

# The XeTeX reference guide

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## *Introduction*

This document serves to summarise XeTeX's additional features without being so much as a 'users' guide'. Note that much of the functionality addressed here is provided in abstracted form in various L<sup>A</sup>T<sub>E</sub>X packages and ConTeXt modules.

The descriptions here should be a fairly exhaustive list of the new primitives and features of XeTeX. Descriptions are still a little aenemic, however. I don't have much time to maintain this document, so contributions are highly welcomed :)

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## Part I

# X<sub>Y</sub>TeX specifics

## 1 The `\font` command

The `\font` command has seen significant addition in X<sub>Y</sub>TeX to facilitate rich font feature selection. Under TeX, fonts were selected like so: `\font\1="<font name>"` with various options appended such as `'at 10pt'` or `'scaled 1.2'`, with obvious meaning. This syntax has been extended in X<sub>Y</sub>TeX by passing additional options through the `<font name>`.

This syntax looks something like

```
\font\1="<font name><font options>:<font features>" <TeX font features>
```

The `<font name>` is the actual name of the font (e.g., `'Charis SIL'`) and the only mandatory part of the above syntax.

When using the `xdvipdfmx` driver, it is possible to use fonts that aren't installed in the operating system by surrounding their name with square brackets. The current directory and the `texmf` trees are searched for files named in this way, or the path may be embedded in the font declaration. *E.g.*,

<code>\font\1="[fp9r8a]"</code>	<i>Selects 'FPL Neu' in the current directory</i>
<code>\font\1="[/myfonts/fp9r8a]"</code>	<i>Selects 'FPL Neu' somewhere else</i>
<code>\font\1="[lmroman10-regular]"</code>	<i>Selects a Latin Modern font in the TDS</i>

### 1.1 Font options

`<Font options>` are only applicable when the font is selected through the operating system (*i.e.*, without square brackets), and may be any concatenation of the following:

<code>/B</code>	Use the bold version of the selected font.
<code>/I</code>	Use the italic version of the selected font.
<code>/BI</code>	Use the bold italic version of the selected font.
<code>/IB</code>	Same as <code>/BI</code> .
<code>/S=<i>x</i></code>	Use the version of the selected font corresponding to the optical size <i>x</i> pt.
<code>/AAT</code>	Explicitly use the ATSUI renderer (Mac OS X only).
<code>/ICU</code>	Explicitly use the ICU OpenType renderer.
<code>/GR</code>	Explicitly use the Graphite font <sup>1</sup> renderer.

---

<sup>1</sup><http://scripts.sil.org/RenderingGraphite>

## 1.2 Font features

The *font features* is a comma or semi-colon separated list activating or deactivating various AAT or OpenType font features, which will vary by font. The X<sub>Y</sub>T<sub>E</sub>X documentation files `aat-info.tex` and `opentype-info.tex` provide per-font lists of supported features.

### 1.2.1 Arbitrary AAT or OpenType features

OpenType font features are chosen with standard tags<sup>2</sup>. They may be either comma- or semicolon-separated, and prepended with a + to turn them on and a - to turn them off.

*Example:*

```
\font\warnock="Warnock Pro/I/S=5:+smcp" at 12pt
\warnock This is the OpenType font Warnock Pro in italic
           with small caps at a small optical size.
```

**THIS IS THE OPENTYPE FONT WARNOCK PRO IN ITALIC WITH SMALL CAPS AT A SMALL OPTICAL SIZE.**

Varying depending on the language and script in use (see section §1.2.3 on the following page), a small number of OpenType features, if they exist, will be activated by default.

AAT font features are specified by strings within each font. Therefore, even equivalent features between different fonts can have different names.

*Example:*

```
\font\hoefler="Hoefler Text/B:Letter Case=Small Caps" at 12pt
\hoefler This is the AAT font Hoefler Text in bold with small caps.
```

**THIS IS THE AAT FONT HOEFLER TEXT IN BOLD WITH SMALL CAPS.**

### 1.2.2 Options for all fonts

Some font features may be applied for any font. These are  
`mapping=<font map>`

Uses the specified font mapping for this font. This uses the TECKit engine to transform unicode characters in the last-minute processing stage of the source. For example, `mapping=tex-text` will enable the classical mappings from ugly ascii ``---'` to proper typographical glyphs “—”, and so on.

`color=RRGGBB[TT]`

Triple pair of hex values to specify the colour in RGB space, with an optional value for the transparency.

---

<sup>2</sup><http://www.microsoft.com/typography/otspec/featuretags.htm>

`letterspace= $x$`

Adds  $x/S$  space between letters in words, where  $S$  is the font size.

