIN**. In either case, the last one invoked sets the line length. The choice of which to use is up to you. In some instances, you may find it easier to think of a section of type as having a right margin. In others, giving a line length may make more sense.

For example, if you're setting a page of type you know should have 6-pica margins left and right, it makes sense to enter a left and right margin, like this:

```
.L_MARGIN 6P
```

```
.R_MARGIN 6P
```

That way, you don't have to worry about calculating the line length. On the other hand, if you know the line length for a patch of type should be 17 picas and 3 points, entering the line length with **LL** is much easier than calculating the right margin, e.g.,

```
.LL 17P+3p
```

If you use the macros **.PAGE**, **.PAGEWIDTH** or **PAPER** without invoking **.R\_MARGIN** afterwards, **mom** automatically sets **.R\_MARGIN** to *1 inch*. If you set a line length after these macros (with **LL**), the line length calculated by **.R\_MARGIN** is, of course, overridden.

*Note:* **.R\_MARGIN** behaves in a special way when you're using the document processing macros.

**.ST** <tab number> **L** | **R** | **C** | **J** [**QUAD**]

After *string tabs* have been marked off on an input line (see `\*[ST]..*\[STX]`), you need to *set* them by giving them a direction and, optionally, the **QUAD** argument.

In this respect, **.ST** is like **.TAB\_SET** except that you don't have to give **.ST** an indent or a line length (that's already taken care of, inline, by `\*[ST]..*\[STX]`).

If you want string *tab 1* to be **left**, enter

```
.ST 1 L
```

If you want it to be *left* and *filled*, enter

```
.ST 1 L QUAD
```

If you want it to be justified, enter

```
.ST 1 J
```

**.TAB** <tab number>

After *tabs* have been defined (either with **.TAB\_SET** or **.ST**), **.TAB** moves to whatever *tab number* you pass it as an argument.

For example,

```
.TAB 3
```

moves you to *tab 3*.

Note: **.TAB** breaks the line preceding it and advances 1 linespace. Hence,

```
.TAB 1  
A line of text in tab 1.  
.TAB 2  
A line of text in tab 2.
```

produces, on output

```
A line of text in tab 1.  
A line of text in tab 2.
```

If you want the tabs to line up, use **.TN** (*Tab Next*) or, more conveniently, the inline escape `\*[TB+]`:

```
.TAB 1  
A line of text in tab 1.\*[TB+]  
A line of text in tab 2.
```

which produces

```
A line of text in tab 1. A line of text in tab 2.
```

If the text in your tabs runs to several lines, and you want the first lines of each tab to align, you must use the multi-column macros.

*Additional note:* Any indents in effect prior to calling a tab are automatically turned off by **TAB**. If you were happily zipping down the page with a left indent of 2 *picas* turned on, and you call a *tab* whose indent from the left margin is 6 *picas*, your new distance from the *left margin* will be 6 *picas*, not 6 *picas* plus the 2 *pica* indent.

*Tabs* are not by nature columnar, which is to say that if the text inside a *tab* runs to several lines, calling another *tab* does not automatically move to the baseline of the first line in the *previous tab*.

To demonstrate:

```
TAB 1  
Carrots  
Potatoes  
Broccoli  
.TAB 2  
$1.99/5 lbs  
$0.25/lb  
$0.99/bunch
```

produces, on output

```

Carrots
Potatoes
Broccoli
          $1.99/5 lbs
          $0.25/lb
          $0.99/bunch

```

**.TB** <*tab number*>

Alias to **.TAB**

**.TI** [ <*measure*> ]

Temporary left indent — the optional argument requires a *unit of measure*

A temporary indent is one that applies only to the first line of text that comes after it. Its chief use is indenting the first line of paragraphs. (**Mom's .PP** macro, for example, uses a *temporary indent*.)

The first time you invoke **.TI**, you must give it a measure. If you want to *indent* the first line of a paragraph by, say, 2 ems, do

```
.TI 2m
```

Subsequent invocations of **.TI** do not require you to supply a measure; **mom** keeps track of the last measure you gave it.

Because *temporary indents* are temporary, there's no need to turn them off.

**IMPORTANT:** Unlike **.IL**, **.IR** and **IB**, measures given to **.TI** are NOT additive. In the following example, the second "**.TI 2P**" is exactly 2 *picas*.

```

.TI 1P
The beginning of a paragraph. . .
.TI 2P
The beginning of another paragraph. . .

```

**.TN** Tab Next

Inline escape `\*[TB+]`

**TN** moves over to the *next tab* in numeric sequence (*tab n+1*) without advancing on the page. See the **NOTE** in the description of the **.TAB** macro for an example of how **TN** works.

In *tabs* that aren't given the **QUAD** argument when they're set up with **.TAB\_SET** or **ST**, you must terminate the line preceding **.TN** with the `\c` inline escape sequence. Conversely, if you did give a **QUAD** argument to **.TAB\_SET** or **ST**, the `\c` **must not be used**.

If you find remembering whether to put in the `\c` bothersome, you may prefer to use the inline escape alternative to **.TN**, `\*[TB+]`, which works consistently regardless of the fill mode.

**Note:** You must put text in the input line immediately after **.TN**. Stacking of **.TN**'s is not allowed. In other words, you cannot do

```

.TAB 1
Some text\c
.TN
Some more text\c
.TN
.TN
Yet more text

```

The above example, assuming *tabs* numbered from 1 to 4, should be entered

```

.TAB 1
Some text\c
.TN
Some more text\c
.TN

```

```
\&\c
.TN
Yet more text
```

\& is a zero-width, non-printing character that *groff* recognizes as valid input, hence meets the requirement for input text following **.TN**.

**.TQ** **TQ** takes you out of whatever *tab* you were in, advances *l linespace*, and restores the *left margin*, *line length*, *quad direction* and *fill mode* that were in effect prior to invoking any *tabs*.

**.T\_MARGIN** *<top margin>*

Top margin

Requires a unit of measure

**.T\_MARGIN** establishes the distance from the top of the printer sheet at which you want your type to start. It requires a unit of measure, and decimal fractions are allowed. To set a top margin of 2½ centimetres, you'd enter

```
.T_MARGIN 2.5c
```

**.T\_MARGIN** calculates the vertical position of the first line of type on a page by treating the top edge of the printer sheet as a baseline. Therefore,

```
.T_MARGIN 1.5i
```

puts the baseline of the first line of type 1½ inches beneath the top of the page.

Note: **.T\_MARGIN** means something slightly different when you're using the document processing macros. See Top and bottom margins in document processing for an explanation.

IMPORTANT: **.T\_MARGIN** does two things: it establishes the top margin for pages that come after it and it moves to that position on the current page. Therefore, **.T\_MARGIN** should only be used at the top of a file (prior to entering text) or after **NEWPAGE**, like this:

```
.NEWPAGE
.T_MARGIN 6P
<text>
```

## Authors

*mom* was written by Peter Schaffter (peter@schaffter.ca). PDF support was provided by Deri James (deri@chuzzlewit.myzen.co.uk). The alphabetical documentation of macros and escape sequences in this man page were written by the *mom* team.

## See also

</usr/local/share/doc/groff-1.23.0/html/mom/toc.html>

entry point to the HTML documentation

<http://www.schaffter.ca/mom/momdoc/toc.html>

HTML documentation online

<http://www.schaffter.ca/mom/>

the *mom* macros homepage

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

[pdfmom\(1\)](#), [groff\(1\)](#), [troff\(1\)](#)

**Name**

groff\_ms – GNU roff manuscript macro package for formatting documents

**Synopsis**

```
groff -ms [option ...] [file ...]
groff -m ms [option ...] [file ...]
```

**Description**

The GNU implementation of the *ms* macro package is part of the *groff* document formatting system. The *ms* package is suitable for the composition of letters, memoranda, reports, and books.

These *groff* macros support cover page and table of contents generation, automatically numbered headings, several different paragraph styles, a variety of text styling options, footnotes, multi-column page layouts, and indexing. *ms* supports the *tbl(1)*, *eqn(1)*, *pic(1)*, and *refer(1)* preprocessors for inclusion of tables, mathematical equations, diagrams, and standardized bibliographic citations.

This implementation is mostly compatible with the documented interface and behavior of AT&T Unix Version 7 *ms*. Several extensions from 4.2BSD (Berkeley) and Tenth Edition Research Unix have been recreated.

**Usage**

The *ms* macro package expects a certain amount of structure: a well-formed document contains at least one paragraphing or heading macro call. To compose a document from scratch, begin it by calling **.LP** or **.PP**. Longer documents have a structure as follows.

**Document type**

Calling the **RP** macro at the beginning of your document puts the document description (see below) on a cover page. Otherwise, *ms* places this information on the first page, followed immediately by the body text. Some document types found in other *ms* implementations are specific to AT&T or Berkeley, and are not supported in *groff ms*.

**Format and layout**

By setting registers and strings, you can change your document's typeface, margins, spacing, headers and footers, and footnote arrangement. See subsection "Document control settings" below.

**Document description**

A document description consists of any of: a title, one or more authors' names and affiliated institutions, an abstract, and a date or other identifier. See subsection "Document description macros" below.

**Body text**

The main matter of your document follows its description (if any). *ms* supports highly structured text consisting of paragraphs interspersed with multi-level headings (chapters, sections, subsections, and so forth) and augmented by lists, footnotes, tables, diagrams, and similar material. The preponderance of subsections below covers these matters.

**Table of contents**

Macros enable the collection of entries for a table of contents (or index) as the material they discuss appears in the document. You then call a macro to emit the table of contents at the end of your document. The table of contents must necessarily follow the rest of the text since GNU *troff* is a single-pass formatter; it thus cannot determine the page number of a division of the text until it has been set and output. Since *ms* output was designed for the production of hard copy, the traditional procedure was to manually relocate the pages containing the table of contents between the cover page and the body text. Today, page resequencing can be done in the digital domain with tools like *pdfjam(1)*. An index works similarly, but because it typically needs to be sorted after collection, its preparation requires separate processing.

**Document control settings**

The following tables list the document control registers, strings, and special characters. For any parameter whose default is unsatisfactory, define it before calling any *ms* macro other than **RP**.

| <b>Margin settings</b> |                           |                  |                |
|------------------------|---------------------------|------------------|----------------|
| <b>Parameter</b>       | <b>Definition</b>         | <b>Effective</b> | <b>Default</b> |
| \n [PO]                | Page offset (left margin) | next page        | 1i             |
| \n [LL]                | Line length               | next paragraph   | 6i             |
| \n [LT]                | Title line length         | next paragraph   | 6i             |
| \n [HM]                | Top (header) margin       | next page        | 1i             |
| \n [FM]                | Bottom (footer) margin    | next page        | 1i             |

| <b>Titles (headers, footers)</b> |                    |                  |                |
|----------------------------------|--------------------|------------------|----------------|
| <b>Parameter</b>                 | <b>Definition</b>  | <b>Effective</b> | <b>Default</b> |
| \* [LH]                          | Left header text   | next header      | <i>empty</i>   |
| \* [CH]                          | Center header text | next header      | -\n [%] -      |
| \* [RH]                          | Right header text  | next header      | <i>empty</i>   |
| \* [LF]                          | Left footer text   | next footer      | <i>empty</i>   |
| \* [CF]                          | Center footer text | next footer      | <i>empty</i>   |
| \* [RF]                          | Right footer text  | next footer      | <i>empty</i>   |

| <b>Text settings</b> |                            |                  |                |
|----------------------|----------------------------|------------------|----------------|
| <b>Parameter</b>     | <b>Definition</b>          | <b>Effective</b> | <b>Default</b> |
| \n [PS]              | Point size                 | next paragraph   | 10p            |
| \n [VS]              | Vertical spacing (leading) | next paragraph   | 12p            |
| \n [HY]              | Hyphenation mode           | next paragraph   | 6              |
| \* [FAM]             | Font family                | next paragraph   | T              |

| <b>Paragraph settings</b> |                              |                  |                |
|---------------------------|------------------------------|------------------|----------------|
| <b>Parameter</b>          | <b>Definition</b>            | <b>Effective</b> | <b>Default</b> |
| \n [PI]                   | Indentation                  | next paragraph   | 5n             |
| \n [PD]                   | Paragraph distance (spacing) | next paragraph   | 0.3v (1v)      |
| \n [QI]                   | Quotation indentation        | next paragraph   | 5n             |
| \n [PORPHANS]             | # of initial lines kept      | next paragraph   | 1              |

| <b>Heading settings</b> |                           |                  |                |
|-------------------------|---------------------------|------------------|----------------|
| <b>Parameter</b>        | <b>Definition</b>         | <b>Effective</b> | <b>Default</b> |
| \n [PSINCR]             | Point size increment      | next heading     | 1p             |
| \n [GROWPS]             | Size increase depth limit | next heading     | 0              |
| \n [HORPHANS]           | # of following lines kept | next heading     | 1              |
| \* [SN-STYLE]           | Numbering style (alias)   | next heading     | \* [SN-DOT]    |

\\* [SN-STYLE] can alternatively be made an alias of \\* [SN-NO-DOT] with the **als** request.

