FontLab

FontLab Studio

5

NEXT-GENERATION PROFESSIONAL FONT EDITOR – POSTSCRIPT, TRUETYPE, UNICODE, OPENTYPE

USER’S MANUAL FOR WINDOWS

Cover illustration: Paweł Jońca, pejot.com

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Introduction

The year 2005 marked an unusual anniversary: 30 years of digital font technology. In 1975, at the ATypI conference in Warsaw, Peter Karow from the Hamburg-based company URW introduced Ikarus, the world's first digital type design system that worked with outline fonts. Ten years later, Adobe created PostScript and the Type 1 font format, which both became standards in publishing. In the early 1990s, Apple introduced the TrueType font format and the Unicode Consortium published the Unicode Standard. Both initiatives laid the foundations for multilingual text processing and were subsequently implemented in Microsoft Windows and Mac OS. The turn of the millennium brought about OpenType, a significant initiative that unified PostScript, TrueType and Unicode, and added a sophisticated system of advanced typographic features.

The development of the digital font technology makes it easier for end-users to do text processing, typesetting and layout without sacrificing the typographic quality and logical correctness of the text. But nothing gets lost in Nature: using fonts is getting easier but developing them is more complex. Apart from just drawing letters, a type designer needs to know about encoding, hinting, layout features and various parameters that need to be set inside of a font.

FontLab Studio 5 is the next-generation a digital font editor from Fontlab Ltd. that allows the designer to create professional-level fonts from start to end.

FontLab Studio 5 is a versatile font editor for all sorts of users. The majority of the large font foundries and many smaller font houses use FontLab for designing new typefaces, creating the final font products, or both. Linguists, historians, publishers, librarians, scholars, educators, software companies, graphic designers and even Greek Orthodox monasteries use FontLab to create new typefaces and to extend, convert, re-encode and otherwise modify existing fonts. If FontLab Studio is “too much” for you, Fontlab Ltd. has simpler and more affordable products such as the basic font editor TypeTool, the beloved classic DTP font editor Fontographer or the universal font converter TransType.

Major new features of FontLab Studio 5

- Better **glyph design**: true tangent points, in-context glyph design with Neighbors and Shape groups, color-customized and streamlined glyph window
- Revolutionary new **metrics and kerning** editing: multiline preview, better class kerning, smart autogeneration of classes
- Better **bitmap** and **pixel font** support: import BDF files and make pixel fonts, built-in autotracing
- **Unicode 4.1** support: SMP codepoints, auto-generate over 2,500 accented characters from built-in definitions, new Unicode glyph template images (from Monotype Imaging)
- Improved **OpenType** support with better VOLT integration, roundtrip editing of complex-script fonts, font merging, glyph suffix renaming
- Better **font proofing** with five new printing modes and the Quick Test feature that tests fonts with system rendering
- **Open** and **save** enhancements: open installed fonts, preview fonts before opening, generate multiple fonts in one step, opens **Mac fonts** on Windows (Mac Type 1, TrueType GX/AAT) and Ikarus® files
- Redesigned **preferences**; save, open and exchange preference profiles and UI workspaces
- Better autohinting with Flex Type 1 hints
- Improved Python scripting, Python 2.4 support

Other key features of FontLab Studio

- Outline editor with more than 20 tools and 200-level undo/redo
- Open, edit and generate OpenType PS, TrueType / OpenType TT and PostScript Type 1 formats with up to 6,400 characters
- Open, edit and generate Multiple Master fonts
- Import and export of individual glyphs in EPS format
- Class-based Multiple Master-compatible metric and kerning editing with autospacing and autokerning
- OpenType feature editing and testing
- Import, edit and generate OpenType Layout features
- Import and export font metrics in PFM and AFM format
- Professional-level manual and automatic Type 1 and TrueType hinting
- Automatic transformation of glyphs with more than 25 filters
- Library of predefined Smart Shapes
- Automatic testing of glyph outlines with our unique FontAudit technology
- Integrated Python scripting language
- Unique Sketch mode with easy drawing tools
- VectorPaint tools
- Support of 4 encoding modes and an unlimited number of encodings
- Easy-to-use completely customisable drag/drop-based user interface
- Popup menus and property panels everywhere
- Sample printing of fonts, sample strings and individual glyphs
- Automatic Multiple Master-compatible font blending
- Smooth outline preview

About this Manual

This manual covers the Windows version of FontLab Studio 5.0.

The following chapters describe all of Studio's features in full detail. They are organized to cover all the functions in their usual sequence.

FontLab Studio User Interface

This chapter covers the basic definitions of the FontLab Studio user interface and its customization and gives a short description of all the Studio editing windows and panels. All FontLab Studio options are discussed here as well.

Editing Fonts

This chapter explains how to modify fonts, copy characters, change encoding tables, select characters for editing, and edit font info fields.

The Font Header

This chapter provides a detailed description of the Font Header data and the FontLab Studio tools intended to manage it.

Printing And Proofing Fonts

This chapter provides a detailed description of how to print from the Font, Glyph and Metrics windows. Other font proofing methods are also described in this chapter.

Generating Fonts

This chapter explains how to export fonts in different formats, what export options must be set.

The Glyph Window

FontLab Studio includes powerful outline-editing tools that are described in this chapter.

Editing Metrics

If you want to create a professional-looking font you have to edit the font's metric data. The glyphs' widths, sidebearings, and kerning can be edited in FontLab Studio automatically or manually. This chapter shows you how.

Actions

From scale to drop shadow, from autohinting to autospacing - more than 25 transformation filters can help you instantly expand your font collection. This chapter gives detailed descriptions of all the actions and their usage in FontLab Studio.

Hinting

To make your Type 1 or TrueType fonts look great everywhere you have to set hints. FontLab Studio includes hinting tools that were previously available only in high-end proprietary font editing systems. Hinting can be a complicated process, so read this chapter carefully to get the best results.

Multiple Master Fonts

Opening, editing and exporting Multiple Master fonts; adding and removing design axes; editing the Design Map Graph – everything you ever wanted to know about multiple master fonts is in this chapter.

OpenType Fonts

This chapter covers FontLab Studio tools, panels and features that deal with creation and editing of OpenType font features: ligatures, small caps, fractions, alternative glyphs, etc.

Macro Programming

This chapter includes a short description and demonstration of the Python programming language and its integration into the FontLab Studio user interface. Python can be used to create custom tools and operations within FontLab Studio. A brief description of the FontLab Studio classes exported to Python is provided.

System Requirements

The Windows version of FontLab Studio requires one of the following hardware and software configurations:

A PC computer capable of running one of the following versions of Windows: Windows 98, Windows ME, Windows NT 4.0, Windows 2000 or Windows XP with one of these operating systems installed.

At least 10Mb of free space on the hard disk drive and at least 64 MB RAM. FontLab Studio will start on 32 MB RAM but you will need more RAM to open bigger fonts.

FontLab Studio User Interface

Before we start talking about fonts and the FontLab Studio font-editing features let's spend some time learning the FontLab Studio user interface. For the most part it is a standard Windows interface so if you know how to navigate in Windows or in Microsoft Office you will feel comfortable with FontLab Studio. In other parts it is unique and that is where we will focus.

Most of the interface elements in FontLab Studio 5 are completely customizable and from this chapter you will learn how to change the FontLab Studio interface so it will best fit your needs.

Please note that further in the book we will refer to menu commands, toolbar buttons and keyboard shortcuts as they appear in the default FontLab Studio environment, prior to any modifications you may make.

1

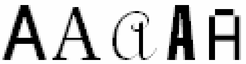
Basic Terms

We cannot go any further without defining a few terms that are critical to understanding FontLab Studio and fonts in general.

Character

The minimal unit of the written language – a part of the alphabet, a symbol.

Any picture that can be recognized as having the same meaning represents the same character:



All the pictures above mean the character 'A'

Please note that sometimes pictures that look the same represent different characters:

A Latin 'A'

A Cyrillic 'A'

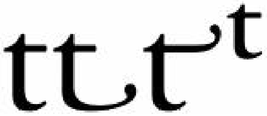
A Greek 'Alpha'

Characters have *codes* that are used to store text data on a computer.

Glyph

The basic element of the font, literally – an image that is printed. All glyphs are unique, even if they represent the same character.