`embolden= $x$`

Increase the envelope of each glyph by the set amount (this makes the letters look 'more bold').  $x = 0$  corresponds to no change;  $x = 1.5$  is a good default value.

`extend= $x$`

Stretch each glyph horizontally by a factor of  $x$  (i.e.,  $x = 1$  corresponds to no change).

`slant= $x$`

Slant each glyph by the set amount.  $x = 0$  corresponds to no change;  $x = 0.2$  is a good default value.

### 1.2.3 *OpenType script and language support*

OpenType font features (and font behaviour) can vary by script<sup>3</sup> ('alphabet') and by language<sup>4</sup>. These are selected with four and three letter tags, respectively.

`script=<script tag>`

Selects the font script.

`language=<lang tag>`

Selects the font language.

### 1.2.4 *Multiple Master and Variable Axes AAT font support*

`weight= $x$`

Selects the normalised font weight,  $x$ .

`width= $x$`

Selects the normalised font width,  $x$ .

`optical size= $x$`

Selects the optical size,  $x$  pt. Note the difference between the  $/S$  font option, which selects discrete fonts.

### 1.2.5 *Vertical typesetting*

`vertical`

Enables glyph rotation in the output so vertical typesetting can be performed.

---

<sup>3</sup><http://www.microsoft.com/typography/otspec/scripttags.htm>

<sup>4</sup><http://www.microsoft.com/typography/otspec/languagetags.htm>

## Part II

# New commands

## 2 *Font primitives*

`\XeTeXuseglyphmetrics`

Counter to specify if the height and depth of characters are taken into account while typesetting ( $\geq 1$ ). Otherwise ( $< 1$ ), a single height and depth for the entire alphabet is used. Gives better output but is slower. Activated ( $\geq 1$ ) by default.

*Example:*

```
\XeTeXuseglyphmetrics=0 \fbox{a}\fbox{A}\fbox{j}\fbox{J} vs.
```

```
\XeTeXuseglyphmetrics=1 \fbox{a}\fbox{A}\fbox{j}\fbox{J}
```

 vs. 

`\XeTeXglyph` *<Glyph slot>*

Inserts the glyph in *<slot>* of the current font. **Font specific**, so will give different output for different fonts.

`\XeTeXglyphindex` "*<Glyph name>*" *<space>* or `\relax`

Expands to the *<glyph slot>* corresponding to the (possibly font specific) *<glyph name>* in the currently selected font. Only works for TrueType fonts (or TrueType-based OpenType fonts) at present. Use `fontforge` or similar to discover glyph names.

`\XeTeXcharglyph` *<Char code>*

Expands to the default glyph number of character *<Char code>* in the current font, or 0 if the character is not available in the font.

*Example:*

```
\font\1="Charis SIL"\1
```

The glyph slot in Charis SIL for the Yen symbol is:

```
\the\XeTeXglyphindex"yen" . % the font-specific glyph name  
Or: \the\XeTeXcharglyph"00A5. % the unicode character slot
```

This glyph may be typeset with the font-specific glyph slot:

```
\XeTeXglyph150,  
or the unicode character slot:  
\char"00A5.
```

**The glyph slot in Charis SIL for the Yen symbol is: 150. Or: 150.**

**This glyph may be typeset with the font-specific glyph slot: ¥, or the unicode character slot: ¥.**

`\XeTeXglyphbounds` *<edge>* *<glyph number>*

Expands to a dimension corresponding to one of the bounds of a glyph, where *<edge>* is an integer from 1 to 4 indicating left/top/right/bottom edge respectively, and *<glyph number>* is an integer glyph index in the current font (only valid for TrueType/OpenType/PostScript fonts loaded ‘natively’, not TFM-based fonts). The left and right measurements are the glyph sidebearings, measured ‘inwards’ from the origin and advance respectively, so for a glyph that fits completely within its ‘cell’ they will both be positive; for a glyph that ‘overhangs’ to the left or right, they will be negative. The actual width of the glyph’s bounding box, therefore, is the character width (advance) minus both these sidebearings. The top and bottom are measured from the baseline, like  $\TeX$ ’s height and depth; the height of the bounding box is the sum of these two dimensions.