| <b>Footnote settings</b> |                              |                  |                |
|--------------------------|------------------------------|------------------|----------------|
| <b>Parameter</b>         | <b>Definition</b>            | <b>Effective</b> | <b>Default</b> |
| \n [FI]                  | Indentation                  | next footnote    | 2n             |
| \n [FF]                  | Format                       | next footnote    | 0              |
| \n [FPS]                 | Point size                   | next footnote    | \n [PS] -2p    |
| \n [FVS]                 | Vertical spacing (leading)   | next footnote    | \n [FPS] +2p   |
| \n [FPD]                 | Paragraph distance (spacing) | next footnote    | \n [PD] /2     |
| \* [FR]                  | Line length ratio            | <i>special</i>   | 11/12          |

| <b>Display settings</b> |                            |                  |                |
|-------------------------|----------------------------|------------------|----------------|
| <b>Parameter</b>        | <b>Definition</b>          | <b>Effective</b> | <b>Default</b> |
| \n [DD]                 | Display distance (spacing) | <i>special</i>   | 0.5v (1v)      |
| \n [DI]                 | Display indentation        | <i>special</i>   | 0.5i           |

| Parameter                  | Other settings<br>Definition | Effective           | Default              |
|----------------------------|------------------------------|---------------------|----------------------|
| <code>\n[MINGW]</code>     | Minimum gutter width         | next page           | 2n                   |
| <code>\n[TC-MARGIN]</code> | TOC page number margin width | next <b>PX</b> call | <code>\w'000'</code> |
| <code>\[TC-LEADER]</code>  | TOC leader character         | next <b>PX</b> call | <code>.\h'1m'</code> |

For entries marked “*special*” in the “Effective” column, see the discussion in the applicable section below. The **PD** and **DD** registers use the larger value if the vertical motion quantum of the output device is too coarse for the smaller one; usually, this is the case only for output to terminals and emulators thereof. The “gutter” affected by `\n[MINGW]` is the gap between columns in multiple-column page arrangements. The **TC-MARGIN** register and **TC-LEADER** special character affect the formatting of tables of contents assembled by the **XS**, **XA**, and **XE** macros.

### Document description macros

Define information describing the document by calling the macros below in the order shown; **.DA** or **.ND** can be called to set the document date (or other identifier) at any time before (a) the abstract, if present, or (b) its information is required in a header or footer. Use of these macros is optional, except that **.TL** is mandatory if any of **.RP**, **.AU**, **.AI**, or **.AB** is called, and **.AE** is mandatory if **.AB** is called.

#### **.RP** [**no**]

Use the “report” (AT&T: “released paper”) format for your document, creating a separate cover page. The default arrangement is to print most of the document description (title, author names and institutions, and abstract, but not the date) at the top of page 1. If the optional “**no**” argument is given, *ms* prints a cover page but does not repeat any of its information on page 1 (but see the **DA** macro below regarding the date).

**.TL** Specify the document title. *ms* collects text on input lines following a call to this macro into the title until reaching an **.AU**, **.AB**, or heading or paragraphing macro call.

**.AU** Specify an author’s name. *ms* collects text on input lines following a call to this macro into the author’s name until reaching an **.AI**, **.AB**, another **.AU**, or heading or paragraphing macro call. Call it repeatedly to specify multiple authors.

**.AI** Specify the preceding author’s institution. An **.AU** call is usefully followed by at most one **.AI** call; if there are more, the last **.AI** call controls. *ms* collects text on input lines following a call to this macro into the author’s institution until reaching an **.AU**, **.AB**, or heading or paragraphing macro call.

#### **.DA** [*x* . . .]

Typeset the current date, or any arguments *x*, in the center footer, and, if **.RP** is also called, left-aligned after other document description information on the cover page.

#### **.ND** [*x* . . .]

Typeset the current date, or any arguments *x*, if **.RP** is also called, left-aligned after other document description information on the cover page. This is the *groff ms* default.

#### **.AB** [**no**]

Begin the abstract. *ms* collects text on input lines following a call to this macro into the abstract until reaching an **.AE** call. By default, *ms* places the word “ABSTRACT” centered and in italics above the text of the abstract. The optional argument “**no**” suppresses this heading.

**.AE** End the abstract.

### Text settings

The **FAM** string sets the font family for body text; the default is “**T**” (Times). The **PS** and **VS** registers set the type size and vertical spacing (distance between text baselines), respectively. The font family and type size are ignored on terminal devices. Setting these parameters before the first call of a heading, paragraphing, or (non-date) document description macro also applies them to headers, footers, and (for **FAM**) footnotes.

The **HY** register defines the automatic hyphenation mode used with the **hy** request. Setting `\n[HY]` to **0** is

equivalent to using the **nh** request. This is a Tenth Edition Research Unix extension.

### Typographical symbols

*ms* provides a handful of strings to obtain typographical symbols not easily entered with the keyboard. Many others are available as special character escape sequences—see [groff\\_char\(7\)](#).

`\*[-]` Interpolate an em dash.

`\*[Q]`

`\*[U]` Interpolate typographer’s quotation marks where available, and neutral quotes otherwise. `\*[Q]` is the left quote and `\*[U]` the right. (As a mnemonic, think of “quote” and “unquote”.)

### Paragraphs

Several paragraph types are available, differing in how indentation applies to them: to left, right, or both margins; to the first output line of the paragraph, all output lines, or all but the first. All paragraphing macro calls cause the insertion of vertical space in the amount stored in the **PD** register, except at page or column breaks.

The **PORPHANS** register defines the minimum number of initial lines of any paragraph that must be kept together to avoid isolated lines at the bottom of a page. If a new paragraph is started close to the bottom of a page, and there is insufficient space to accommodate `\n[PORPHANS]` lines before an automatic page break, then a page break is forced before the start of the paragraph. This is a GNU extension.

**.LP** Set a paragraph without any (additional) indentation.

**.PP** Set a paragraph with a first-line left indentation in the amount stored in the **PI** register.

**.JP** [*marker* [*width*]]

Set a paragraph with a left indentation. The optional *marker* is not indented and is empty by default. *width* overrides the indentation amount in `\n[PI]`; its default unit is “n”. Once specified, *width* applies to further **.JP** calls until specified again or a heading or different paragraphing macro is called.

**.QP** Set a paragraph indented from both left and right margins by `\n[QI]`.

**.QS**

**.QE** Begin (**QS**) and end (**QE**) a region where each paragraph is indented from both margins by `\n[QI]`. The text between **.QS** and **.QE** can be structured further by use of other paragraphing macros.

**.XP** Set an “exdented” paragraph—one with a left indentation of `\n[PI]` on every line *except* the first (also known as a hanging indent). This is a Berkeley extension.

### Headings

Use headings to create a hierarchical structure for your document. The *ms* macros print headings in **bold** using the same font family and, by default, type size as the body text. Headings are available with and without automatic numbering. Text lines immediately after heading macro calls are treated as part of the heading, rendered on the same output line in the same style.

**.NH** [*depth*]

Set an automatically numbered heading. *ms* produces a numbered heading in the form *a.b.c. . .*, to any level desired, with the numbering of each depth increasing automatically and being reset to zero when a more significant depth is increased. “1” is the most significant or coarsest division of the document. Only nonzero values are output. If *depth* is omitted, it is taken to be 1. If you specify *depth* such that an ascending gap occurs relative to the previous **NH** call—that is, you “skip a depth”, as by “.NH 1” and then “.NH 3”, *groff ms* emits a warning on the standard error stream.

**.NH S** *heading-depth-index . . .*

Alternatively, you can give **NH** a first argument of “S”, followed by integers to number the heading depths explicitly. Further automatic numbering, if used, resumes using the specified indices as their predecessors. This feature is a Berkeley extension.

After **.NH** is called, the assigned number is made available in the strings **SN-DOT** (as it appears in a

printed heading with default formatting, followed by a terminating period) and **SN-NO-DOT** (with the terminating period omitted). These are GNU extensions.

You can control the style used to print numbered headings by defining an appropriate alias for the string **SN-STYLE**. By default, `\*[SN-STYLE]` is aliased to `\*[SN-DOT]`. If you prefer to omit the terminating period from numbers appearing in numbered headings, you may alias it to `\*[SN-NO-DOT]`. Any such change in numbering style becomes effective from the next use of **.NH** following redefinition of the alias for `\*[SN-STYLE]`. The formatted number of the current heading is available in `\*[SN]` (a feature first documented by Berkeley), facilitating its inclusion in **.XS/XA/XE** table of contents entries.

#### **.SH** [*depth*]

Set an unnumbered heading. The optional *depth* argument is a GNU extension indicating the heading depth corresponding to the *depth* argument of **.NH**. It matches the type size at which the heading is set to that of a numbered heading at the same depth when the `\n[GROWPS]` and `\n[PSINCR]` heading size adjustment mechanism is in effect.

The **PSINCR** register defines an increment in type size to be applied to a heading at a lesser depth than that specified in `\n[GROWPS]`. The value of `\n[PSINCR]` should be specified in points with the “p” scaling unit and may include a fractional component.

The **GROWPS** register defines the heading depth above which the type size increment set by `\n[PSINCR]` becomes effective. For each heading depth less than the value of `\n[GROWPS]`, the type size is increased by `\n[PSINCR]`. Setting `\n[GROWPS]` to a value less than 2 disables the incremental heading size feature.

In other words, if the value of **GROWPS** register is greater than the *depth* argument to a **.NH** or **.SH** call, the type size of a heading produced by these macros increases by `\n[PSINCR]` units over `\n[PS]` multiplied by the difference of `\n[GROWPS]` and *depth*.

The `\n[HORPHANS]` register operates in conjunction with the **NH** and **SH** macros to inhibit the printing of isolated headings at the bottom of a page; it specifies the minimum number of lines of the subsequent paragraph that must be kept on the same page as the heading. If insufficient space remains on the current page to accommodate the heading and this number of lines of paragraph text, a page break is forced before the heading is printed. Any display macro or *tbl*, *pic*, or *eqn* region between the heading and the subsequent paragraph suppresses this grouping.

### **Typeface and decoration**

The *ms* macros provide a variety of ways to style text. Attend closely to the ordering of arguments labeled *pre* and *post*, which is not intuitive. Support for *pre* arguments is a GNU extension.

#### **.B** [*text* [*post* [*pre*]]]

Style *text* in bold, followed by *post* in the previous font style without intervening space, and preceded by *pre* similarly. Without arguments, *ms* styles subsequent text in bold until the next highlighting, paragraphing, or heading macro call.

#### **.R** [*text* [*post* [*pre*]]]

As **.B**, but use the roman style (upright text of normal weight) instead of bold. Arguments are recognized only by *groff ms*.

#### **.I** [*text* [*post* [*pre*]]]

As **.B**, but use an italic or oblique style instead of bold.

#### **.BI** [*text* [*post* [*pre*]]]

As **.B**, but use a bold italic or bold oblique style instead of upright bold. This is a Tenth Edition Research Unix extension.

#### **.CW** [*text* [*post* [*pre*]]]

As **.B**, but use a constant-width (monospaced) roman typeface instead of bold. This is a Tenth Edition Research Unix extension.

#### **.BX** [*text*]

Typeset *text* and draw a box around it. On terminal devices, reverse video is used instead. If you want *text* to contain space, use horizontal motion escape sequences of appropriate width (`\~`, `\^`, `\|`,

$\backslash 0$ , or  $\backslash h$ ).

**.UL** [*text* [*post*]]

Typeset *text* with an underline. Set *post*, if present, after *text* with no intervening space.

**.LG**

Set subsequent text in larger type (2 points larger than the current size) until the next font size, highlighting, paragraphing, or heading macro call. You can specify this macro multiple times to enlarge the type size as needed.

**.SM**

Set subsequent text in smaller type (2 points smaller than the current size) until the next type size, highlighting, paragraphing, or heading macro call. You can specify this macro multiple times to reduce the type size as needed.

**.NL**

Set subsequent text at the normal type size ( $\backslash n[PS]$ ).

When *pre* is used, a hyphenation control escape sequence  $\backslash %$  that would ordinarily start *text* must start *pre* instead.

*groff ms* also offers strings to begin and end super- and subscripting. These are GNU extensions.

$\backslash *{$

$\backslash *}$  Begin and end superscripting, respectively.

$\backslash *<$

$\backslash *>$  Begin and end subscripting, respectively.

### Indented regions

You may need to indent a region of text while otherwise formatting it normally.

**.RS**

Begin a region where headings, paragraphs, and displays are indented (further) by  $\backslash n[PI]$ .

**.RE**

End the most recent indented region.

### Keeps, boxed keeps, and displays

On occasion, you may want to *keep* several lines of text, or a region of a document, together on a single page, preventing an automatic page break within certain boundaries. This can cause a page break to occur earlier than it normally would.

You can alternatively specify a *floating keep*: if a keep cannot fit on the current page, *ms* holds its contents and allows text following the keep (in the source document) to fill in the remainder of the current page. When the page breaks, whether by reaching the end or **bp** request, *ms* puts the floating keep at the beginning of the next page.

**.KS**

Begin a keep.

**.KF**

Begin a floating keep.

**.KE**

End (floating) keep.

As an alternative to the keep mechanism, the **ne** request forces a page break if there is not at least the amount of vertical space specified in its argument remaining on the page.