Glyphs are used to represent characters. Please note that many different glyphs may be used to represent the same character, even in the same font:



Font

An organized collection of glyphs and font header information. Usually glyphs that are united in a font have some similarities in design and other properties.

In the past, a “font” was defined as a single size of the characters of a particular typeface. Now, since fonts are scalable, the term “font” covers all possible sizes of the same typeface design.

Encoding

When text is printed an important process takes place: character to glyph mapping. The source text (in computer form) is a list of codes that represents a list of characters. A font (see above) is a collection of glyphs. So there must be some way to relate characters to glyphs so that when the computer’s operating system encounters a certain character it knows which glyph to print. This “mapping” (or “vector”) is called the encoding. Sometimes the encoding information resides within the font itself as part of the header and other times it is in a separate file.

Font Family

It is important to know the difference between a font and a font family. A font family is a set of fonts that represents some design idea. “Times” is a font family (sometimes called typeface). “Times Bold Italic” is a font.

A font family may include from one to a few dozen fonts.

Glyph name

The only identification of a glyph (other than its visual appearance) is its name. A Western glyph name consists of Latin characters, digits and punctuation. It is highly recommended you name glyphs in accordance with the following rules:

1. No spaces.
2. No digits at the beginning.
3. Only '.' And '_' punctuation marks are allowed in the name.

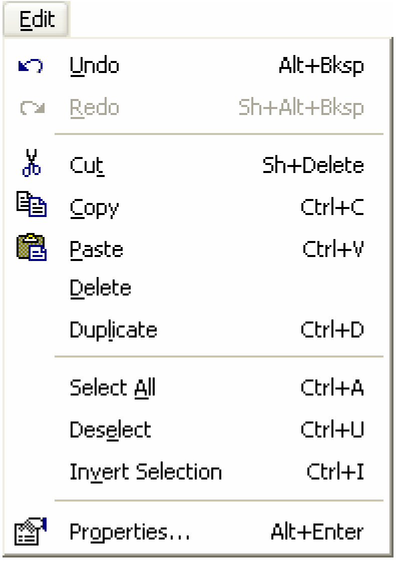
Menu

When we refer to menu items in the main FontLab Studio menu, we will use the following notation:

[top menu item] > [sub-item]

For example:

Edit > Copy means: click the word Edit on the menu bar and select the **Copy** command from the menu:



Folders and Paths

Recent applications from Fontlab Ltd. use a new folder structure for storing their **data files** such as encoding or codepage definitions, glyph generation recipes, text samples for metrics and kerning, mapping tables, Python macros etc. FontLab Studio 5 looks for data files in four different folders.

Shared default data folder

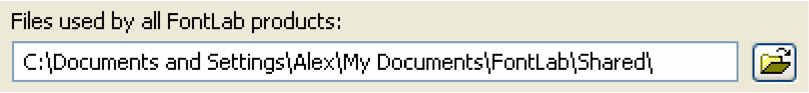
typically, `C:\Program Files\Common Files\FontLab`

This folder holds files that are commonly used by all recent Fontlab Ltd. applications: FontLab Studio 5, TransType SE/Pro, FogLamp, SigMaker 2, with more to come. In each respective subfolder, codepage definitions, encoding definitions, glyph-to-Unicode mapping files and some special data files are stored. Only Fontlab Ltd. applications and applications from registered Fontlab Ltd. developer partners should place their files there. This is to rule out conflicts between the user's customized files and default files.

Shared user data folder

typically
`C:\Documents and Settings\Your Username\My Documents\FontLab\Shared`

This folder has exactly the same structure as the folder discussed above and can store any files customized by the user. Any file placed in the respective location within that folder will override the corresponding file placed in the shared Fontlab Ltd. Please put your customized files in this folder. The location of the folder can be modified in Tools > Options > General Options > Folders and paths:



Files used by all FontLab products:

C:\Documents and Settings\Alex\My Documents\FontLab\Shared\

Application default data folder

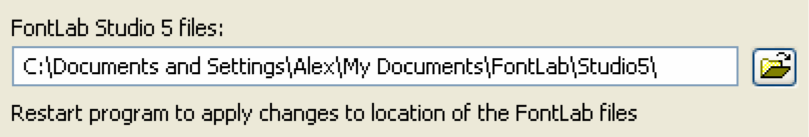
typically `C:\Program Files\FontLab\Studio5`

This folder holds files that are only used by FontLab Studio 5. In each respective subfolder, metrics, kerning and other text strings, additional encodings, Python macros and modules as well as samples are stored. Only Fontlab Ltd. applications and applications from registered Fontlab Ltd. developer partners should place their files there. This is to rule out conflicts between the user's customized files and default files.

Application user data folder

typically
C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5

This folder has exactly the same structure as the folder discussed above and can store any files customized by the user. Any file placed in the respective location within that folder will override the corresponding file placed in the shared Fontlab Ltd. Please put your customized files in this folder. The location of the folder can be modified in Tools > Options > General Options > Folders and paths:



FontLab Studio 5 files:

C:\Documents and Settings\Alex\My Documents\FontLab\Studio5\

Restart program to apply changes to location of the FontLab files

Please refer to the "Macro Programming" chapter for information about placing macros and modules in the appropriate folders.

When we refer to one of the folders, we will use the following syntax:

[main folder]/[subfolder name]

Where [main folder] can be one of the following: [Shared default data folder], [Shared user data folder], [Application default data folder], [Application user data folder], and [subfolder name] is the name of the particular subfolder within that folder.

For reasons of brevity, we will sometimes write:

[Shared] which will mean either [Shared default data folder] or [Shared user data folder]

[Application] which will mean either [Application default data folder] or [Application user data folder]

This means that a particular file can be stored in either of the two locations (default or user). Remember that user locations always override default locations.

Mouse

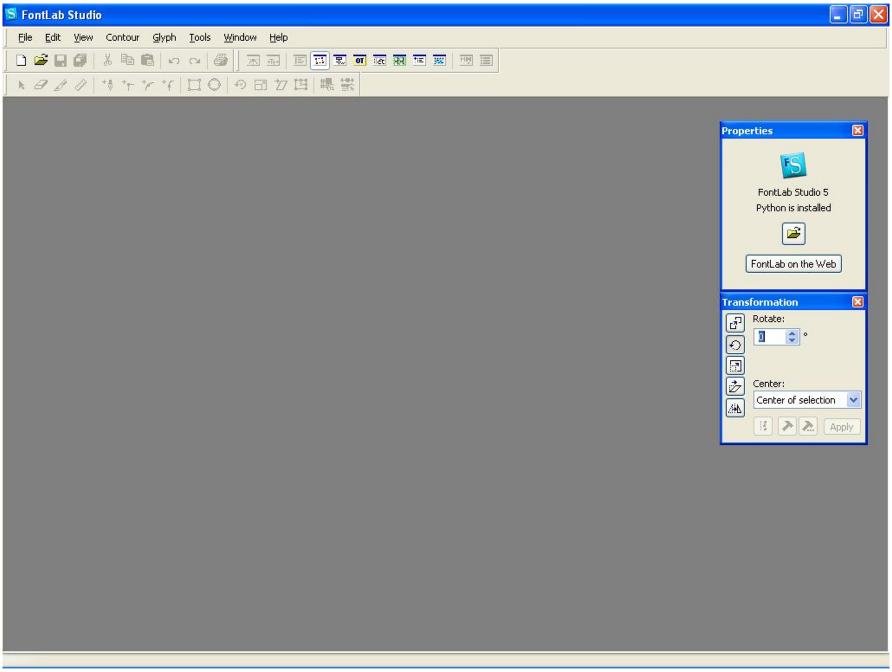
Click the mouse on some object	Position the mouse cursor on the object and click the left mouse button
Right-click some object	Position the cursor on the object and click the right mouse button
Ctrl-click something	Position the cursor over “something”, hold down the CTRL key on the keyboard and click the left mouse button.
Drag some object	Position the cursor on the object, press the left mouse button and move the mouse to move the object. Release the mouse button when you’re done.

Context Menu

Most windows and panels in FontLab Studio have attached context menus. To open the context menu, right-click an empty area in the window or panel.