*Example:*

```
\def\shadebbox#1{%
\leavevmode\rlap{%
  \dimen0=\fontcharwd\font`#1%
  \edef\gid{\the\XeTeXcharglyph`#1}%
  \advance\dimen0 by -\XeTeXglyphbounds1 \gid
  \advance\dimen0 by -\XeTeXglyphbounds3 \gid
  \kern\XeTeXglyphbounds1 \gid
  \special{color push rgb 1 1 0.66667}%
  \vrule width \dimen0
    height \XeTeXglyphbounds2 \gid
    depth \XeTeXglyphbounds4 \gid
  \special{color pop}%
  \kern\XeTeXglyphbounds3 \gid}%
#1}

\noindent
\font\x="Charis SIL/I" at 24pt \x
\shadebbox{A} \shadebbox{W} \shadebbox{a} \shadebbox{f}
\shadebbox{;} \shadebbox{*} \shadebbox{=}
```

**A W a f ; \* =**

`\XeTeXfonttype <font>`

Expands to a number corresponding to which renderer is used for a *<font>*:

- 0 for T<sub>E</sub>X (a legacy TFM-based font);
- 1 for ATSUI (usually an AAT font);
- 2 for ICU (an OpenType font);
- 3 for Graphite.

*Example:*

```
\newcommand\whattype[1]{%
  \texttt{\fontname#1} is rendered by
  \ifcase\XeTeXfonttype#1\TeX\or ATSUI\or ICU\fi.\par}
\font\1="cmr10"
\font\2="Hoefler Text"
\font\3="Charis SIL"
\font\4="Charis SIL/AAT"
\whattype\1\whattype\2\whattype\3\whattype\4
```

*cmr10* is rendered by  $\TeX$ .

"Hoefler Text" is rendered by ATSUI.

"Charis SIL" is rendered by ICU.

"Charis SIL/AAT" is rendered by ATSUI.

## 2.1 OpenType fonts

$\XeTeXOTcountscripts$   $\langle Font \rangle$

Expands to the number of scripts in a font.

$\XeTeXOTscripttag$   $\langle Font \rangle$   $\langle Integer, n \rangle$

Expands to the  $n$ -th script tag of a font.

$\XeTeXOTcountlanguages$   $\langle Font \rangle$   $\langle Script tag \rangle$

Expands to the number of languages in the script of a font.

$\XeTeXOTlanguage$   $\langle Font \rangle$   $\langle Script tag \rangle$   $\langle Integer, n \rangle$

Expands to the  $n$ -th language tag in the script of a font.

$\XeTeXOTcountfeatures$   $\langle Font \rangle$   $\langle Script tag \rangle$   $\langle Language tag \rangle$

Expands to the number of features in the language of a script of a font.

$\XeTeXOTfeaturetag$   $\langle Font \rangle$   $\langle Script tag \rangle$   $\langle Language tag \rangle$   $\langle Integer, n \rangle$

Expands to the  $n$ -th feature tag in the language of a script of a font.

## 2.2 AAT fonts

### 2.2.1 Features

`\XeTeXcountfeatures` *font*

Expands to the number of features in the *font*.

`\XeTeXfeaturecode` *font* *integer, n*

Expands to the feature code for the *n*-th feature in the *font*.

`\XeTeXfeaturename` *font* *feature code*

Expands to the name corresponding to the *feature code* in the *font*.

`\XeTeXisexclusivefeature` *font* *feature code*

Expands to a number greater than zero if the feature of a font is exclusive (can only take a single selector).

### 2.2.2 Feature selectors

`\XeTeXcountselectors` *font* *feature*

Expands to the number of selectors in a *feature* of a *font*.

`\XeTeXselectorcode` *font* *feature code* *integer, n*

Expands to the selector code for the *n*-th selector in a *feature* of a *font*.

`\XeTeXselectorname` *font* *feature code* *selector code*

Expands to the name corresponding to the *selector code* of a feature of a *font*.

`\XeTeXisdefaultselector` *font* *feature code* *selector code*

Expands to a number greater than zero if the selector of a feature of a font is on by default.

### 2.2.3 Variation axes

`\XeTeXcountvariations` *font*

Expands to the number of variation axes in the *font*.

`\XeTeXvariation` *font* *integer, n*

Expands to the variation code for the *n*-th feature in the *font*.

`\XeTeXvariationname` *font* *variation code*

Expands to the name corresponding to the *feature code* in the *font*.

`\XeTeXvariationmin` *<font>* *<variation code>*

Expands to the minimum value of the variation corresponding to the *<variation code>* in the *<font>*.

`\XeTeXvariationmax` *<font>* *<variation code>*

Expands to the maximum value of the variation corresponding to the *<variation code>* in the *<font>*.

`\XeTeXvariationdefault` *<font>* *<variation code>*

Expands to the default value of the variation corresponding to the *<variation code>* in the *<font>*.

### 2.3 Maths fonts

The primitives described following are extensions of T<sub>E</sub>X's 8-bit primitives.