A keep have a frame drawn around it; this is called a *boxed keep*.

**.B1**

Begin a keep with a box drawn around it.

**.B2**

End boxed keep.

Boxed keep macros cause breaks; if you need to box a word or phrase within a line, see the **BX** macro in section “Highlighting” above. Box lines are drawn as close as possible to the text they enclose so that they are usable within paragraphs. If you wish to place one or more paragraphs in a boxed keep, you may improve their appearance by calling **.B1** after the first paragraphing macro, and by adding a small amount of vertical space before calling **.B2**.

If you want a boxed keep to float, you will need to enclose the **.B1** and **.B2** calls within a pair of **.KF** and **.KE** calls.

*Displays* turn off filling; lines of verse or program code are shown with their lines broken as in the source

document without requiring **br** requests between lines. Displays can be kept on a single page or allowed to break across pages. The **DS** macro begins a kept display of the layout specified in its first argument; non-kept displays are begun with dedicated macros corresponding to their layout.

**.DS L**

**.LD** Begin (**DS**: kept) left-aligned display.

**.DS** [**I** [*indent*]]

**.ID** [*indent*]

Begin (**DS**: kept) display indented by *indent* if specified, **\n[DI]** otherwise.

**.DS B**

**.BD** Begin (**DS**: kept) block display: the entire display is left-aligned, but indented such that the longest line in the display is centered on the page.

**.DS C**

**.CD** Begin (**DS**: kept) centered display: each line in the display is centered.

**.DS R**

**.RD** Begin (**DS**: kept) right-aligned display. This is a GNU extension.

**.DE** End any display.

The distance stored in **\n[DD]** is inserted before and after each pair of display macros; this is a Berkeley extension. The **DI** register is a GNU extension; its value is an indentation applied to displays created with **.DS** and **.ID** without arguments, to “**.DS I**” without an indentation argument, and to equations set with “**.EQ I**”. Changes to either register take effect at the next display boundary.

### Tables, figures, equations, and references

The *ms* package is often used with the *tbl*, *pic*, *eqn*, and *refer* preprocessors. The **\n[DD]** distance is also applied to regions of the document preprocessed with *eqn*, *pic*, and *tbl*. Mark text meant for preprocessors by enclosing it in pairs of tokens as follows, with nothing between the dot and the macro name. The preprocessors match these tokens only at the start of an input line.

**.TS** [**H**]

**.TE** Demarcate a table to be processed by the *tbl* preprocessor. The optional **H** argument instructs *groff* to repeat table rows (often column headings) at the top of each new page the table spans, if applicable; calling the **TH** macro marks the end of such rows. *tbl(1)* provides a comprehensive reference to the preprocessor and offers examples of its use.

**.PS**

**.PE** Demarcate a diagram to be processed by the *pic* preprocessor.

**.EQ** [*align*]

**.EN** Demarcate an equation to be processed by the *eqn* preprocessor. The equation is center-aligned by default; the optional *align* argument can be **C**, **L**, or **I** to center, left-align, or indent it by **\n[DI]**, respectively.

**.[**

**.]** Demarcate a bibliographic citation to be processed by the *refer* preprocessor. *refer(1)* provides a comprehensive reference to the preprocessor and the format of its bibliographic database.

When *refer* emits collected references (as might be done on a “Works Cited” page), it interpolates the string **\\*[REFERENCES]** as an unnumbered heading (**.SH**).

Attempting to place a multi-page table inside a keep can lead to unpleasant results, particularly if the *tbl* “**allbox**” option is used.

### Footnotes

A footnote is typically anchored to a place in the text with a *marker*, which is a small integer, a symbol, or arbitrary user-specified text.

**\\*\*** Place an *automatic number*; an automatically generated numeric footnote marker, in the text. Each time this string is interpolated, the number it produces increments by one. Automatic numbers start at 1. This is a Berkeley extension.

Enclose the footnote text in **FS** and **FE** macro calls to set it at the nearest available “foot”, or bottom, of a text column or page.

**.FS** [*marker*]

Begin a footnote. The **.FS-MARK** hook (see below) is called with any supplied *marker* argument, which is then also placed at the beginning of the footnote text. If *marker* is omitted, the next pending automatic number enqueued by interpolation of the \* string is used, and if none exists, nothing is prefixed.

**.FE** End footnote text.

*groff ms* provides a hook macro, **FS-MARK**, for user-determined operations to be performed when the **FS** macro is called. It is passed the same arguments as **.FS** itself. By default, this macro has an empty definition. **.FS-MARK** is a GNU extension.

Footnote text is formatted as paragraphs are, using analogous parameters. The registers **FI**, **FPD**, **FPS**, and **FVS** correspond to **PI**, **PD**, **PS**, and **VS**, respectively. The **FPD**, **FPS**, and **FVS** registers are GNU extensions.

The **FF** register controls the formatting of automatically numbered footnote paragraphs, and those for which **.FS** is given a *marker* argument, at the bottom of a column or page as follows.

- 0 Set an automatic number, or a specified **FS** *marker* argument, as a superscript (on typesetter devices) or surrounded by square brackets (on terminals). The footnote paragraph is indented as with **.PP** if there is an **.FS** argument or an automatic number, and as with **.LP** otherwise. This is the default.
- 1 As **0**, but set the marker as regular text, and follow an automatic number with a period.
- 2 As **1**, but without indentation (like **.LP**).
- 3 As **1**, but set the footnote paragraph with the marker hanging (like **.JP**).

### Language and localization

*groff ms* provides several strings that you can customize for your own purposes, or redefine to adapt the macro package to languages other than English. It is already localized for Czech, German, French, Italian, and Swedish. Load the desired localization macro package after *ms*; see [groff\\_tmac\(5\)](#).

| String                | Default                  |
|-----------------------|--------------------------|
| <b>\*[REFERENCES]</b> | References               |
| <b>\*[ABSTRACT]</b>   | <b>\f[I]ABSTRACT\f[]</b> |
| <b>\*[TOC]</b>        | Table of Contents        |
| <b>\*[MONTH1]</b>     | January                  |
| <b>\*[MONTH2]</b>     | February                 |
| <b>\*[MONTH3]</b>     | March                    |
| <b>\*[MONTH4]</b>     | April                    |
| <b>\*[MONTH5]</b>     | May                      |
| <b>\*[MONTH6]</b>     | June                     |
| <b>\*[MONTH7]</b>     | July                     |
| <b>\*[MONTH8]</b>     | August                   |
| <b>\*[MONTH9]</b>     | September                |
| <b>\*[MONTH10]</b>    | October                  |
| <b>\*[MONTH11]</b>    | November                 |
| <b>\*[MONTH12]</b>    | December                 |

The default for **ABSTRACT** includes font selection escape sequences to set the word in italics.

## Headers and footers

There are multiple ways to produce headers and footers. One is to define the strings **LH**, **CH**, and **RH** to set the left, center, and right headers, respectively; and **LF**, **CF**, and **RF** to set the left, center, and right footers similarly. This approach works best for documents that do not distinguish odd- and even-numbered pages.

Another method is to call macros with arguments that set headers or footers for odd- or even-numbered pages; these variables produce four combinations, so four macros are available. Each takes a delimiter separating the left, center, and right header or footer texts from each other. You can replace the neutral apostrophes (') with any character not appearing in the header or footer text. These macros are Berkeley extensions.

**.OH** 'left'center'right'

**.OF** 'left'center'right'

**.EH** 'left'center'right'

**.EF** 'left'center'right'

The **OH** and **EH** macros define headers for odd- (recto) and even-numbered (verso) pages, respectively; the **OF** and **EF** macros define footers for them.

By default, *ms* places no header on any page numbered “1” (regardless of its assigned format).

**.P1** Typeset the header even on page 1. To be effective, this macro must be called before the header trap is sprung on any page numbered “1”. This is a Berkeley extension.

For even greater flexibility, *ms* is designed to permit the redefinition of the macros that are called when the *groff* traps that ordinarily cause the headers and footers to be output are sprung. **PT** (“page trap”) is called by *ms* when the header is to be written, and **BT** (“bottom trap”) when the footer is to be. The page location trap that *ms* sets up to format the header also calls the (normally undefined) **HD** macro after **.PT**; you can define **HD** if you need additional processing after setting the header. The **HD** hook is a Berkeley extension. Any such macros you (re)define must implement any desired specialization for odd-, even-, or first numbered pages.

## Tab stops

Use the **ta** request to set tab stops as needed.

**.TA** Reset the tab stops to the *ms* default (every 5 ens). Redefine this macro to create a different set of default tab stops.

## Margins

Control margins using registers. These are summarized in the “Margin settings” table in subsection “Document control settings” above. There is no explicit right margin setting; the combination of page offset **\n[PO]** and line length **\n[LL]** provides the information necessary to derive the right margin.

## Multiple columns

*ms* can set text in as many columns as reasonably fit on the page. The following macros force a page break if a multi-column layout is active when they are called.

**.1C** Arrange page text in a single column (the default).

**.2C** Arrange page text in two columns.

**.MC** [*column-width* [*gutter-width*]]

Arrange page text in multiple columns. If you specify no arguments, it is equivalent to the **2C** macro. Otherwise, *column-width* is the width of each column and *gutter-width* is the minimum distance between columns. **\n[MINGW]** is the default minimum gutter width; it is a GNU extension.

## Creating a table of contents

Define an entry to appear in the table of contents by bracketing its text between calls to the **XS** and **XE** macros. A typical application is to call them immediately after **NH** or **SH** and repeat the heading text within them. The **XA** macro, used within **.XS/.XE** pairs, supplements an entry—for instance, when it requires multiple output lines, whether because a heading is too long to fit or because style dictates that page

numbers not be repeated. You may wish to indent the text thus wrapped to correspond to its heading depth; this can be done in the entry text by prefixing it with tabs or horizontal motion escape sequences, or by providing a second argument to the **XA** macro. **.XS** and **.XA** automatically associate the page number where they are called with the text following them, but they accept arguments to override this behavior. At the end of the document, call **TC** or **PX** to emit the table of contents; **.TC** resets the page number to **i** (Roman numeral one), and then calls **PX**.

**.XS** [*page-number*]

**.XA** [*page-number* [*indentation*]]

**.XE** Begin, supplement, and end a table of contents entry. Each entry is associated with *page-number* (otherwise the current page number); a *page-number* of “**no**” prevents a leader and page number from being emitted for that entry. Use of **.XA** within **.XS/.XE** is optional; it can be repeated. If *indentation* is present, a supplemental entry is indented by that amount; *ens* are assumed if no unit is indicated. Text on input lines between **.XS** and **.XE** is stored for later recall by **.PX**.

**.PX** [**no**]

Switch to single-column layout. Unless “**no**” is specified, center and interpolate `\*[TOC]` in bold and two points larger than the body text. Emit the table of contents entries.

**.TC** [**no**]

Set the page number to 1, the page number format to lowercase Roman numerals, and call **PX** (with a “**no**” argument, if present).

When creating a table of contents, incorporating content derived from headings specified by **.NH** and **.SH**, traditional *ms* implementations provide no convenient mechanism for duplication of the heading text into the table of contents; *groff ms* mitigates this limitation, by providing the following pair of macros, (for use after **.NH** and **.SH** respectively):

**.XN** *text ...*

**.XH** *outline-level text ...*

Duplicate *text ...* added to the body of the document, to create a table of contents entry, (which may be indented in accordance with *outline-level*).

Either, or both of **XN** and **XH** may be redefined by the user, (preferably by definition of the replacement hook macros, **XN-REPLACEMENT**, and **XH-REPLACEMENT** respectively); in their default implementations, both emit their *text* arguments into the body of the document, as heading text; they also pass this same text to the callback macro:

**.XH-UPDATE-TOC** *outline-level text ...*

Encapsulate *text* within **.XS...XE**, to create a table of contents entry. This macro is called by both **.XN** and **.XH** (no complementary **XN-UPDATE-TOC** macro is required), and may be redefined by the user; in its default implementation, its *outline-level* argument, (which is inferred from the last-specified **.NH** heading level, when called by **.XN**), is simply ignored, but may be used by any user-defined replacement, for example, to control indentation of the table of contents.

When called by **.XN**, in addition to the inference of the *outline-level* argument, the *text* arguments are augmented, by prefixing the current heading number, (which is also deduced from the last preceding use of **.NH**).

In addition to **XH-UPDATE-TOC**, the default **XN** and **XH** implementations support the following pair of callback macros:

**.XN-INIT**

**.XH-INIT**

Called by **.XN**, and by **.XH** respectively, *before* **XH-UPDATE-TOC** is called; in their default implementations, neither does anything, but either, or both, may be redefined by the user.

If the user has chosen to redefine **XH-UPDATE-TOC**, in some fashion which requires discrimination between the cases of having been called by **.XN**, or by **.XH**, then it may also be appropriate to redefine **XN-INIT**, or **XH-INIT**, or both, to handle the required discriminatory effect.

It should be noted that, whereas *groff ms* will emit an error diagnostic, and will *not* create any table of con-

tents entry, if **.XN** is used before the first use of **.NH**, no such restriction is imposed on the use of **.XH**. Thus, while it is nominally intended for use after **.SH**, **.XH** may be used in any context, in which use of **.XS...XE** is permitted.