Getting Started

When you run FontLab Studio 5 for the first time (to run FontLab Studio double-click on its icon) you will see a welcome screen for a few seconds and then the FontLab Studio window:



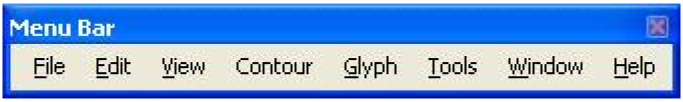
FontLab Studio 5
Python is installed

Rotate: 0 °

Center: Center of selection

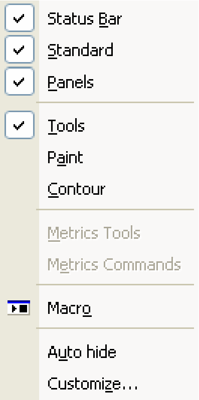
Like almost all Windows programs FontLab Studio has a menu, a few toolbars and a status bar at the bottom.

There is nothing special about the FontLab Studio menu except that you can position it any place on the screen. The usual location is at the top of the screen, but if you want to put it somewhere else, just drag it there:



The same thing can be done with any toolbar – you can leave them at the top or drag them anywhere.

You can easily choose which toolbars you want to see: use the **Toolbars** command in the **View** menu or simply click the right mouse button on a menu, toolbar, or toolbar docking panel and you'll get exactly the same menu:



Following is a list of common toolbars with a few comments about each:

Status Bar	Status bar at the bottom of the window
Standard	Contains basic commands like file open and save, copy/paste, print and help
Panels	Controls the appearance of FontLab Studio *panels* – shared windows used to control most professional FontLab Studio features
Show Layers	Controls the appearance of basic *Editing layers*
Tools	Probably the most important toolbar – gives access to editing tools that you will use to work on glyph shapes
Macro	Opens the Macro panel which gives quick access to pre-written *macro programs* that can automate various font-editing tasks.

You may notice a few *italic* terms. We will describe them later. Specifically, *panels* and *Glyph window* will be described in a few pages; *Editing layers* in the "Glyph Window" chapter; and *macro programs* in "Macro Programming" chapter.

OK, we are almost ready to open a sample font, but before we do let's talk about *customization* of the FontLab Studio user interface.

Customizing FontLab Studio’s User Interface

As you may infer from the title of this section most of the FontLab Studio user interface (which means menus, toolbars and keyboard shortcuts) is customizable. We believe our default interface is the easiest to use, but if for some reason you don’t like it, you are free to make any changes you want. If you don’t want to change anything in the FontLab Studio user interface, you can fast forward to the next section.

The general idea of customization is simple: there is a long list of commands that you can use and three kinds of controls: menus, toolbars and keyboard shortcuts. Through customization you can assign any command to a menu item, button on a toolbar or combination of keys pressed on a keyboard. In addition you can organize commands in popup menus or toolbars.

Most of the customization commands are concentrated in the Customize panel that you can open with the **Customize** command from the **Tools** menu or the same command located in the context menu which appears if you right-click on a menu, toolbar or toolbar dock area:

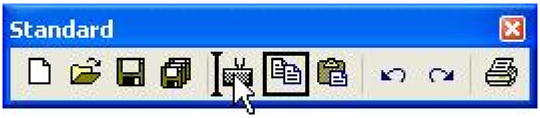
The **Customize** dialog box consists of several pages:

Commands	List of all the available commands grouped into several categories
Toolbars	Customization of toolbars. There is an option to create new toolbars.
Tools	On this page you can “connect” an external program to a menu item in FontLab Studio’s Tools menu
Keyboard	Customization of keyboard shortcuts
Menu	Customization of menus

While the **Customize** dialog box is open all interface elements are in “editable” mode, so you can simply drag-drop buttons and menu items between different toolbars. You can also customize the appearance of menu items and toolbar buttons.

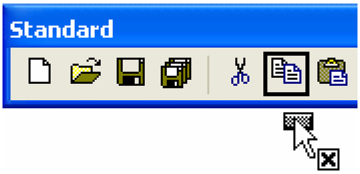
Customizing Toolbars

To move a button within a toolbar just press the left mouse button on it; drag it to the new location and drop it. If you drag the button slightly further to the right, a separator bar will be added between it and the previous button:

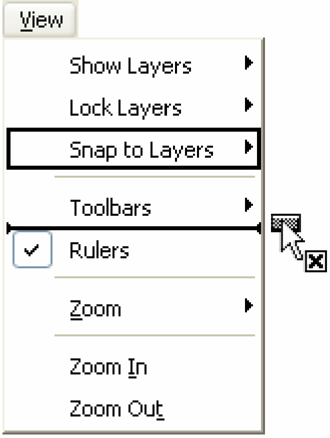


To move a button to another toolbar, just drag-drop it there. To copy a button, hold the **Ctrl** key while you drag the button.

To remove a button from a toolbar, drag it out of the toolbar:

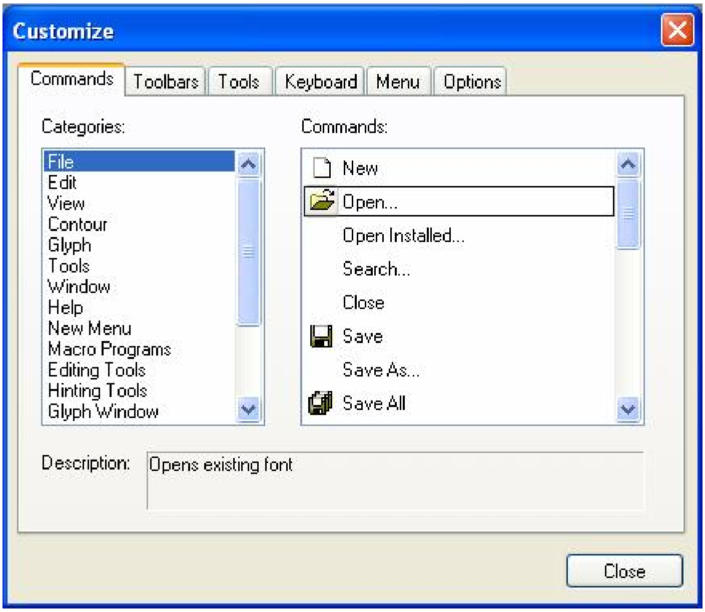


In FontLab Studio there is very little difference between a menu and a toolbar, so you can **re-arrange, copy or remove menu items** just like you did with toolbar buttons:



You can also drag a menu item onto a toolbar **to add a toolbar button**. Hold the **Ctrl** key to copy the item.

To get access to all the FontLab Studio commands, open the **Commands** page in the Customize dialog box:



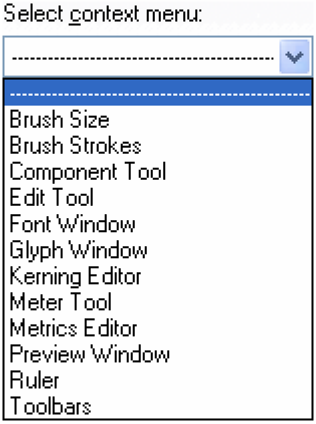
Description: Opens existing font

In the list select a group of commands and use the list of commands in the right list as a source of menu items and toolbar buttons: just drag the commands from there.

Customizing Menus

If you want **to create a new popup menu**, just select the **New Menu** group in the left menu and drag it onto the main menu bar or any of the toolbars. A new menu appears and you can start adding commands to it using the drag-drop technique described above.

With the Customize dialog not only can you customize the main menu, but also most of the context menus which appear when you right-click FontLab Studio windows. Open the **Menu** page in the Customize dialog box and choose a context menu in the right combo box:

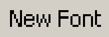
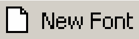


A menu appears on screen and you can customize it by dragging commands from the toolbar, other menus or the list of the commands on the **Commands** page.

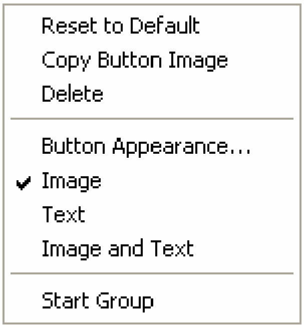
To reset changes you've made in menus, use the **Reset** buttons on the Menu page of the Customize dialog box. Use the left **Reset** command **to reset changes in the main menu** and the right **Reset** button **to reset changes in the context menus**.