In the following commands, *<fam.>* is a number (0–255) representing font to use in maths. *<math type>* is the 0–7 number corresponding to the type of math symbol; see a T<sub>E</sub>X reference for details.

`\XeTeXmathcode` *<char slot>* [=] *<math type>* *<fam.>* *<glyph slot>*

Defines a maths glyph accessible via an input character. Note that the input takes *three* arguments unlike T<sub>E</sub>X's `\mathcode`.

`\XeTeXmathcodenum` *<char slot>* [=] *<math type/fam./glyph slot>*

Pure extension of `\mathcode` that uses a 'bit-packed' single number argument. Can also be used to extract the bit-packed mathcode number of the *<char slot>* if no assignment is given.

`\XeTeXmathchar` *<math type>* *<fam.>* *<glyph slot>*

Typesets the math character in the *<glyph slot>* in the family specified.

`\XeTeXmathcharnum` *<type/fam./glyph slot>*

Pure extension of `\mathchar` that uses a 'bit-packed' single number argument. Can also be used to extract the bit-packed mathcode number of the *<char slot>* if no assignment is given.

`\XeTeXmathchardef` *<control sequence>* [=] *<math type>* *<fam.>* *<glyph slot>*

Defines a maths glyph accessible via a control sequence.

`\XeTeXdelcode`  $\langle char slot \rangle$  [=]  $\langle fam. \rangle$   $\langle glyph slot \rangle$   
Defines a delimiter glyph accessible via an input character.

`\XeTeXdelcodenum`  $\langle char slot \rangle$  [=]  $\langle fam./glyph slot \rangle$   
Pure extension of `\delcode` that uses a ‘bit-packed’ single number argument. Can also be used to extract the bit-packed delcode number of the  $\langle char slot \rangle$  if no assignment is given.

`\XeTeXdelim投资`  $\langle math type \rangle$   $\langle fam. \rangle$   $\langle glyph slot \rangle$   
Typesets the delimiter in the  $\langle glyph slot \rangle$  in the family specified of either  $\langle math type \rangle$  4 (opening) or 5 (closing).

`\XeTeXmathaccent`  $\langle math type \rangle$   $\langle fam. \rangle$   $\langle glyph slot \rangle$   
Typesets the math accent character in the  $\langle glyph slot \rangle$  in the family specified.

`\XeTeXradical`  $\langle fam. \rangle$   $\langle glyph slot \rangle$   
Typesets the radical in the  $\langle glyph slot \rangle$  in the family specified.

### 3 Character classes

The idea behind character classes is to define a boundary where tokens can be added to the input stream without explicit markup. It was originally intended to add glue around punctuation to effect correct Japanese typesetting. This feature can also be used to adjust space around punctuation for European traditions. The general nature of this feature, however, lends it to several other useful applications including automatic font switching when small amounts of another language (in another script) is present in the text.

`\XeTeXinterchartokenstate`  
Counter. If positive, enables the character classes functionality.

`\newXeTeXintercharclass`  $\langle control sequence \rangle$   
Allocates a new interchar class and assigns it to the  $\langle control sequence \rangle$  argument.

`\XeTeXcharclass`  $\langle char slot \rangle$  [=]  $\langle interchar class \rangle$   
Assigns a class corresponding to  $\langle interchar class \rangle$  (range 0–255) to a  $\langle char slot \rangle$ . Most characters are class 0 by default. Class 1 is for CJK ideographs, classes 2 and 3 are CJK punctuation. The boundary of a text string is considered class 255, wherever there is a boundary between a ‘run’ of characters and something else — glue, kern, math, box, etc. Special case class 256 is ignored; useful for diacritics so I’m told.

`\XeTeXinterchartoks <interchar class 1> <interchar class 2> [=] {<token list>}`  
 Defines tokens to be inserted at the interface between *<interchar class 1>* and *<interchar class 2>* (in that order).

*Example:*

```

\XeTeXinterchartokenstate = 1
\newXeTeXintercharclass \mycharclassa
\newXeTeXintercharclass \mycharclassA
\newXeTeXintercharclass \mycharclassB
\XeTeXcharclass `a \mycharclassa
\XeTeXcharclass `A \mycharclassA
\XeTeXcharclass `B \mycharclassB

% between "a" and "A":
\XeTeXinterchartoks \mycharclassa \mycharclassA = {[\itshape]}
\XeTeXinterchartoks \mycharclassA \mycharclassa = {\upshape]}

% between " " and "B":
\XeTeXinterchartoks 255 \mycharclassB = {\bgroup\color{blue}}
\XeTeXinterchartoks \mycharclassB 255 = {\egroup}

% between "B" and "B":
\XeTeXinterchartoks \mycharclassB \mycharclassB = {.}

aAa A a B aBa BB
a[A]a A a B aBa B.B

```

In the above example the input text is typeset as

`a[\itshape A\unshape]a A a \bgroup\color{blue}B\egroup aBa B.B`

## 4 *Encodings*

`\XeTeXinputnormalization` *<Integer>*

Specify whether XeTeX is to perform normalisation on the input text and, if so, what type of normalisation to use. See <http://unicode.org/reports/tr15/> for a description of Unicode normalisation.