You can customize the style of the leader that bridges each table of contents entry with its page number; define the **TC-LEADER** special character by using the **char** request. A typical leader combines the dot glyph “.” with a horizontal space escape sequence to spread the dots. The width of the page number field is stored in the **TC-MARGIN** register.

### Differences from AT&T *ms*

The *groff ms* macros are an independent reimplementaion, using no AT&T code. Since they take advantage of the extended features of *groff*, they cannot be used with AT&T *troff*. *groff ms* supports several features described above as Berkeley and Tenth Edition Research Unix extensions, and adds several of its own.

- The internals of *groff ms* differ from the internals of AT&T *ms*. Documents that depend upon implementation details of AT&T *ms* may not format properly with *groff ms*. Such details include macros whose function was not documented in the AT&T *ms* manual (“Typing Documents on the UNIX System: Using the `-ms` Macros with Troff and Nroff”, M. E. Lesk, Bell Laboratories, 1978).
- The error-handling policy of *groff ms* is to detect and report errors, rather than silently to ignore them.
- Tenth Edition Research Unix supported a pair of **P1** and **P2** macros for setting code examples; *groff ms* does not.
- *groff ms* does not work in GNU *troff*’s AT&T compatibility mode. If loaded when that mode is enabled, it aborts processing with a diagnostic message.
- Multiple line spacing is not supported (use a larger vertical spacing instead).
- *groff ms* uses the same header and footer defaults in both *nroff* and *troff* modes as AT&T *ms* does in *troff* mode; AT&T’s default in *nroff* mode is to put the date, in U.S. traditional format (e.g., “January 1, 2021”), in the center footer (the **CF** string).
- Many *groff ms* macros, including those for paragraphs, headings, and displays, cause a reset of paragraph rendering parameters, and may change the indentation; they do so not by incrementing or decrementing it, but by setting it absolutely. This can cause problems for documents that define additional macros of their own that try to manipulate indentation. The solution is to use, not the **in** request, but **.RS** and **.RE**.
- AT&T *ms* supported only integer values for the type size and vertical spacing. To overcome this restriction, for the registers **PS**, **VS**, **FPS**, and **FVS**, *groff ms* interprets values equal to or larger than 1000 as decimal fractions multiplied by 1000. In *ms* documents that don’t need to be portable to other implementations, use of a scaling unit, as in “**.nr PS 10.5p**”, is preferable.
- To make *groff ms* use the default page offset (which also specifies the left margin), the **PO** register must stay undefined until the first *ms* macro is called. This implies that **\n[PO]** should not be used early in the document, unless it is changed also: accessing an undefined register automatically defines it.
- AT&T *ms*’s **AU** macro recognized arguments that were used with some cover sheet types; *groff ms* does not.
- Right-aligned displays are available. The AT&T *ms* manual observes that “it is tempting to assume that “**.DS R**” will right adjust lines, but it doesn’t work”. In *groff ms*, it does.
- *groff ms* supports the **PN** register, but it is not necessary; you can access the page number via the usual **%** register and invoke the **af** request to assign a different format to it if desired. (If you redefine the *ms* **PT** macro and desire special treatment of certain page numbers—like “1”—you may need to handle a non-Arabic page number format, as *groff ms*’s **.PT** does; see the macro package source. *groff ms* aliases the **PN** register to **%**.)
- The AT&T *ms* manual documents registers **CW** and **GW** as setting the default column width and “intercolumn gap”, respectively, and which applied when **.MC** was called with fewer than two arguments. *groff ms* instead treats **.MC** without arguments as synonymous with **.2C**; there is thus no occasion for a

default column width register. Further, the **MINGW** register and the second argument to **.MC** specify a *minimum* space between columns, not the fixed gutter width of AT&T *ms*.

- The AT&T *ms* manual did not document the **QI** register, whereas Berkeley did; *groff ms* accordingly supports it.
- The register **GS** is set to 1 by the *groff ms* macros, but is not used by the AT&T *ms* package. Documents that need to determine whether they are being formatted with *groff ms* or another implementation should test this register.

#### Unix Version 7 macros not implemented by *groff ms*

Several macros described in the Unix Version 7 *ms* documentation are unimplemented by *groff ms* because they are specific to the requirements of documents produced internally by Bell Laboratories, some of which also require a glyph for the Bell System logo that *groff* does not support. These include macros implementing several document type formats (**EG**, **IM**, **MF**, **MR**, **TM**, **TR**), were meaningful only in conjunction with the use of certain document types (**AT**, **CS**, **CT**, **OK**, **SG**), stored the postal addresses of Bell Labs sites (**HO**, **IH**, **MH**, **PY**, **WH**), or lack a stable definition historically (**UX**).

#### Legacy features

*groff ms* retains support for some legacy features solely to support rendering of historical documents; contemporary ones should not use them because they can render poorly. See [groff\\_char\(7\)](#) instead.

#### AT&T *ms* accent mark strings

AT&T *ms* defined accent mark strings as follows.

| String   | Description                                  |
|----------|----------------------------------------------|
| \* [ ' ] | Apply acute accent to subsequent glyph.      |
| \* [ ` ] | Apply grave accent to subsequent glyph.      |
| \* [ : ] | Apply dieresis (umlaut) to subsequent glyph. |
| \* [ ^ ] | Apply circumflex accent to subsequent glyph. |
| \* [ ~ ] | Apply tilde accent to subsequent glyph.      |
| \* [ C ] | Apply caron to subsequent glyph.             |
| \* [ , ] | Apply cedilla to subsequent glyph.           |

#### Berkeley *ms* accent mark and glyph strings

Berkeley *ms* offered an **AM** macro; calling it redefined the AT&T accent mark strings (except for \\*C), applied them to the *preceding* glyph, and defined additional strings, some for spacing glyphs.

**.AM** Enable alternative accent mark and glyph-producing strings.

| String    | Description                                           |
|-----------|-------------------------------------------------------|
| \* [ ' ]  | Apply acute accent to preceding glyph.                |
| \* [ ` ]  | Apply grave accent to preceding glyph.                |
| \* [ : ]  | Apply dieresis (umlaut) to preceding glyph.           |
| \* [ ^ ]  | Apply circumflex accent to preceding glyph.           |
| \* [ ~ ]  | Apply tilde accent to preceding glyph.                |
| \* [ , ]  | Apply cedilla to preceding glyph.                     |
| \* [ / ]  | Apply stroke (slash) to preceding glyph.              |
| \* [ v ]  | Apply caron to preceding glyph.                       |
| \* [ _ ]  | Apply macron to preceding glyph.                      |
| \* [ . ]  | Apply underdot to preceding glyph.                    |
| \* [ o ]  | Apply ring accent to preceding glyph.                 |
| \* [ ? ]  | Interpolate inverted question mark.                   |
| \* [ ! ]  | Interpolate inverted exclamation mark.                |
| \* [ 8 ]  | Interpolate small letter sharp s.                     |
| \* [ q ]  | Interpolate small letter o with hook accent (ogonek). |
| \* [ 3 ]  | Interpolate small letter yogh.                        |
| \* [ d- ] | Interpolate small letter eth.                         |

|        |                                   |
|--------|-----------------------------------|
| \*[D-] | Interpolate capital letter eth.   |
| \*[th] | Interpolate small letter thorn.   |
| \*[TH] | Interpolate capital letter thorn. |
| \*[ae] | Interpolate small ae ligature.    |
| \*[AE] | Interpolate capital ae ligature.  |
| \*[oe] | Interpolate small oe ligature.    |
| \*[OE] | Interpolate capital oe ligature.  |

## Naming conventions

The following conventions are used for names of macros, strings, and registers. External names available to documents that use the *groff ms* macros contain only uppercase letters and digits.

Internally the macros are divided into modules; naming conventions are as follows:

- Names used only within one module are of the form *module\*name*.
- Names used outside the module in which they are defined are of the form *module@name*.
- Names associated with a particular environment are of the form *environment:name*; these are used only within the **par** module.
- *name* does not have a module prefix.
- Constructed names used to implement arrays are of the form *array!index*.

Thus the *groff ms* macros reserve the following names:

- Names containing the characters \*, @, and :.
- Names containing only uppercase letters and digits.

## Files

*/usr/local/share/groff/1.23.0/tmac/s.tmac*  
implements the package.

*/usr/local/share/groff/1.23.0/tmac/refer-ms.tmac*  
implements [refer\(1\)](#) support for *ms*.

*/usr/local/share/groff/1.23.0/tmac/ms.tmac*  
is a wrapper enabling the package to be loaded with “**groff -m ms**”.

## Authors

The GNU version of the *ms* macro package was written by James Clark and contributors. This document was (re-)written by Larry Kollar <lkollar@despammed.com>.

## See also

A manual is available in source and rendered form. On your system, it may be compressed and/or available in additional formats.

*/usr/local/share/doc/groff-1.23.0/ms.ms*

*/usr/local/share/doc/groff-1.23.0/ms.ps*

“Using *groff* with the *ms* Macro Package”; Larry Kollar and G. Branden Robinson.

*/usr/local/share/doc/groff-1.23.0/msboxes.ms*

*/usr/local/share/doc/groff-1.23.0/msboxes.pdf*

“Using PDF boxes with *groff* and the *ms* macros”; Deri James. **BOXSTART** and **BOXSTOP** macros are available via the *sboxes* extension package, enabling colored, bordered boxes when the **pdf** output device is used.

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

[groff\(1\)](#), [troff\(1\)](#), [tbl\(1\)](#), [pic\(1\)](#), [eqn\(1\)](#), [refer\(1\)](#)

**Name**

groff\_rfc1345 – special character names from RFC 1345 and Vim digraphs

**Description**

The file *rfc1345.tmac* defines special character escape sequences for *groff(7)* based on the glyph mnemonics specified in RFC 1345 and the digraph table of the text editor Vim. Each escape sequence translates to a Unicode code point, and will render correctly if the underlying font is a Unicode font that covers the code point.

For example, “`\[Rx]`” is the “recipe” or “prescription take” symbol, and maps to the code point U+211E. *groff* lets you write it as “`\[u211E]`”, but “`\[Rx]`” is more mnemonic.

For a list of the glyph names provided, please see the file *rfc1345.tmac*, which contains definitions of the form

```
.char \[Rx] \[u211E]    \ " PRESCRIPTION TAKE
```

where `.char`'s first argument defines a *groff* special character escape sequence with a mnemonic glyph name, its second argument is a special character escape sequence based on the code point, and the comment describes the glyph defined.

The RFC 1345 glyph names cover a wide range of Unicode code points, including supplemental Latin, Greek, Cyrillic, Hebrew, Arabic, Hiragana, Katakana, and Bopomofo letters, punctuation, math notation, currency symbols, industrial and entertainment icons, and box-drawing symbols.

The Vim digraph table is practically a subset of RFC 1345 (being limited to two-character mnemonics), but, as a newer system, adds four new mnemonics not specified in the RFC (the horizontal ellipsis, the Euro sign, and two mappings for the rouble sign). These have also been added to *rfc1345.tmac*.

*rfc1345.tmac* contains a total of 1,696 glyph names. It is not an error to load *rfc1345.tmac* if your font does not have all the glyphs, as long as it contains the glyphs that you actually use in your document.

The RFC 1345 mnemonics are not identical in every case to the mappings for special character glyph names that are built in to *groff*; for example, “`\[<<]`” means the “much less than” sign (U+226A) when *rfc1345.tmac* is not loaded and this special character is not otherwise defined by a document or macro package. *rfc1345.tmac* redefines “`\[<<]`” to the “left-pointing double angle quotation mark” (U+00AB). See *groff\_char(7)* for the full list of predefined special character escape sequences.

**Usage**

Load the *rfc1345.tmac* file. This can be done by either adding “`.mso rfc1345.tmac`” to your document before the first use of any of the glyph names the macro file defines, or by using the *troff(1)* option “`-m rfc1345`” from the shell.

**Bugs**

As the *groff* Texinfo manual notes, “[o]nly the current font is checked for ligatures and kerns; neither special fonts nor entities defined with the `char` request (and its siblings) are taken into account.” Many of the characters defined in *rfc1345.tmac* are accented Latin letters, and will be affected by this deficiency, producing subpar typography (<https://savannah.gnu.org/bugs/?59932>).

**Files**

*/usr/local/share/groff/1.23.0/tmac/rfc1345.tmac*  
implements the character mappings.

**Authors**

*rfc1345.tmac* was contributed by Dorai Sitaram ([ds26gte@yahoo.com](mailto:ds26gte@yahoo.com)).

**See also**

RFC 1345 (<https://tools.ietf.org/html/rfc1345>), by Keld Simonsen, June 1992.

The Vim digraph table can be listed using the *vim(1)* command “`:help digraph-table`”.

*groff\_char(7)*

**Name**

groff\_trace – GNU roff macros for debugging groff documents

**Synopsis**

```
groff -m trace [option ...] [file ...]
```

**Description**

*trace* is a macro package for the [groff\(7\)](#) document formatting system, designed as an aid for debugging documents written in its language. It issues a message to the standard error stream upon entry to and exit from each macro call. This can ease the process of isolating errors in macro definitions.