Customizing Individual Items

You can customize the appearance of any menu item or toolbar button. The following appearances are available for most items:

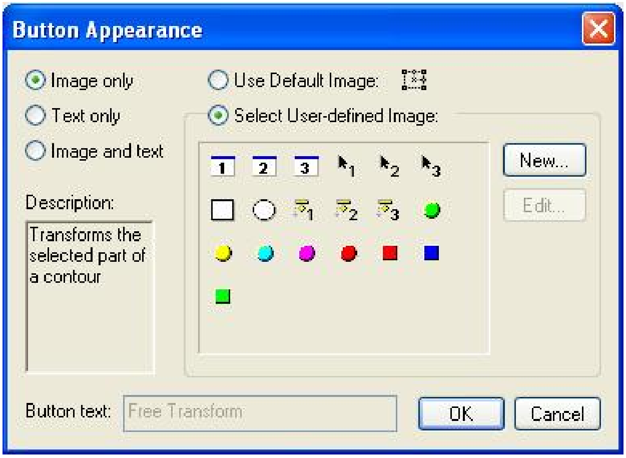
Image	
Text	
Image and Text	

To change the appearance of the menu item or toolbar button position the mouse cursor on the button and click the right mouse button. Select the new appearance method in the context menu:



Most commands in FontLab Studio have pre-designed images, but you can easily create your own images for any toolbar button or menu command. To do so, select the **Button Appearance** command in the button's context menu:

You will see a dialog box where you can choose the appearance method and, if it includes an image, choose the picture that appears on the button or at the left of the menu item:



Button Appearance

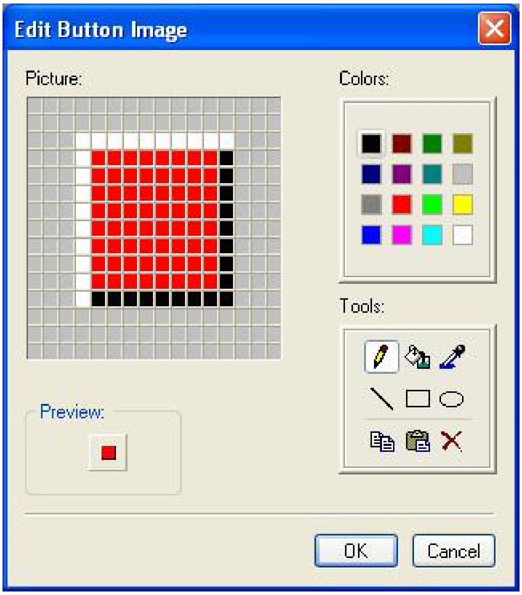
● Image only
○ Text only
○ Image and text

○ Use Default Image:
● Select User-defined Image:

Description: Transforms the selected part of a contour

Button text: Free Transform

Choose a User-defined image; click **New to create a new image**; or **Edit to edit one of the User images**. If you decide to change the picture, use the included image editor to change it:

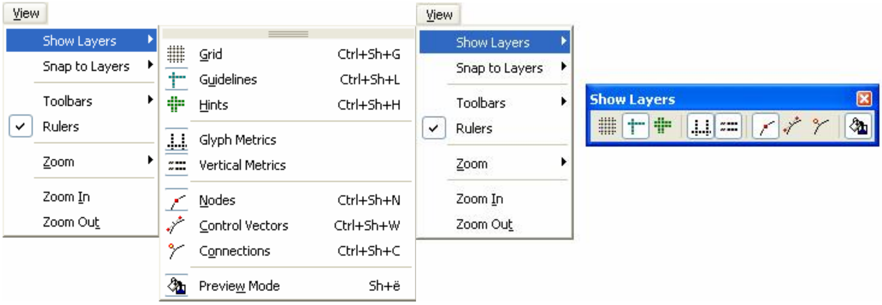


Edit Button Image

Use one of the **Tools to edit the enlarged image** and choose a color in the **Colors** area. Click the **OK** button when you are ready.

Converting a Menu to a Toolbar

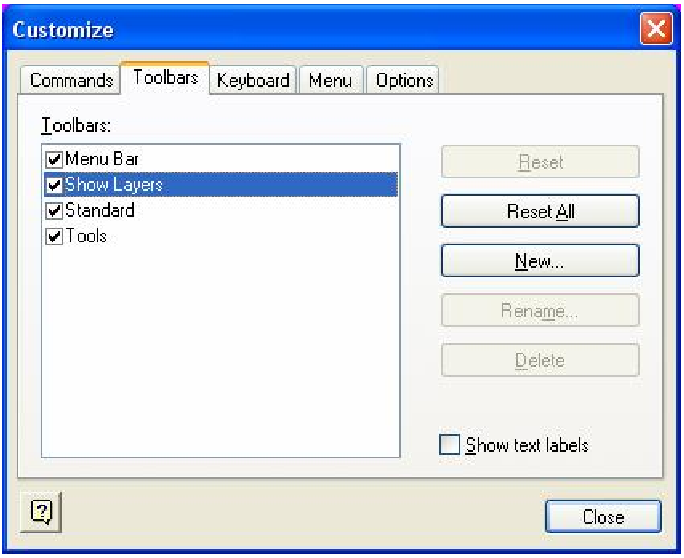
In FontLab Studio some menus can be converted to toolbars. If you open a popup menu and can see a tiny caption in the top area of it, you can drag it to any place on screen and it becomes a toolbar:



Not all menus have this feature, but you may find it really useful.

OK, that’s almost all about customizing toolbars and menus. Just a couple more things:

To reset changes you've made in toolbars, use the **Reset All** button on the **Toolbars** page in the **Customize** dialog box:



Toolbars:

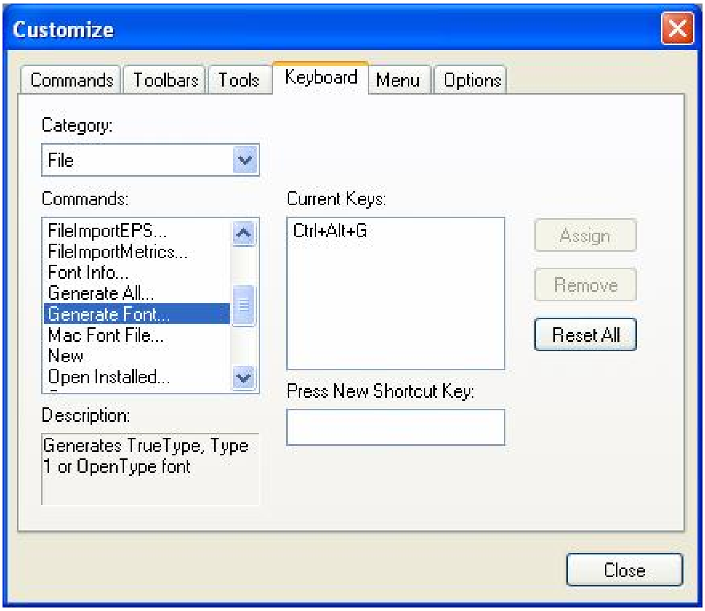
☑ Menu Bar
☑ Show Layers
☑ Standard
☑ Tools

□ Show text labels

Use the **New** command on the same page **to create a new toolbar**. After doing this, add commands to it by the drag-drop method described earlier in this section.

Customization of the Keyboard

Open the **Keyboard** page of the **Customize** dialog box:



Category: File

Commands:
FileImportEPS...
FileImportMetrics...
Font Info...
Generate All...
Generate Font...
Mac Font File...
New
Open Installed...

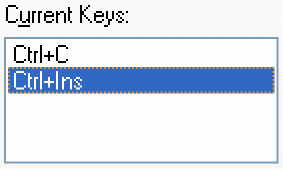
Current Keys: Ctrl+Alt+G

Press New Shortcut Key:

Description: Generates TrueType, Type 1 or OpenType font

In the left area of the page you can select the command, which you want to customize. Choose the commands category in the top list and the command itself in the list below.