`\XeTeXinputnormalization=0` (default) do not perform normalisation.

`\XeTeXinputnormalization=1` normalise to NFC form, using precomposed characters where possible instead base characters with combining marks.

`\XeTeXinputnormalization=2` normalise to NFD form, using base characters with combining marks instead of precomposed characters.

`\XeTeXinputencoding` *<Charset name>*

Defines the input encoding of the following text.

`\XeTeXdefaultencoding` *<Charset name>*

Defines the input encoding of subsequent files to be read.

## 5 *Line breaking*

`\XeTeXdashbreakstate` *<Integer>*

Specify whether line breaks after en- and em-dashes are allowed. Off, 0, by default.

`\XeTeXlinebreaklocale` *<Locale ID>*

Defines how to break lines for multilingual text.

`\XeTeXlinebreakskip` *<Glue>*

Inter-character linebreak stretch

`\XeTeXlinebreakpenalty` *<Integer>*

Inter-character linebreak penalty

`\XeTeXupwardsmode` *<Integer>*

If greater than zero, successive lines of text (and rules, boxes, etc.) will be stacked upwards instead of downwards.

## 6 Graphics

This description is incomplete.

`\XeTeXpicfile <filename> <optional options>`

Insert an image.

`\XeTeXpdffile <filename> <optional options>`

Insert (pages of) a PDF.

## 7 Parity with pdf $\TeX$

`\pdfpageheight <dimension>`

The height of the PDF page.

`\pdfpagewidth <dimension>`

The width of the PDF page.

`\pdfsavepos`

Saves the current location of the page in the typesetting stream.

`\pdflastxpos`

Retrieves the horizontal position saved by `\pdfsavepos`.

`\pdflastypos`

Retrieves the vertical position saved by `\pdfsavepos`.

`\ifincsname...(\else...)\fi`

$\TeX$  conditional to branch true if the expansion occurs within `\csname ... \endcsname`.

*Example:*

```
\def\x{\ifincsname y\else hello\fi}
```

```
\def\y{goodbye}
```

```
\x/\csname\x\endcsname
```

```
hello/goodbye
```

`\ifprimitive <control sequence> ...(\else...)\fi`

TeX conditional to test if a control sequence is a primitive and that it has not been redefined.

`\primitive <control sequence>`

If the control sequence is a primitive that's been redefined, this command causes it to expand with its original (i.e., primitive) definition.

`\shellescape`

Read-only status indicating the level of 'shell escape' allowed. That is, whether commands are allowed to be executed through `\write18{...}`. Expands to zero for off; one for on (allowed); two is 'restricted' (default in TeX Live 2009 and greater) in which a subset of commands only are allowed.

*Example:*

Shell escape `\ifnum\shellescape>0` is `\else` is not `\fi` enabled.

Shell escape is enabled.

`\strcmp <arg one> <arg two>`

Compares the full expansion of the two token list arguments. Expands to zero if they are the same, less than one if the first argument sorts lower (lexicographically) than the second argument, and greater than one if vice versa.

*Example:*

``a` is less than `z`: \strcmp{a}{z}`

`\def\z{a}`

The tokens expand before being compared: `\strcmp{a}{\z}`

`\def\a{z}`

Therefore, `\a` is greater than `\z`: `\strcmp{\a}{\z}`

`\edef\b{\string b}`

Also note that catcodes are ignored: `\strcmp{b}{\b}`

`'a` is less than `z': -1`

The tokens expand before being compared: 0

Therefore, `\a` is greater than `\z`: 1

Also note that catcodes are ignored: 0

## 8 *Misc.*

`\XeTeXversion`

Expands to a number corresponding to the  $\text{\XeTeX}$  version.

`\XeTeXrevision`

Expands to a string corresponding to the  $\text{\XeTeX}$  revision number.

*Example:*

The `\XeTeX\` version used to typeset this document is:

`\the\XeTeXversion\XeTeXrevision`

The  $\text{\XeTeX}$  version used to typeset this document is: 0.9997