Activate the package by specifying the command-line option “**-m trace**” to the formatter program (often [groff\(1\)](#)). You can achieve finer control by including the macro file within the document; invoke the **mso** request, as in “**.mso trace.tmac**”. Only macros that are defined after this invocation are traced. If the **trace-full** register is set to a true value, as with the command-line option “**-r trace-full=1**”, register and string assignments, along with some other requests, are traced also. If another macro package should be traced as well, specify it after “**-m trace**” on the command line.

The macro file *trace.tmac* is unusual because it does not contain any macros to be called by a user. Instead, *groff*’s macro definition and alteration facilities are wrapped such that they display diagnostic messages.

**Limitations**

Because *trace.tmac* wraps the **de** request (and its cousins), macro arguments are expanded one level more. This causes problems if an argument uses four or more backslashes to delay interpretation of an escape sequence. For example, the macro call

```
.foo \\ \\ \\n[bar]
```

normally passes “`\\n[bar]`” to macro “`foo`”, but with **de** redefined, it passes “`\\n[bar]`” instead.

The solution to this problem is to use *groff*’s **\E** escape sequence, an escape character that is not interpreted in copy mode.

```
.foo \En[bar]
```

**Examples**

We will illustrate *trace.tmac* using the shell’s “here document” feature to supply *groff* with a document on the standard input stream. Since we are interested only in diagnostic messages appearing on the standard error stream, we discard the formatted output by redirecting the standard output stream to */dev/null*.

**Observing nested macro calls**

Macro calls can be nested, even with themselves. Tracing recurses along with them; this feature can help to detangle complex call stacks.

```
$ cat <<EOF | groff -m trace > /dev/null
.de countdown
. nop \\$1
. nr count (\\$1 - 1)
. if \\n[count] .countdown \\n[count]
..
.countdown 3
blastoff
EOF
*** .de countdown
*** de trace enter: .countdown "3"
*** de trace enter: .countdown "2"
*** de trace enter: .countdown "1"
*** trace exit: .countdown "1"
*** trace exit: .countdown "2"
*** trace exit: .countdown "3"
```

**Tracing with the mso request**

Now let us activate tracing within the document, not with a command-line option. We might do this when using a macro package like *ms* or *mom*, where we may not want to be distracted by traces of macros we didn't write.

```
$ cat <<EOF | groff -ms > /dev/null
.LP
This is my introductory paragraph.
.mso trace.tmac
.de Mymac
..
.Mymac
.PP
Let us review the existing literature.
EOF
*** .de Mymac
*** de trace enter: .Mymac
*** trace exit: .Mymac
```

As tracing was not yet active when the macros “LP” and “PP” were defined (by *s.tmac*), their calls were not traced; contrast with the macro “Mymac”.

**Files**

*/usr/local/share/groff/1.23.0/tmac/trace.tmac*  
implements the package.

**Authors**

*trace.tmac* was written by James Clark. This document was written by Bernd Warken (groff-bernd.warken-72@web.de) and G. Branden Robinson (g.branden.robinson@gmail.com).

**See also**

*Groff: The GNU Implementation of troff*, by Trent A. Fisher and Werner Lemberg, is the primary *groff* manual. You can browse it interactively with “info groff”.

[groff\(1\)](#) gives an overview of the *groff* document formatting system.

[troff\(1\)](#) supplies details of the **-m** command-line option.

[groff\\_tmac\(5\)](#)  
offers a survey of *groff* macro packages.

[groff\(7\)](#) is a reference manual for the *groff* language.

**Name**

groff\_www – GNU roff macros for authoring web pages

**Synopsis**

**groff -m www** [*option* ...] [*file* ...]

**Description**

This manual page describes the GNU *www* macro package, which is part of the *groff(7)* document formatting system. This macro file is automatically loaded by the default *troffrc* file when the formatter (usually *groff(1)*) is called with either of the options **-Thtml** or **-Txhtml**. To see hyperlinks in action, format this man page using one of those options.

This document is a basic guide; the HTML output driver (*grohtml*) remains in an alpha state. It has been included with the distribution to encourage testing.

Here is a summary of the functions found in this macro set.

|            |                                                      |
|------------|------------------------------------------------------|
| .JOBNAME   | split output into multiple files                     |
| .HX        | automatic heading level cut off                      |
| .BCL       | specify colours on a web page                        |
| .BGIMG     | specify background image                             |
| .URL       | create a URL using two parameters                    |
| .FTP       | create an FTP reference                              |
| .MTO       | create an HTML email address                         |
| .TAG       | generate an HTML name                                |
| .IMG       | include an image file                                |
| .PIMG      | include PNG image                                    |
| .MPIMG     | place PNG on the margin and wrap text around it      |
| .HnS       | begin heading                                        |
| .HnE       | end heading                                          |
| .LK        | emit automatically collected links.                  |
| .HR        | produce a horizontal rule                            |
| .NHR       | suppress automatic generation of rules.              |
| .HTL       | only generate HTML title                             |
| .HEAD      | add data to <head> block                             |
| .ULS       | unordered list begin                                 |
| .ULE       | unordered list end                                   |
| .OLS       | ordered list begin                                   |
| .OLE       | ordered list end                                     |
| .DLS       | definition list begin                                |
| .DLE       | definition list end                                  |
| .LI        | insert a list item                                   |
| .DC        | generate a drop capital                              |
| .HTML      | pass an HTML raw request to the device driver        |
| .CDS       | code example begin                                   |
| .CDE       | code example end                                     |
| .ALN       | place links on left of main text.                    |
| .LNS       | start a new two-column table with links in the left. |
| .LNE       | end the two-column table.                            |
| .LINKSTYLE | initialize default URL attributes.                   |

Output of the **pic**, **eqn**, **refer**, and **tbl** preprocessors is acceptable as input.

**Requests****.JOBNAME filename**

Split output into multiple HTML files. A file is split whenever a **.SH** or **.NH 1** is encountered. Its argument is the file stem name for future output files. This option is equivalent to *grohtml*'s **-j** option.

**.HX n** Specify the cut off depth when generating links from section headings. For example, a parameter of 2 would cause *grohtml* to generate a list of links for **.NH 1** and **.NH 2** but not for **.NH 3**. Whereas

```
.HX 0
```

tells *grohtml* that no heading links should be created at all. Another method for turning automatic headings off is by issuing the command-line switch **-P-I** to *groff*.

**.BCL** *foreground background active not-visited visited*

This macro takes five parameters: foreground, background, active hypertext link, hypertext link not yet visited, and visited hypertext link colour.

**.BGIMG imagefile**

the only parameter to this macro is the background image file.

**.URL url [description] [after]**

generates a URL using either one, two, or three arguments. The first parameter is the actual URL, the second is the name of the link, and the third is optional stuff to be printed immediately afterwards. If **description** and **after** are absent then the **URL** becomes the anchor text. Hyphenation is disabled while printing the actual URL; explicit breakpoints should be inserted with the **\:** escape sequence. Here is how to encode foo (`http://foo.org/`):

```
.URL http://\:foo\:.org/ foo :
```

If this is processed by a device other than **-Thtml** or **-Txhtml** it appears as:

```
foo (http://foo.org):
```

The URL macro can be of any type; for example, we can reference Eric Raymond's *pic* guide (`pic.html`) by:

```
.URL pic\:.html "Eric Raymond's pic guide"
```

**.MTO address [description] [after]**

Generate an email HTML reference. The first argument is mandatory as the email address. The optional second argument is the text you see in your browser. If an empty argument is given, **address** is used instead. An optional third argument is stuff printed immediately afterwards. Hyphenation is disabled while printing the actual email address. For example, Joe User (`joe@user.org`) can be achieved by the following macro:

```
.MTO joe@user.org "Joe User"
```

All URLs currently are treated as consuming no textual space in *groff*. This could be considered as a bug since it causes some problems. To circumvent this, **www.tmac** inserts a zero-width character which expands to a harmless space (only if run with **-Thtml** or **-Txhtml**).

**.FTP url [description] [after]**

indicates that data can be obtained via FTP. The first argument is the URL and the second is the browser text. A third argument, similar to the macros above, is intended for stuff printed immediately afterwards. The second and the third parameter are optional. Hyphenation is disabled while printing the actual URL. As an example, here is the location of the GNU FTP server (`ftp://ftp.gnu.org/`). The macro example above can be specified as:

```
.FTP ftp://\:ftp\:.gnu\:.org/ "GNU FTP server" .
```

**.TAG name**

Generates an HTML name tag from its argument. This can then be referenced using the URL (`#URL`) macro. As you can see, you must precede the tag name with **#** since it is a local reference. This link was achieved via placing a TAG in the URL description above; the source looks like this:

```
.TP
.B URL
generates
.TAG URL
```

a URL using either two or three arguments.  
...

**.IMG [-R|-L|-C] filename [width] [height]**

Include a picture into the document. The first argument is the horizontal location: right, left, or center (**-R**, **-L**, or **-C**). Alignment is centered by default (**-C**). The second argument is the filename. The optional third and fourth arguments are the width and height. If the width is absent it defaults to 1 inch. If the height is absent it defaults to the width. This maps onto an HTML `img` tag. If you are including a PNG image then it is advisable to use the **PIMG** macro.

**.PIMG [-R|-L|-C] filename [width] [height]**

Include an image in PNG format. This macro takes exactly the same parameters as the **IMG** macro; it has the advantage of working with PostScript and HTML devices also since it can automatically convert the image into the EPS format, using the following programs of the **netpbm** package: **pngtopnm**, **pnmcrop**, and **pnmtops**. If the document isn't processed with **-Thtml** or **-Txhtml** it is necessary to use the **-U** option of *groff*.

**.MPIMG [-R|-L] [-G gap] filename [width] [height]**

Place a PNG image on the margin and wrap text around it. The first parameters are optional. The alignment: left or right (**-L** or **-R**) specifies the margin where the picture is placed at. The default alignment is left (**-L**). Optionally, **-G gap** can be used to arrange a gap between the picture and the text that wraps around it. The default gap width is zero.

The first non-optional argument is the filename. The optional following arguments are the width and height. If the width is absent it defaults to 1 inch. If the height is absent it defaults to the width. Example:

```
.MPIMG -L -G 2c foo.png 3c 1.5c
```

The height and width may also be given as percentages. The PostScript device calculates the width from the **.I** register and the height from the **.p** register. For example:

```
.MPIMG -L -G 2c foo.png 15%
```

**.HnS n** Begin heading. The numeric heading level *n* is specified by the first parameter. Use this macro if your headings contain URL, FTP or MTO macros. Example:

```
.HnS 1
.HR
GNU Troff
.URL https://\:www\:.gnu\:.org/\:software/\:groff/
\[em]a
.URL http://www\:.gnu\:.org/ GNU
project.
.HR
.HnE
```

In this case you might wish to disable automatic links to headings. This can be done via **-P-I** from the command line.

**.HnE** End heading.

**.LK** Force *grohtml* to place the automatically generated links at this position.

**.HR** Generate a full-width horizontal rule for **-Thtml** and **-Txhtml**. No effect for all other devices.

**.NHR** Suppress generation of the top and bottom rules which *grohtml* emits by default.

**.HTL** Generate an HTML title only. This differs from the **TL** macro of the **ms** macro package which generates both an HTML title and an `<H1>` heading. Use it to provide an HTML title as search engine fodder but a graphic title in the document. The macro terminates when a space or break is seen (`.sp`, `.br`).

**.HEAD**

Add arbitrary HTML data to the <head> block. Ignored if not processed with **-Thtml** or **-Txhtml**. Example:

```
.HEAD "<link \
      rel="icon" \
      type="image/png" \
      href="http://foo.org/bar.png"/>"
```

**.HTML**

All text after this macro is treated as raw HTML. If the document is processed without **-Thtml** or **-Txhtml** then the macro is ignored. Internally, this macro is used as a building block for other higher-level macros.

For example, the **BGIMG** macro is defined as

```
.de BGIMG
. HTML <body background=\\$1>
..
```

**.DC I text [color]**

Produce a drop capital. The first parameter is the letter to be dropped and enlarged, the second parameter **text** is the adjoining text whose height the first letter should not exceed. The optional third parameter is the color of the dropped letter. It defaults to black.

**.CDS** Start displaying a code section in constant width font.

**.CDE** End code display

**.ALN [color] [percentage]**

Place section heading links automatically to the left of the main text. The color argument is optional and if present indicates which HTML background color is to be used under the links. The optional percentage indicates the amount of width to devote to displaying the links. The default values are #eeeeee and 30 for color and percentage width, respectively. This macro should only be called once at the beginning of the document. After calling this macro each section heading emits an HTML table consisting of the links in the left and the section text on the right.

**.LNS** Start a new two-column table with links in the left column. This can be called if the document has text before the first **.SH** and if **.ALN** is used. Typically this is called just before the first paragraph and after the main title as it indicates that text after this point should be positioned to the right of the left-hand navigational links.

**.LNE** End a two-column table. This should be called at the end of the document if **.ALN** was used.

**.LINKSTYLE color [ fontstyle [ openglyph closeglyph ] ]**

Initialize default URL attributes to be used if this macro set is not used with the HTML device. The macro set initializes itself with the following call

```
.LINKSTYLE blue CR \[la] \[ra]
```

but these values will be superseded by a user call to **LINKSTYLE**.