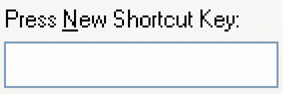
On the right part of the page you will see the list of keyboard shortcuts currently defined for that command:



Current Keys:
Ctrl+C
Ctrl+Ins

The **Remove** command at the right of the list allows removal of one of the existing shortcuts.

To define a new keyboard shortcut, select a command and position the cursor on the editing field below the **Press New Shortcut Key:** label:

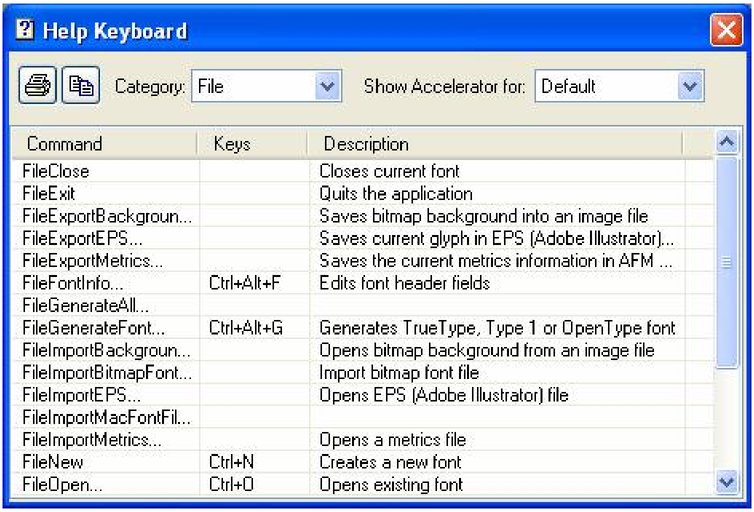


Press New Shortcut Key:

When the caret is in position just press the combination of keys that you want to assign. A description of that combination will appear in the editing field and you can click the **Assign** button **to assign that combination to the currently selected command**.

Press the **Reset All** button **to reset all changes back to FontLab Studio defaults**.

There is a **Keyboard shortcuts** command in the **Help** menu. Use it after you finish customizing the user interface to see or print a list of all the shortcuts:



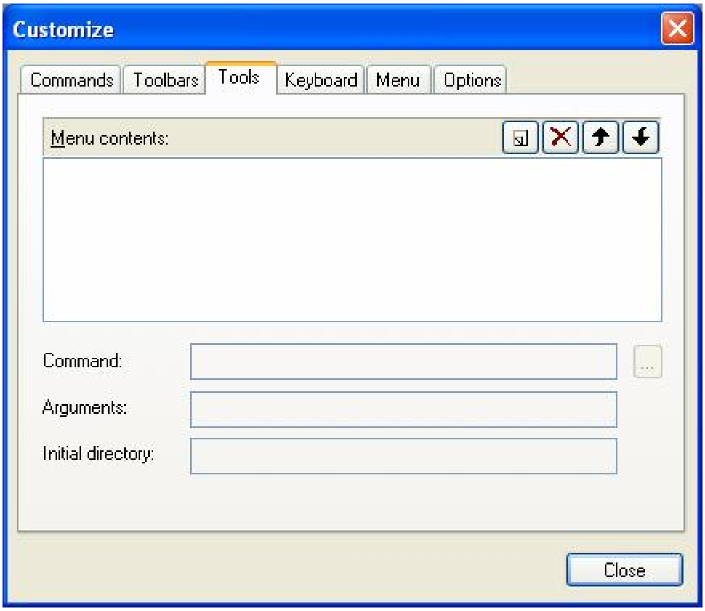
Category: File

Show Accelerator for: Default

Command	Keys	Description
FileClose		Closes current font
FileExit		Quits the application
FileExportBackgroun...		Saves bitmap background into an image file
FileExportEPS...		Saves current glyph in EPS (Adobe Illustrator)...
FileExportMetrics...		Saves the current metrics information in AFM ...
FileFontInfo...	Ctrl+Alt+F	Edits font header fields
FileGenerateAll...		
FileGenerateFont...	Ctrl+Alt+G	Generates TrueType, Type 1 or OpenType font
FileImportBackgroun...		Opens bitmap background from an image file
FileImportBitmapFont...		Import bitmap font file
FileImportEPS...		Opens EPS (Adobe Illustrator) file
FileImportMacFontFil...		
FileImportMetrics...		Opens a metrics file
FileNew	Ctrl+N	Creates a new font
FileOpen...	Ctrl+O	Opens existing font

Links to External Programs

Use the **Tools** page of the **Customize** dialog box **to assign Windows programs to menu items** in FontLab Studio's **Tools** menu:



There is a list of the assigned programs in the middle of the page and it is empty by default. Click this button: ⧉ **to add a link**.

Enter the name of the program as it will appear in the menu:

ScanFont

Then use the ... button at the right of the **Command:** editing field **to locate the program to run**:

Editing fields at the bottom of the **Command** field allow you **to define arguments for the program** you want to run from FontLab Studio's menu.

Use the ✕ button at the top of the **Tools list to remove the reference to the program** and the 🡅 and 🡇 buttons **to change the order of the commands**.

You may use special parameters to run external programs with the currently opened font as an argument. When FontLab Studio recognizes this argument, it will replace it with the file name of the currently active font or with some other parameters.

Suppose that current font was last saved into file named “c:/fonts/sample.vfb”.

Special arguments are:

%p Full file name of the current font [c:/fonts/sample.vfb]

%f Name of the file with extension [sample.vfb]

%n File name only [sample]

%x File name extension [vfb]

%d Path where file was saved [c:/fonts/]

%a Path to FontLab Studio installation [usually it is “/program files/FontLab/Studio5”]

Now you know everything about the customization of menus, toolbars and the keyboard, so you can click the **Close** button at the bottom of the Customize dialog box **to exit the customization mode**.

✐ **Important note:** in the following manual we will describe all commands, buttons and keyboard shortcuts as they come with FontLab Studio, without any customizations. If you changed the interface but want to follow the manual, reset all changes with the **Reset** buttons on the **Toolbars**, **Keyboard** and **Menu** pages of the **Customize** dialog box.

Faster Method to Customize Commands

You can **customize toolbars and menus without opening the Customize dialog box** by pressing and holding the ALT key on the keyboard and dragging buttons between toolbars or toolbars and menu.

FontLab Studio Windows

There are only three types of Windows in FontLab Studio:

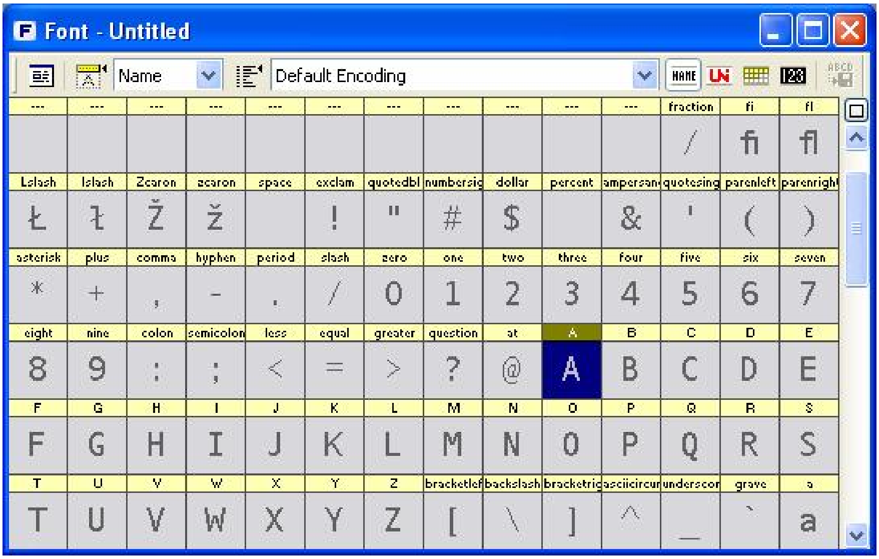
Font Window	Represents one of the opened fonts
Glyph Window	Used to edit glyphs
Metrics Window	Used to edit glyph metrics and kerning.

In this chapter we will provide only very basic information about the main windows. Please refer to the "Editing Fonts", "Glyph Window" and "Editing Metrics" chapters to get detailed information about the windows and their features.

Font Window

As an exercise let's create a font in order to demonstrate the FontLab Studio Windows. Use the **New** command in the **File** menu or click this button on the Standard toolbar.

You will see the Font window:



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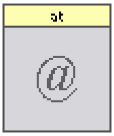
											/	ﬁ	ﬂ
Lslash	lslash	Zcaron	zcaron	space	exclam	quotedbl	numbersig	dollar	percent	ampersan	quotesing	parenleft	parenright
Ł	ł	Ž	ž		!	"	#	$		&	'	(	)
asterisk	plus	comma	hyphen	period	slash	zero	one	two	three	four	five	six	seven
*	+	,	-	.	/	0	1	2	3	4	5	6	7
eight	nine	colon	semicolon	less	equal	greater	question	at	A	B	C	D	E
8	9	:	;	<	=	>	?	@	A	B	C	D	E
F	G	H	I	J	K	L	M	N	O	P	Q	R	S
F	G	H	I	J	K	L	M	N	O	P	Q	R	S
T	U	V	W	X	Y	Z	bracketlef	backslash	bracketrig	asciicircu	underscor	grave	a
T	U	V	W	X	Y	Z	[	\	]	^	_	`	a

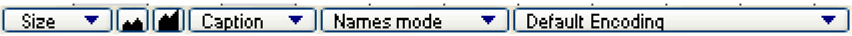
As you can see, this window has a caption with a few buttons and options and a big table of cells that represent characters and glyphs. Each cell has a caption that contains glyph identification information: name, Unicode index or some other data:

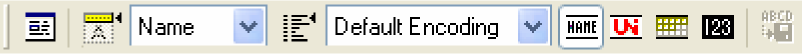


Cells can also contain little icons that show properties of glyphs, but more about that later.

There are no glyphs in the font that we just created, but the Font window nevertheless shows some pictures in the glyph cells. These are template images that show which character should be placed in the cell. FontLab Studio has templates for thousands of characters, so you will usually know where to place new characters.

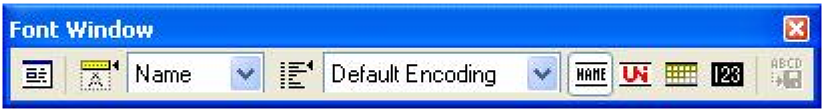
We'll discuss navigation in the Font window later, in the "Editing Fonts" chapter, so let's talk about the Font window command bar, which is located either at the bottom or at the top of the window:





You can switch between the top and the bottom location of the command bar by clicking on this button ⊟ in the top-right corner of the Font Window.

When the command bar is in the top position, it can be detached and you can drag it to the bottom area or just leave it floating around:



On the command bar you can easily find a button ▤ on the left, which is a duplicate of the **File > Font Info** command, which is described later in this manual.

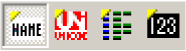
Right of the buttons there is a combo box, which allows you to change the information that appears in the character cell's captions:

Next is a combo box that allows you to change the encoding table of the current font:

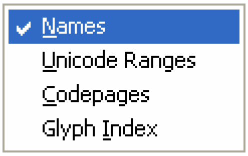
We will talk about encodings later, but you could choose a couple different ones from the combo box and see how the Font window changes.

At the right of the encoding list there are four buttons that allow a choice of encoding modes. Again, a detailed description of this follows. Just a few words here: any glyph in the font may be identified by a name, Unicode index or just its order in the glyph table.

Four buttons in the command bar in the top position allow you to choose one of four modes: Names, Unicode Ranges, Codepages or Index.



In the bottom position, there is a combo box that you can use to choose the mode:



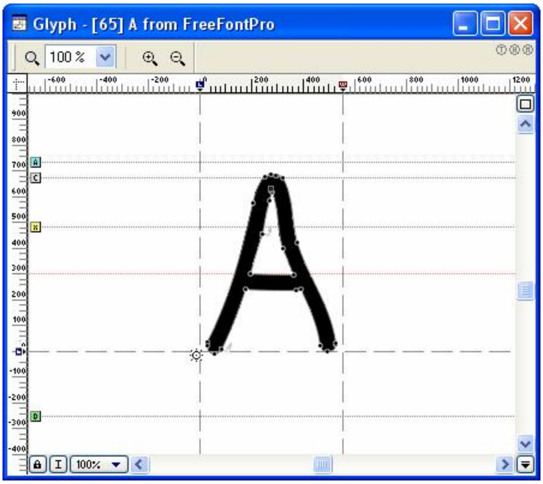
The last button in the top position controls the saving of custom encoding file and can be also reached via **Glyph > Glyph Names > Save Encoding**.

That's all about the Font window for now so let's open the Glyph window.

Glyph Window

To open a Glyph window for editing individual glyphs you need to create one. Remember, we started with a new font that doesn't have any glyphs. **To create a glyph**, double-click on any cell in the Font window. You will see that the gray cell (which means there is no glyph defined) is replaced by a white one, which represents a glyph that is defined, but contains no image. When you draw or paste something into it, the white cell will show a small picture of the glyph.

After the glyph cell is created we are ready to open the Glyph window. Select the glyph cell (just click on it with the left button) and double-click it to open the Glyph window. It will immediately appear on screen:



Instead of double-clicking, you can also use several other methods **to open the Glyph window**:

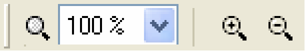
1. Right-click the glyph cell and select the **Edit** command in the context menu.
2. Select the glyph and choose **New Edit window** in the **Window** menu.
3. Select the glyph and press on the Panels toolbar
4. And finally, select the glyph cell and just press the **ENTER** key on the keyboard.

If you have more than one glyph in your font (which is normal when you open an existing font) and have a glyph window already open when you double-click another glyph in the Font window (or use any other method of opening a glyph window except the **New Edit window** command or a button on the toolbar) a new glyph will appear in the original glyph window. If you need to open many glyph windows simultaneously just hold down the **Ctrl** key when you double-click the new glyph cell or otherwise open a new Glyph window.

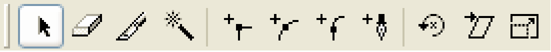
You may have as many open glyph windows as you want, just close those you don't need so as not have all your workspace covered with glyph windows.

Glyph Window Contents

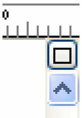
All windows in FontLab Studio have a similar layout: control panel on the top and main area covering most of the window. The glyph window is no exception: the top-docked control area (which, of course, can be docked to the bottom location also) contains zoom, selection tools, a combo box, and a few toolbar buttons:



Actually there are two toolbars here: the left one is used only to select the zoom mode of the Glyph window and to choose the **Zoom in** and **Zoom out** commands. The second toolbar is there to select the properties of the editing tool:

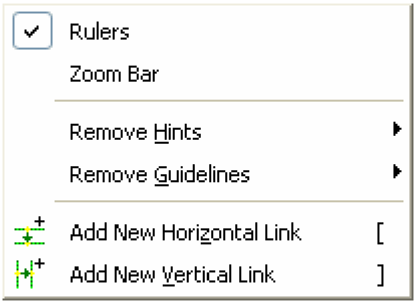


To get more screen space for the editing field you may hide the zoom toolbar if you click on this button in the top-right area of the glyph window:

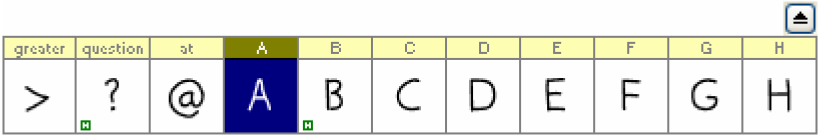


The main area of the window has scroll bars to change the view of the glyph, and vertical and horizontal ruler bars.

You can switch the ruler bars on and off with the **Rulers** option in the **View** menu. A quicker way is to right-click the ruler and choose the option in the context menu:



At the very bottom-right corner of the Glyph window you will find a little expand button that, when clicked on, opens the *Glyphs bar*:

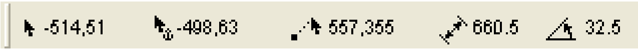


This is nothing more than a slice of the Font window, making it easier to access cells in the font window while the glyph window is maximized for precise editing work.