**Section heading links**

By default *grohtml* generates links to all section headings and places these at the top of the HTML document. (See **LINKS** <#LK> for details of how to switch this off or alter the position).

**Limitations of *grohtml***

*tbl(1)* tables are rendered as PNG images. Paul DuBois's approach with *tblcvt(1)*, part of the *troffcvt* distribution (<http://www.snake.net/software/troffcvt/>), should be explored.

**Files**

*/usr/local/share/groff/1.23.0/tmac/www.tmac*

**Authors**

The *www* macro package was written by Gaius Mulley <gaius@glam.ac.uk>, with additions by Werner Lemberg <wl@gnu.org> and Bernd Warken <groff-bernd.warken-72@web.de>.

**See also**

[groff\(1\)](#), [troff\(1\)](#), [grohtml\(1\)](#), [netpbm\(1\)](#)

**Name**

roff – concepts and history of roff typesetting

**Description**

The term *roff* denotes a family of document formatting systems known by names like *troff*, *nroff*, and *ditroff*. A *roff* system consists of an interpreter for an extensible text formatting language and a set of programs for preparing output for various devices and file formats. Unix-like operating systems often distribute a *roff* system. The manual pages on Unix systems (“man pages”) and bestselling books on software engineering, including Brian Kernighan and Dennis Ritchie’s *The C Programming Language* and W. Richard Stevens’s *Advanced Programming in the Unix Environment* have been written using *roff* systems. GNU *roff*—*groff*—is arguably the most widespread *roff* implementation.

This document presents typographical concepts that form the common background of all *roff* implementations, describes some of the development history of *roff* systems, offers details of the *roff* pipeline which are usually managed by front ends like *groff(1)*, surveys the formatting language, suggests some tips for editing *roff* input files, and recommends materials for further reading.

**Concepts**

*roff* input files contain text interspersed with instructions to control the formatter. Even in the absence of such instructions, a *roff* formatter still processes its input in several ways, by filling, hyphenating, breaking, and adjusting it, and supplementing it with inter-sentence space. These processes are basic to typesetting, and can be controlled at the input document’s discretion.

When a device-independent *roff* formatter starts up, it obtains information about the device for which it is preparing output from the latter’s description file (see *groff\_font(5)*). An essential property is the length of the output line, such as “6.5 inches”.

The formatter interprets plain text files employing the Unix line-ending convention. It reads input a character at a time, collecting words as it goes, and fits as many words together on an output line as it can—this is known as *filling*. To a *roff* system, a *word* is any sequence of one or more characters that aren’t spaces, tabs, or newlines. The exceptions separate words.

A *roff* formatter attempts to detect the boundaries between sentences, and supplies additional inter-sentence space between them. It does this by flagging certain characters (normally “!”, “?”, and “.”) as potentially ending a sentence. When the formatter encounters one of these *end-of-sentence characters* at the end of a line, or one of them is followed by two spaces on the same input line, it appends an inter-word space followed by an inter-sentence space in the formatted output. The non-printing input break escape sequence `&` can be used after an end-of-sentence character to defeat end-of-sentence detection on a per-instance basis. Normally, the occurrence of a visible non-end-of-sentence character (as opposed to a space or tab) immediately after an end-of-sentence character cancels detection of the end of a sentence. However, several characters are treated *transparently* after the occurrence of an end-of-sentence character. That is, a *roff* does not cancel end-of-sentence detection when it processes them. This is because such characters are often used as footnote markers or to close quotations and parentheticals. The default set is “, ’, ), \*, `\[dg]`, `\[dd]`, `\[rq]`, and `\[cg]`. The last four are examples of *special characters*, escape sequences whose purpose is to obtain glyphs that are not easily typed at the keyboard, or which have special meaning to the formatter (like `\`).

When an output line is nearly full, it is uncommon for the next word collected from the input to exactly fill it—typically, there is room left over only for part of the next word. The process of splitting a word so that it appears partially on one line (with a hyphen to indicate to the reader that the word has been broken) with its remainder on the next is *hyphenation*. Hyphenation points can be manually specified; *groff* also uses a hyphenation algorithm and language-specific pattern files to decide which words can be hyphenated and where. Hyphenation does not always occur even when the hyphenation rules for a word allow it; it can be disabled, and when not disabled there are several parameters that can prevent it in certain circumstances.

Once an output line has been filled, whether or not hyphenation has occurred on that line, the next word read from the input will be placed on a different output line; this is called a *break*. In this document and in *roff* discussions generally, a “break” if not further qualified always refers to the termination of an output line. When the formatter is filling text, it introduces breaks automatically to keep output lines from exceeding the configured line length. After an automatic break, a *roff* formatter *adjusts* the line if applicable (see

below), and then resumes collecting and filling text on the next output line.

Sometimes, a line cannot be broken automatically. This usually does not happen with natural language text unless the output line length has been manipulated to be extremely short, but it can with specialized text like program source code. *groff* provides a means of telling the formatter where the line may be broken without hyphens. This is done with the non-printing break point escape sequence `\:`.

There are several ways to cause a break at a predictable location. A blank input line not only causes a break, but by default it also outputs a one-line vertical space (effectively a blank output line). Macro packages may discourage or disable this “blank line method” of paragraphing in favor of their own macros. A line that begins with one or more spaces causes a break. The spaces are output at the beginning of the next line without being *adjusted* (see below). Again, macro packages may provide other methods of producing indented paragraphs. Trailing spaces on *text lines* (see below) are discarded. The end of input causes a break.

After the formatter performs an automatic break, it then tries to *adjust* the line: inter-word spaces are widened until the text reaches the right margin. Extra spaces between words are preserved. Leading and trailing spaces are handled as noted above. Text can be aligned to the left or right margins or centered using *requests*.

A *roff* formatter translates horizontal tab characters, also called simply “tabs”, in the input into movements to the next tab stop. These tab stops are by default located every half inch measured from the current position on the input line. With them, simple tables can be made. However, this method can be deceptive, as the appearance (and width) of the text in an editor and the results from the formatter can vary greatly, particularly when proportional typefaces are used. A tab character does not cause a break and therefore does not interrupt filling. The formatter provides facilities for sophisticated table composition; there are many details to track when using the “tab” and “field” low-level features, so most users turn to the *tbl(1)* pre-processor for table construction.

### Page geometry

*roff* systems format text under certain assumptions about the size of the output medium, or page. For the formatter to correctly break a line it is filling, it must know the line length, which it derives from the page width. For it to decide whether to write an output line to the current page or wait until the next one, it must know the page length. A device’s *resolution* converts practical units like inches or centimeters to *basic units*, a convenient length measure for the output device or file format. The formatter and output driver use basic units to reckon page measurements. The device description file defines its resolution and page dimensions (see *groff\_font(5)*).

A *page* is a two-dimensional structure upon which a *roff* system imposes a coordinate system with its upper left corner as the origin. Coordinate values are in basic units and increase down and to the right. Useful ones are therefore always positive and within numeric ranges corresponding to the page boundaries.

While the formatter (and, later, output driver) is processing a page, it keeps track of its *drawing position*, which is the location at which the next glyph will be written, from which the next motion will be measured, or where a geometric primitive will commence rendering. Notionally, glyphs are drawn from the text baseline upward and to the right. (*groff* does not yet support right-to-left scripts.) The *text baseline* is a (usually invisible) line upon which the glyphs of a typeface are aligned. A glyph therefore “starts” at its bottom-left corner. If drawn at the origin, a typical letter glyph would lie partially or wholly off the page, depending on whether, like “g”, it features a descender below the baseline.

Such a situation is nearly always undesirable. It is furthermore conventional not to write or draw at the extreme edges of the page. Therefore the initial drawing position of a *roff* formatter is not at the origin, but below and to the right of it. This rightward shift from the left edge is known as the *page offset*. (*groff*’s terminal output devices have page offsets of zero.) The downward shift leaves room for a text output line.

Text is arranged on a one-dimensional lattice of text baselines from the top to the bottom of the page. *Vertical spacing* is the distance between adjacent text baselines. Typographic tradition sets this quantity to 120% of the type size. The initial vertical drawing position is one unit of vertical spacing below the page top. Typographers have a name for this unit: “vee”.

Vertical spacing has an impact on page-breaking decisions. Generally, when a break occurs, the formatter moves the drawing position to the next text baseline automatically. If the formatter were already writing to the last line that would fit on the page, advancing by one vee would place the next text baseline off the page. Rather than let that happen, *roff* formatters instruct the output driver to eject the page, start a new one, and again set the drawing position to one vee below the page top; this is a *page break*.

When the last line of input text is also the last output line that can fit on the page, the break caused by the end of input will also break the page, producing a useless blank one. Macro packages keep users from having to confront this difficulty by setting “traps”; moreover, all but the simplest page layouts tend to have headers and footers, or at least bear vertical margins larger than one vee.

### Language elements

Lines of input to any *roff* formatter can be classified as one of two types: control lines and text lines.

A *control line* starts with the *control character*, a dot (.) or the *no-break control character*, a neutral apostrophe ('). Either control character is followed by zero or more spaces or tabs and then an optional *request*, an instruction built in to the formatter. Some requests take one or more *arguments*, which follow on the same line, separated from the request name and each other only by spaces.

Any input line that is not a control line is a *text line*. See section “Line continuation” in [groff\(7\)](#) for an exception to this rule. Text lines generally become formatted output. To start a text line with the control or no-break control character, prefix the character with the `\&` escape sequence.

*Escape sequences* start with the *escape character*, a backslash `\`, and are followed by at least one additional character. They can appear anywhere in the input.

With requests, the escape and control characters can be changed; further, escape sequence recognition can be turned off and back on.

*Macros* permit the extension or replacement of the request repertoire. Certain requests can be invoked to define a macro, a user-directed abbreviation for a collection of input lines. Macros are called on control lines much as requests are invoked, albeit with occasional differences in argument handling. When a macro is called, its definition (or “body”) is *interpolated*, as if typed at its call site. Its contents are then parsed for further request invocations, macro calls, and escape sequences.

*Strings* store character sequences. In *groff*, they can be parameterized as macros can.

*Registers* store numerical values, including measurements. The latter are generally in basic units; *scaling units* can be appended to numeric expressions to clarify their meaning when stored or interpolated. Some read-only predefined registers interpolate text.

*Fonts* are identified either by a name or by a mounting position (a non-negative number). Four font styles are available on all devices. **R** is “roman”: normal, upright text. **B** is **bold**, an upright typeface with a heavier weight. **I** is *italic*, a face that is oblique on typesetter output devices and usually underlined instead on terminal devices. **BI** is **bold-italic**, combining both of the foregoing style variations. Typesetter devices typically offer one or more *special* fonts as well; they provide glyphs that are not available in the multiple styles of text fonts.

*groff* supports named *colors* for glyph rendering and drawing of geometric primitives. Stroke and fill colors are distinct; the stroke color is used for glyphs.

*Glyphs* are visual representation forms of *characters*. In *groff*, the distinction between those two elements is not always obvious (and a full discussion is beyond our scope). To roughly characterize, “A” is a character when we consider it in the abstract: to make it a glyph, we must select a typeface with which to render it, and determine its type size and color. The formatting process turns input characters into output glyphs. A few characters commonly seen on keyboards are treated specially by *roff* languages and may not look correct in output if used unthinkingly; they are the (double) quotation mark ("), the neutral apostrophe ('), the minus sign (−), the backslash (\), the caret or circumflex accent (^), the grave accent (`), and the tilde (~). All are available via *special character* escape sequences, along with numerous other symbols; see [groff\\_char\(7\)](#).

*groff* offers *streams*, identifiers for writable files, but for security reasons this feature is disabled by default.

A further few language elements arise as page layouts become more sophisticated and demanding. *Environments* collect formatting parameters like line length and typeface. A *diversion* stores formatted output for later use. A *trap* is a condition on the input or output, tested automatically by the formatter, that is associated with a macro, causing it to be called when that condition is fulfilled.

Footnote support often exercises all three of the foregoing features. A simple implementation might work as follows. A pair of macros is defined: one starts a footnote and the other ends it. The author calls the first macro where a footnote marker is desired. The macro establishes a diversion so that the footnote text is collected at the place in the body text where its corresponding marker appears. An environment is created for the footnote so that it is set at a smaller typeface. The footnote text is formatted in the diversion using that environment, but it does not yet appear in the output. The document author calls the footnote end macro, which returns to the previous environment and ends the diversion. Later, after much more body text in the document, a trap, set a small distance above the page bottom, is sprung. The macro called by the trap draws a line across the page and emits the stored diversion. Thus, the footnote is rendered.

## History

Computer-driven document formatting dates back to the 1960s. The *roff* system itself is intimately connected with the Unix operating system, but its roots go back to the earlier operating systems CTSS, GECOS, and Multics.