At the bottom-left corner of the windows you will find two more buttons, Lock and Meter:

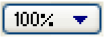
The Lock button controls quick access to the font glyph – when it is in the "unlocked" state 🔓 you can use the keyboard to directly access the glyphs. I.e. when you press a key the corresponding glyph will automatically open in the glyph window.

The Meter button controls the appearance of the *Meter panel*, which usually sits at the right end of the glyph window toolbar and shows the current coordinates and other parameters of the cursor:



-514,51 -498,63 557,355 660.5 32.5

To the right of the meter button you will find a *zoom selection menu*:



100%

If you click on it you will get the zoom menu that has same options that you may find in the zoom toolbar. This menu is useful if zoom toolbar is not visible.

We will return to a more detailed description of the glyph window properties in the "Glyph Window" chapter.

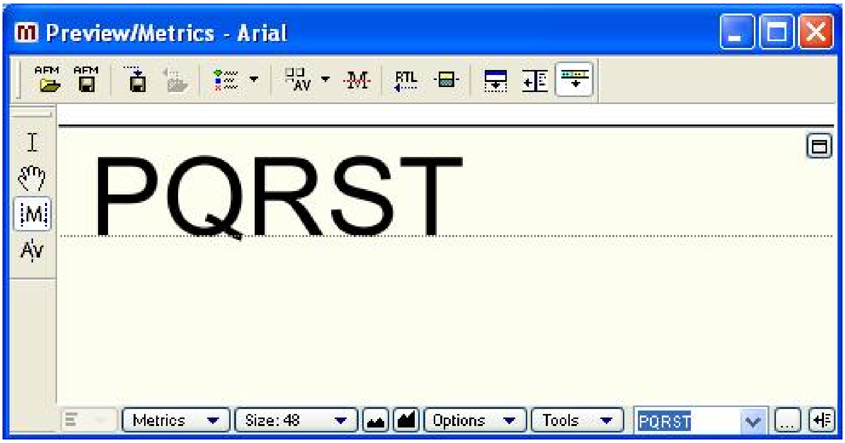
Finally, let's quickly preview the last window in FontLab Studio: the Metrics window.

Metrics Window

The Metrics window is used to adjust glyph metrics – glyph sidebearings and kerning.

To open the Metrics window select some glyphs in the Font window and click on the **New Metrics Window** command in the **Window** menu.

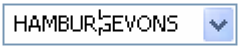
You will see a new window:



Glyphs that are currently selected in the Font window or the glyph that is in the active glyph window will appear in the Metrics window.

The Metrics window has a main editing field, a command area and two local toolbars.

To choose a string of characters to preview or modify use the string selection control:



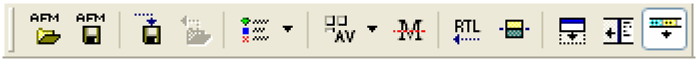
To the right of the button there is an options [...] button. Click it to get access to the list of strings where you can customize it.

One powerful option in this dialog box is support for a second preview string. The second string appears below the main preview string and can be used to compare different characters. The second string is not directly editable in the Metrics window.

Metrics Window Toolbars

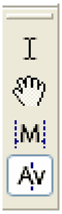
The Metrics window contains two local toolbars and a command area.

A Metrics window toolbar with controls for importing and exporting metrics files, automating metrics or kerning generation and other commands:



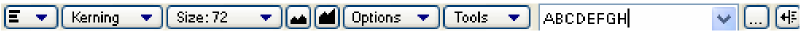
By default the toolbar is docked to the top of the window, but you can drag it to the bottom or leave it floating around.

A Metrics Tools toolbar with four buttons that allow you to select one of the metrics tools:

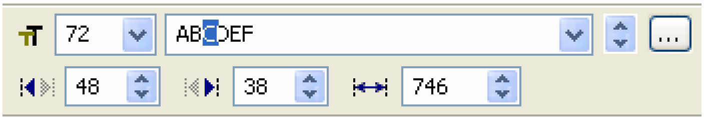


By default this toolbar is vertically aligned and docked to the left side of the window. You can drag it anywhere or dock to any side.

A local command area that is used to select a mode for the Metrics window and a string for metrics or kerning editing:



The local command area of the Metrics window may be located in the bottom (default) or top area of the window. When the local command area is in the top location, it includes controls to modify metrics or kerning:

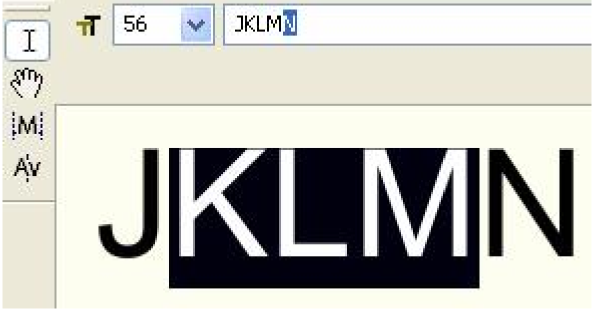


The content of this properties area depends on the current mode of the Metrics window.

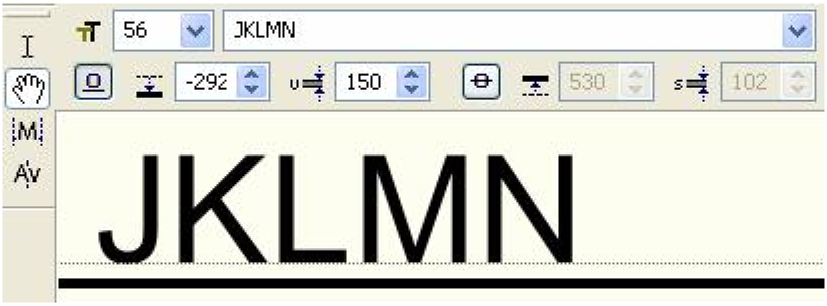
Metrics Modes

The metrics window works in four modes: *text*, *preview, metrics* and *kerning*.

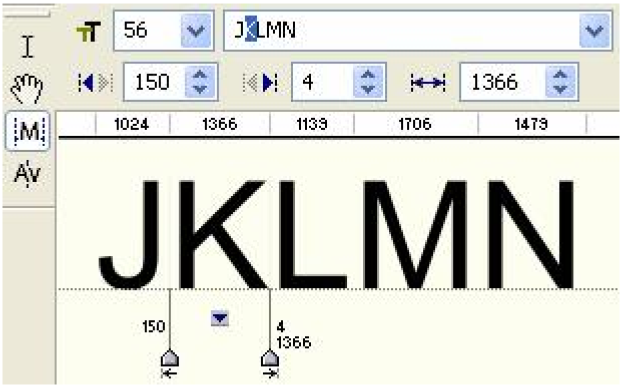
In **Text mode** you can enter and edit text in the main editing area of the Metrics window. It works very similar to any standard text editor:



Preview mode is used to preview text with kerning applied and check it at different sizes. Also the position and width of the underline and middle-stroke line can be adjusted in this mode:



In **Metrics mode** you can change the glyph sidebearings using either visual or digital controls:



56

JKLMN

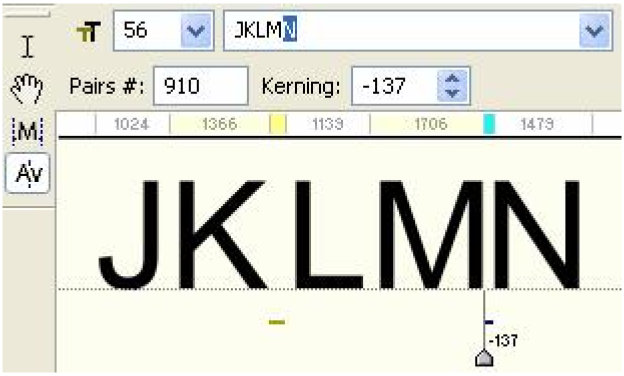
150

4

1366

In Metrics mode the string of glyphs is previewed without kerning.