### The predecessor—*RUNOFF*

*roff*'s ancestor *RUNOFF* was written in the MAD language by Jerry Saltzer to prepare his Ph.D. thesis using the Compatible Time Sharing System (CTSS), a project of the Massachusetts Institute of Technology (MIT). The program is generally referred to in full capitals, both to distinguish it from its many descendants, and because bits were expensive in those days; five- and six-bit character encodings were still in widespread usage, and mixed-case alphabets in file names seen as a luxury. *RUNOFF* introduced a syntax of inlining formatting directives amid document text, by beginning a line with a period (an unlikely occurrence in human-readable material) followed by a “control word”. Control words with obvious meaning like “.line length *n*” were supported as well as an abbreviation system; the latter came to overwhelm the former in popular usage and later derivatives of the program. A sample of control words from a *RUNOFF* manual of December 1966 (<http://web.mit.edu/Saltzer/www/publications/ctss/AH.9.01.html>) was documented as follows (with the parameter notation slightly altered). The abbreviations will be familiar to *roff* veterans.

| Abbreviation | Control word           |
|--------------|------------------------|
| <b>.ad</b>   | .adjust                |
| <b>.bp</b>   | .begin page            |
| <b>.br</b>   | .break                 |
| <b>.ce</b>   | .center                |
| <b>.in</b>   | .indent <i>n</i>       |
| <b>.ll</b>   | .line length <i>n</i>  |
| <b>.nf</b>   | .nofill                |
| <b>.pl</b>   | .paper length <i>n</i> |
| <b>.sp</b>   | .space [ <i>n</i> ]    |

In 1965, MIT's Project MAC teamed with Bell Telephone Laboratories and General Electric (GE) to inaugurate the Multics (<http://www.multicians.org>) project. After a few years, Bell Labs discontinued its participation in Multics, famously prompting the development of Unix. Meanwhile, Saltzer's *RUNOFF* proved influential, seeing many ports and derivations elsewhere.

In 1969, Doug McIlroy wrote one such reimplementations, adding extensions, in the BCPL language for a GE 645 running GECOS at the Bell Labs location in Murray Hill, New Jersey. In its manual, the control commands were termed “requests”, their two-letter names were canonical, and the control character was configurable with a **.cc** request. Other familiar requests emerged at this time; no-adjust (**.na**), need (**.ne**), page offset (**.po**), tab configuration (**.ta**, though it worked differently), temporary indent (**.ti**), character translation (**.tr**), and automatic underlining (**.ul**; on *RUNOFF* you had to backspace and underscore in the input yourself). **.fi** to enable filling of output lines got the name it retains to this day. McIlroy's program also featured a heuristic system for automatically placing hyphenation points, designed and implemented

by Molly Wagner. It furthermore introduced numeric variables, termed registers. By 1971, this program had been ported to Multics and was known as *roff*, a name McIlroy attributes to Bob Morris, to distinguish it from CTSS *RUNOFF*.

### Unix and *roff*

McIlroy's *roff* was one of the first Unix programs. In Ritchie's term, it was "transliterated" from BCPL to DEC PDP-7 assembly language for the fledgling Unix operating system. Automatic hyphenation was managed with **.hc** and **.hy** requests, line spacing control was generalized with the **.ls** request, and what later *roff*'s would call diversions were available via "footnote" requests. This *roff* indirectly funded operating systems research at Murray Hill; AT&T prepared patent applications to the U.S. government with it. This arrangement enabled the group to acquire a PDP-11; *roff* promptly proved equal to the task of formatting the manual for what would become known as "First Edition Unix", dated November 1971.

Output from all of the foregoing programs was limited to line printers and paper terminals such as the IBM 2471 (based on the Selectric line of typewriters) and the Teletype Corporation Model 37. Proportionally-spaced type was unavailable.

### New *roff* and Typesetter *roff*

The first years of Unix were spent in rapid evolution. The practicalities of preparing standardized documents like patent applications (and Unix manual pages), combined with McIlroy's enthusiasm for macro languages, perhaps created an irresistible pressure to make *roff* extensible. Joe Ossanna's *nroff*, literally a "new roff", was the outlet for this pressure. By the time of Unix Version 3 (February 1973)—and still in PDP-11 assembly language—it sported a swath of features now considered essential to *roff* systems: definition of macros (**.de**), diversion of text thence (**.di**), and removal thereof (**.rm**); trap planting (**.wh**; "when") and relocation (**.ch**; "change"); conditional processing (**.if**); and environments (**.ev**). Incremental improvements included assignment of the next page number (**.pn**); no-space mode (**.ns**) and restoration of vertical spacing (**.rs**); the saving (**.sv**) and output (**.os**) of vertical space; specification of replacement characters for tabs (**.tc**) and leaders (**.lc**); configuration of the no-break control character (**.c2**); shorthand to disable automatic hyphenation (**.nh**); a condensation of what were formerly six different requests for configuration of page "titles" (headers and footers) into one (**.tl**) with a length controlled separately from the line length (**.lt**); automatic line numbering (**.nm**); interactive input (**.rd**), which necessitated buffer-flushing (**.fl**), and was made convenient with early program cessation (**.ex**); source file inclusion in its modern form (**.so**); though *RUNOFF* had an ".append" control word for a similar purpose) and early advance to the next file argument (**.nx**); ignorable content (**.ig**); and programmable abort (**.ab**).

Third Edition Unix also brought the *pipe(2)* system call, the explosive growth of a componentized system based around it, and a "filter model" that remains perceptible today. Equally importantly, the Bell Labs site in Murray Hill acquired a Graphic Systems C/A/T phototypesetter, and with it came the necessity of expanding the capabilities of a *roff* system to cope with proportionally-spaced type, multiple sizes, and a variety of fonts. Ossanna wrote a parallel implementation of *nroff* for the C/A/T, dubbing it *troff* (for "typesetter roff"). Unfortunately, surviving documentation does not illustrate what requests were implemented at this time for C/A/T support; the *troff(1)* man page in Fourth Edition Unix (November 1973) does not feature a request list, unlike *nroff(1)*. Apart from typesetter-driven features, Unix Version 4 *roff*'s added string definitions (**.ds**); made the escape character configurable (**.ec**); and enabled the user to write diagnostics to the standard error stream (**.tm**). Around 1974, empowered with multiple type sizes, italics, and a symbol font specially commissioned by Bell Labs from Graphic Systems, Kernighan and Lorinda Cherry implemented *eqn* for typesetting mathematics. In the same year, for Fifth Edition Unix, Ossanna combined and reimplemented the two *roff*'s in C, using preprocessor conditions of that language to generate both from a single source tree.

Ossanna documented the syntax of the input language to the *nroff* and *troff* programs in the "Troff User's Manual", first published in 1976, with further revisions as late as 1992 by Kernighan. (The original version was entitled "Nroff/Troff User's Manual", which may partially explain why *roff* practitioners have tended to refer to it by its AT&T document identifier, "CSTR #54".) Its final revision serves as the *de facto* specification of AT&T *troff*, and all subsequent implementors of *roff* systems have done so in its shadow.

A small and simple set of *roff* macros was first used for the manual pages of Unix Version 4 and persisted for two further releases, but the first macro package to be formally described and installed was *ms* by

Michael Lesk in Version 6. He also wrote a manual, “Typing Documents on the Unix System”, describing *ms* and basic *nroff*/*troff* usage, updating it as the package accrued features. Sixth Edition additionally saw the debut of the *tbl* preprocessor for formatting tables, also by Lesk.

For Unix Version 7 (January 1979), McIlroy designed, implemented, and documented the *man* macro package, introducing most of the macros described in [groff\\_man\(7\)](#) today, and edited volume 1 of the Version 7 manual using it. Documents composed using *ms* featured in volume 2, edited by Kernighan.

Meanwhile, *troff* proved popular even at Unix sites that lacked a C/A/T device. Tom Ferrin of the University of California at San Francisco combined it with Allen Hershey’s popular vector fonts to produce *vtroff*, which translated *troff*’s output to the command language used by Versatec and Benson-Varian plotters.

Ossanna had passed away unexpectedly in 1977, and after the release of Version 7, with the C/A/T typesetter becoming supplanted by alternative devices such as the Mergenthaler Linotron 202, Kernighan undertook a revision and rewrite of *troff* to generalize its design. To implement this revised architecture, he developed the font and device description file formats and the device-independent output format that remain in use today. He described these novelties in the article “A Typesetter-independent TROFF”, last revised in 1982, and like the *troff* manual itself, it is widely known by a shorthand, “CSTR #97”.

Kernighan’s innovations prepared *troff* well for the introduction of the Adobe PostScript language in 1982 and a vibrant market in laser printers with built-in interpreters for it. An output driver for PostScript, *dpost*, was swiftly developed. However, due to AT&T software licensing practices, Ossanna’s *troff*, with its tight coupling to the capabilities of the C/A/T, remained in parallel distribution with device-independent *troff* throughout the 1980s. Today, however, all actively maintained *troff*’s follow Kernighan’s device-independent design.

### **groff—a free roff from GNU**

The most important free *roff* project historically has been *groff*, the GNU implementation of *troff*, developed from scratch by James Clark starting in 1989 and distributed under copyleft (<http://www.gnu.org/copyleft>) licenses, ensuring to all the availability of source code and the freedom to modify and redistribute it, properties unprecedented in *roff* systems to that point. *groff* rapidly attracted contributors, and has served as a complete replacement for almost all applications of AT&T *troff* (exceptions include *mv*, a macro package for preparation of viewgraphs and slides, and the *ideal* preprocessor for producing diagrams from a constraint-based language). Beyond that, it has added numerous features; see [groff\\_diff\(7\)](#). Since its inception and for at least the following three decades, it has been used by practically all GNU/Linux and BSD operating systems.

*groff* continues to be developed, is available for almost all operating systems in common use (along with several obscure ones), and it is free. These factors make *groff* the *de facto* *roff* standard today.

### **Heirloom Doctools troff**

An alternative is *Gunnar Ritter’s Heirloom roff project* (<https://github.com/n-t-roff/heirloom-doctools>) project, started in 2005, which provides enhanced versions of the various *roff* tools found in the OpenSolaris and Plan 9 operating systems, now available under free licenses. You can get this package with the shell command:

```
$ git clone https://github.com/n-t-roff/heirloom-doctools
```

Moreover, one finds there the *Original Documenter’s Workbench Release 3.3* (<https://github.com/n-t-roff/DWB3.3>).

### **Using roff**

Many people use *roff* frequently without knowing it. When you read a system manual page (man page), it is often a *roff* working in the background to render it. But using a *roff* explicitly isn’t difficult.

Some *roff* implementations provide wrapper programs that make it easy to use the *roff* system from the shell’s command line. These can be specific to a macro package, like [mmroff\(1\)](#), or more general. [groff\(1\)](#) provides command-line options sparing the user from constructing the long, order-dependent pipelines familiar to AT&T *troff* users. Further, a heuristic program, [grog\(1\)](#), is available to infer from a document’s contents which *groff* arguments should be used to process it.

### The *roff* pipeline

Each *roff* system consists of preprocessors, one or more *roff* formatter programs, and a set of output drivers (or “device postprocessors”). This arrangement is designed to take advantage of a landmark Unix innovation in inter-process communication: the pipe. That is, a series of programs termed a “pipeline” is called together where the output of each program in the sequence is taken as the input for the next program, without (necessarily) passing through temporary files on a disk. (On non-Unix systems, pipelines may have to be simulated.)

```
$ preproc1 < input-file | preproc2 | ... | troff [option ...] \
| output-driver
```

Once all preprocessors have run, they deliver a pure *roff* document to the formatter, which in turn generates intermediate output that is fed into an output driver for viewing, printing, or further processing.

All of these parts use programming languages of their own; each language is totally unrelated to the other parts. Moreover, *roff* macro packages that are tailored for special purposes can be included.

Most *roff* input files use the macros of a document formatting package, intermixed with instructions for one or more preprocessors, seasoned with escape sequences and requests directly from the *roff* language. Some documents are simpler still, since their formatting packages discourage direct use of *roff* requests; man pages are a prominent example. The full power of the *roff* formatting language is seldom needed by users; only programmers of macro packages need a substantial command of it.

### Preprocessors

A *roff* preprocessor is any program that generates output that syntactically obeys the rules of the *roff* formatting language. Each preprocessor defines a language of its own that is translated into *roff* code when run through the preprocessor program. Parts written in these languages may be included within a *roff* document; they are identified by special *roff* requests or macros. Each document that is enhanced by preprocessor code must be run through all corresponding preprocessors before it is fed into the actual *roff* formatter program, for the formatter just ignores all alien code. The preprocessor programs extract and transform only the document parts that are determined for them.

There are a lot of free and commercial *roff* preprocessors. Some of them aren’t available on each system, but there is a small set of preprocessors that are considered as an integral part of each *roff* system. The classical preprocessors are

|               |                                                    |
|---------------|----------------------------------------------------|
| <b>tbl</b>    | for tables.                                        |
| <b>eqn</b>    | for mathematical formulae.                         |
| <b>pic</b>    | for drawing diagrams.                              |
| <b>refer</b>  | for bibliographic references.                      |
| <b>soelim</b> | for including macro files from standard locations. |
| <b>chem</b>   | for drawing chemical formulæ.                      |

Other known preprocessors that are not available on all systems include

|             |                                            |
|-------------|--------------------------------------------|
| <b>grap</b> | for constructing graphical elements.       |
| <b>grn</b>  | for including <b>gremlin</b> (1) pictures. |

### Formatter programs

In the context of *roff* systems, the formatter is the program that parses documents written in the *roff* language. It generates intermediate output, which is intended to be fed into an output driver (also known as a device postprocessor), the identity of which must be known prior to processing. The documents must already have been run through all necessary preprocessors to render correctly.

The output produced by a *roff* formatter is represented in another language, termed the “intermediate output format”. As noted in section “History” above, this language was first specified in CSTR #97; GNU extensions to it are documented in [groff\\_out\(5\)](#). Intermediate output is specialized in its parameters, but not its syntax, for the output driver used; the format is device-*independent*, but not device-*agnostic*.

The formatter is the heart of the *roff* system. AT&T had two formatters: *nroff* for terminals, and *troff* for typesetters.

Often, the name *troff* is used as a general term to refer to both formatters. When speaking that generally, *groff* documentation prefers the term “*roff*”.

### Devices and output drivers

To a *roff* system, a *device* is a hardware interface like a printer, a text or graphical terminal, or a standardized file format that unrelated software can interpret.

A *roff* output driver is a program that parses the device-independent intermediate output format of *troff* and produces instructions specific to the device or file format it supports.

The names of the devices and their driver programs are not standardized. Technologies change; the devices used for document preparation have greatly changed since CSTR #54 was first written in the 1970s. Such hardware is no longer used in production environments, and device capabilities (including resolution, color drawing, and font repertoire) have tended to increase. The PostScript output driver *dpost*(1) from an AT&T *troff* of 1980s vintage had a resolution of 720 units per inch, whereas *groff*'s *grops*(1) uses 72 000.

### roff programming

Documents using *roff* are normal text files interleaved with *roff* formatting elements. *roff* languages are powerful enough to support arbitrary computation and supply facilities that encourage their extension. The primary such facility is macro definition; with this feature, macro packages have been developed that are tailored for particular applications.

### Macro packages

Macro packages can have a much smaller vocabulary than *roff* itself; this trait combined with their domain-specific nature can make them easy to acquire and master. The macro definitions of a package are typically kept in a file called *name.tmac* (historically, *tmac.name*). All tmac files are stored in one or more directories at standardized positions. Details on the naming of macro packages and their placement is found in *groff\_tmac*(5).

A macro package anticipated for use in a document can be declared to the formatter by the command-line option **-m**; see *troff*(1). It can alternatively be specified within a document using the file inclusion requests of the *roff* language; see *groff*(7).

Well-known macro packages include *man* for traditional man pages and *mdoc* for BSD-style manual pages. Macro packages for typesetting books, articles, and letters include *ms* (from “manuscript macros”), *me* (named by a system administrator from the first name of its creator, Eric Allman), *mm* (from “memorandum macros”), and *mom*, a punningly-named package exercising many *groff* extensions.

### The roff formatting language

The canonical reference for the AT&T *troff* language is Ossanna’s “Troff User’s Manual”, CSTR #54, in its 1992 revision by Kernighan. *roff* languages provide requests, escape sequences, macro definition facilities, string variables, registers for storage of numbers or dimensions, and control of execution flow. The theoretically-minded will observe that a *roff* is not a mere markup language, but Turing-complete, and would be even stripped of its macro-definition facility. It has storage (registers); it can perform tests (as in conditional expressions like “ $(\backslash n[i] >= 1)$ ”); and it can jump or branch using the **.if** request.

*Requests* and *escape sequences* are instructions, predefined parts of the language, that perform formatting operations or otherwise change the state of the parser. The user can define their own request-like elements by composing together text, requests, and escape sequences *ad libitum*. A document writer will not (usually) note any difference in usage for requests or macros; both are written on a line on their own starting with a dot. However, there is a distinction; requests take either a fixed number of arguments (sometimes zero), silently ignoring any excess, or consume the rest of the input line, whereas macros can take a variable number of arguments. Since arguments are separated by spaces, macros require a means of embedding a space in an argument; in other words, of quoting it. This then demands a mechanism of embedding the quoting character itself, in case *it* is needed literally in a macro argument. AT&T *troff* had complex rules involving the placement and repetition of the double quote to achieve both aims. *groff* cuts this knot by supporting a special character escape sequence for the neutral double quote, “**\[dq]**”, which never performs quoting in the typesetting language, but is simply a glyph, “”.

*Escape sequences* start with a backslash, “\”. They can appear almost anywhere, even in the midst of text

on a line, and implement various features, including the insertion of special characters with “\C” or “\J”, break suppression at input line endings with “\c”, font changes with “\F”, type size changes with “\S”, in-line comments with “\””, and many others.

*Strings* are variables that can store a string. A string is stored by the `.ds` request. The stored string can be retrieved later by the `\*` escape sequence.

*Registers* store numbers and sizes. A register can be set with the request `.nr` and its value can be retrieved by the escape sequence `\n`.

### File name extensions

Manual pages (man pages) take the section number as a file name extension, e.g., the file name for this document is *roff.7*, i.e., it is kept in section 7 of the man pages.

The classical macro packages take the package name as an extension, e.g., *file.me* for a document using the *me* macro package, *file.mm* for *mm*, *file.ms* for *ms*, *file.pic* for *pic* files, and so on.

There is no general naming scheme for *roff* documents, though *file.t* for “troff file” is seen now and then.

File name extensions can be handy in conjunction with the *less(1)* pager. It provides the possibility to feed all input into a command-line pipe that is specified in the shell environment variable *LESSOPEN*. This process is not well documented, so here is an example.

```
LESSOPEN=' |lesspipe %s'
```

where *lesspipe* is either a system-supplied command or a shell script of your own.

See [groff\\_filenames\(5\)](#) for more on file name extensions.

### Input conventions

Since *troff* fills text automatically, it is common practice in *roff* languages to avoid visual composition of text in input files: the esthetic appeal of the formatted output is what matters. Therefore, *roff* input should be arranged such that it is easy for authors and maintainers to compose and develop the document, understand the syntax of *roff* requests, macro calls, and preprocessor languages used, and predict the behavior of the formatter. Several traditions have accrued in service of these goals.

- Follow sentence endings in the input with newlines to ease their recognition. It is frequently convenient to end text lines after colons and semicolons as well, as these typically precede independent clauses. Consider doing so after commas; they often occur in lists that become easy to scan when itemized by line, or constitute supplements to the sentence that are added, deleted, or updated to clarify it. Parenthetical and quoted phrases are also good candidates for placement on text lines by themselves.
- Set your text editor’s line length to 72 characters or fewer; see the subsections below. This limit, combined with the previous item of advice, makes it less common that an input line will wrap in your text editor, and thus will help you perceive excessively long constructions in your text. Recall that natural languages originate in speech, not writing, and that punctuation is correlated with pauses for breathing and changes in prosody.
- Use `\&` after “!”, “?”, and “.” if they are followed by space, tab, or newline characters and don’t end a sentence.
- In filled text lines, use `\&` before “.” and “” if they are preceded by space, so that reflowing the input doesn’t turn them into control lines.
- Do not use spaces to perform indentation or align columns of a table.
- Comment your document. It is never too soon to apply comments to record information of use to future document maintainers (including your future self). The `\'` escape sequence causes *troff* to ignore the remainder of the input line.
- Use the empty request—a control character followed immediately by a newline—to visually manage separation of material in input files. Many of the *groff* project’s own documents use an empty request between sentences, after macro definitions, and where a break is expected, and two empty requests between paragraphs or other requests or macro calls that will introduce vertical space into the document. You can combine the empty request with the comment escape sequence to include whole-line comments in your

document, and even “comment out” sections of it.

An example sufficiently long to illustrate most of the above suggestions in practice follows. An arrow → indicates a tab character.

```
.\"  nroff this_file.roff | less
.\"  groff -T ps this_file.roff > this_file.ps
→The theory of relativity is intimately connected with
the theory of space and time.
.
I shall therefore begin with a brief investigation of
the origin of our ideas of space and time,
although in doing so I know that I introduce a
controversial subject. \" remainder of paragraph elided
.
.
→The experiences of an individual appear to us arranged
in a series of events;
in this series the single events which we remember
appear to be ordered according to the criterion of
\\[lq]earlier\\[rq] and \\[lq]later\\[rq], \" punct swapped
which cannot be analysed further.
.
There exists,
therefore,
for the individual,
an I-time,
or subjective time.
.
This itself is not measurable.
.
I can,
indeed,
associate numbers with the events,
in such a way that the greater number is associated with
the later event than with an earlier one;
but the nature of this association may be quite
arbitrary.
.
This association I can define by means of a clock by
comparing the order of events furnished by the clock
with the order of a given series of events.
.
We understand by a clock something which provides a
series of events which can be counted,
and which has other properties of which we shall speak
later.
.\" Albert Einstein, _The Meaning of Relativity_, 1922
```

### Editing with Emacs

Official GNU doctrine holds that the best program for editing a *roff* document is Emacs; see *emacs*(1). It provides an *nroff* major mode that is suitable for all kinds of *roff* dialects. This mode can be activated by the following methods.

When editing a file within Emacs the mode can be changed by typing “*M-x nroff-mode*”, where *M-x* means to hold down the meta key (often labelled “Alt”) while pressing and releasing the “x” key.

It is also possible to have the mode automatically selected when a *roff* file is loaded into the editor.

- The most general method is to include file-local variables at the end of the file; we can also configure the fill column this way.

```
.\" Local Variables:
.\" fill-column: 72
.\" mode: nroff
.\" End:
```

- Certain file name extensions, such as those commonly used by man pages, trigger the automatic activation of the *nroff* mode.
- Technically, having the sequence

```
.\" -*- nroff -*-
```

in the first line of a file will cause Emacs to enter the *nroff* major mode when it is loaded into the buffer. Unfortunately, some implementations of the *man(1)* program are confused by this practice, so we discourage it.

### Editing with Vim

Other editors provide support for *roff*-style files too, such as *vim(1)*, an extension of the *vi(1)* program. Vim’s highlighting can be made to recognize *roff* files by setting the *filetype* option in a Vim *modeline*. For this feature to work, your copy of *vim* must be built with support for, and configured to enable, several features; consult the editor’s online help topics “auto-setting”, “filetype”, and “syntax”. Then put the following at the end of your *roff* files, after any Emacs configuration:

```
.\" vim: set filetype=groff textwidth=72:
```

Replace “groff” in the above with “nroff” if you want highlighting that does *not* recognize many of the GNU extensions to *roff*, such as request, register, and string names longer than two characters.

### Authors

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### See also

There is a lot of documentation about *roff*. The original papers describing AT&T *troff* are still available, and all aspects of *groff* are documented in great detail.

### Internet sites

*Unix Text Processing* (https://github.com/larrykollar/Unix-Text-Processing), by Dale Dougherty and Tim O’Reilly, 1987, Hayden Books. This well-regarded text from 1987 brings the reader from a state of no knowledge of Unix or text editing (if necessary) to sophisticated computer-aided typesetting. It has been placed under a free software license by its authors and updated by a team of *groff* contributors and enthusiasts.

“History of Unix Manpages” (http://manpages.bsd.lv/history.html), an online article maintained by the mdocml project, provides an overview of *roff* development from Salzer’s *RUNOFF* to 2008, with links to original documentation and recollections of the authors and their contemporaries.

troff.org (http://www.troff.org/), Ralph Corderoy’s *troff* site, provides an overview and pointers to much historical *roff* information.

Multicians (http://www.multicians.org/), a site by Multics enthusiasts, contains a lot of information on the MIT projects CTSS and Multics, including *RUNOFF*; it is especially useful for its glossary and the many links to historical documents.

The Unix Archive (http://www.tuhs.org/Archive/), curated by the Unix Heritage Society, provides the source code and some binaries of historical Unices (including the source code of some versions of *troff* and its documentation) contributed by their copyright holders.

Jerry Saltzer’s home page (http://web.mit.edu/Saltzer/www/publications/pubs.html) stores some documents

using the original *RUNOFF* formatting language.

*groff* (<http://www.gnu.org/software/groff>), GNU *roff*'s web site, provides convenient access to *groff*'s source code repository, bug tracker, and mailing lists (including archives and the subscription interface).

### Historical *roff* documentation

Many AT&T *troff* documents are available online, and can be found at Ralph Corderoy's site (see above) or via Internet search.

Of foremost significance are two mentioned in section "History" above, describing the language and its device-independent implementation, respectively.

"Troff User's Manual" by Joseph F. Ossanna, 1976 (revised by Brian W. Kernighan, 1992), AT&T Bell Laboratories Computing Science Technical Report No. 54.

"A Typesetter-independent TROFF" by Brian W. Kernighan, 1982, AT&T Bell Laboratories Computing Science Technical Report No. 97.

You can obtain many relevant Bell Labs papers in PDF from Bernd Warken's "roff classical" GitHub repository ([https://github.com/bwarken/roff\\_classical.git](https://github.com/bwarken/roff_classical.git)).

### Manual pages

As a system of multiple components, a *roff* system potentially has many man pages, each describing an aspect of it. Unfortunately, there is no general naming scheme for the documentation among the different *roff* implementations.

For GNU *roff*, the [groff\(1\)](#) man page offers a survey of all the documentation distributed with the system.

With other *roff*s, you are on your own, but [troff\(1\)](#) might be a good starting point.