In **Kerning mode** you can edit pair kerning:



56

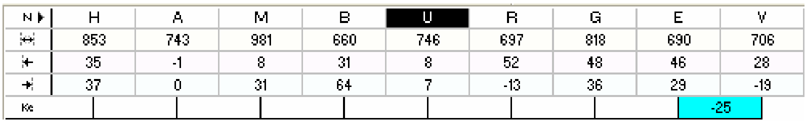
JKLMN

Pairs #: 910

Kerning: -137

Metrics Panel

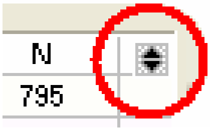
The Metrics Panel is a horizontally oriented table that may appear above or below the editing area:



N ▸	H	A	M	B	U	R	G	E	V
↔	853	743	981	660	746	697	818	690	706
⇤	35	-1	8	31	8	52	48	46	28
⇥	37	0	31	64	7	-13	36	29	-19
Ks								-25	

You may control the appearance of the Metrics Panel using the Panel command in the Options local menu (when the local command area is at the bottom) or with the Panel button on the Metrics window toolbar: .

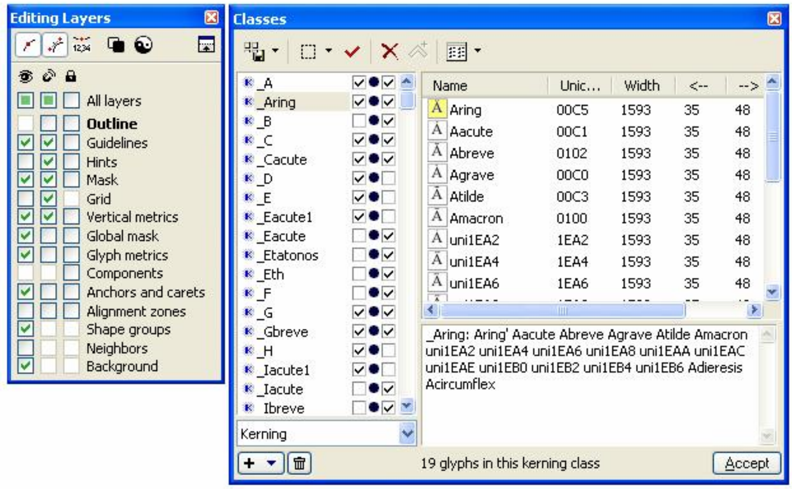
Click on this button in the top-right area of the panel to move it top or bottom:



When the Metrics Panel is visible, the properties area of the command area (if it is at the top) disappears.

Panels

Some FontLab Studio operations are accessible through Panels – small windows that are located in front of the main Font, Glyph and Metrics windows:



■	■	□	All layers
	□	□	**Outline**
☑	☑	□	Guidelines
□	☑	□	Hints
☑	☑	□	Mask
□	☑		Grid
☑	☑	□	Vertical metrics
☑	□	□	Global mask
☑	□	□	Glyph metrics
		□	Components
☑	□	□	Anchors and carets
□	□	□	Alignment zones
☑			Shape groups
□			Neighbors
☑			Background

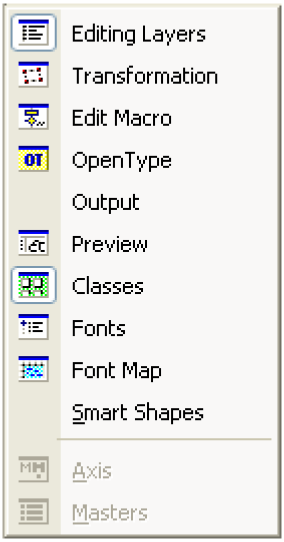
_A	☑	●	☑
_Aring	☑	●	☑
_B	□	●	☑
_C	☑	●	☑
_Cacute	☑	●	☑
_D	☑	●	□
_E	☑	●	□
_Eacute1	☑	●	□
_Eacute	□	●	☑
_Etatonos	□	●	☑
_Eth	□	●	☑
_F	□	●	☑
_G	☑	●	☑
_Gbreve	☑	●	☑
_H	☑	●	□
_Iacute1	☑	●	□
_Iacute	□	●	☑
Ibreve	□	●	☑

Name	Unic...	Width	<--	-->
Aring	00C5	1593	35	48
Aacute	00C1	1593	35	48
Abreve	0102	1593	35	48
Agrave	00C0	1593	35	48
Atilde	00C3	1593	35	48
Amacron	0100	1593	35	48
uni1EA2	1EA2	1593	35	48
uni1EA4	1EA4	1593	35	48
uni1EA6	1EA6	1593	35	48

_Aring: Aring' Aacute Abreve Agrave Atilde Amacron uni1EA2 uni1EA4 uni1EA6 uni1EA8 uni1EAA uni1EAC uni1EAE uni1EB0 uni1EB2 uni1EB4 uni1EB6 Adieresis Acircumflex

19 glyphs in this kerning class

Use the **Window** menu or the **Panels toolbar** to open panels:



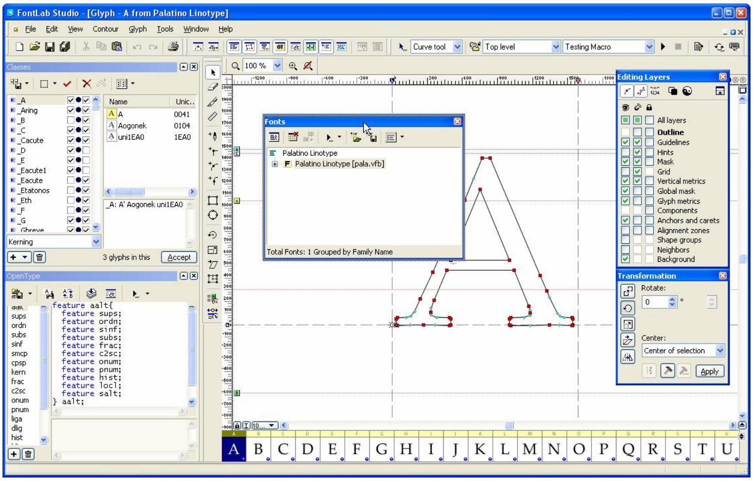
Below is the list of all the panels available in FontLab Studio. They are described in full detail in the sections that are related to their functions, so this is only a short reference:

Editing Layers	Control of all editing layers, “show”, “snap”, “lock” operations
Transformation	Panel for digital outline transformations
Edit Macro	Editor for Python macro programs
OpenType	Editor for OpenType features
Output	Text output panel. Other panels and macro programs may output text here.
Preview	Preview, OpenType Sample and Anchor preview panels.
Classes	Classes - named lists of characters
Fonts	List of all opened fonts grouped by family name
Font Map	A picture representation of big Unicode fonts
Smart Shapes	Collection of outline smart shapes
Axis	Selector of intermediate (or extrapolated) design in a Multiple Master font
Masters	Selector of master in a Multiple Master font

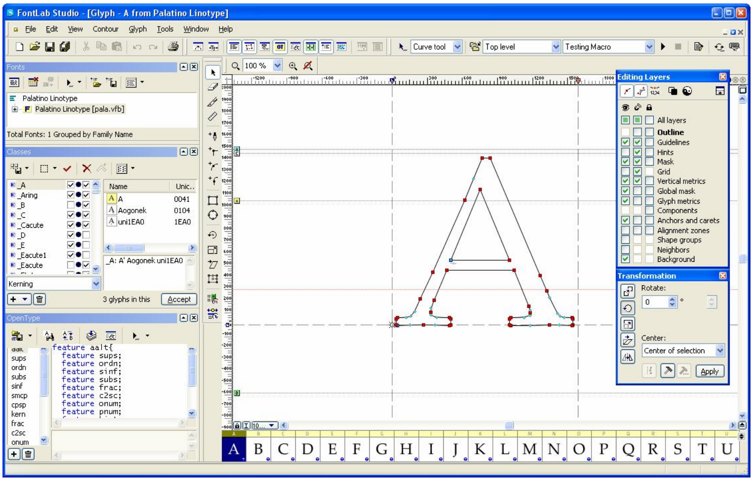
All panels are described in full detail in the following chapters when we discuss the features that they serve.

The Fonts, Edit Macro, OpenType, Output, Preview and Classes panels can be docked to either side of the FontLab Studio window.

To dock a panel just drag it close to the window edge:



```
feature aalt{
  feature sups;
  feature ordn;
  feature sinf;
  feature subs;
  feature frac;
  feature c2sc;
  feature onum;
  feature pnum;
  feature hist;
  feature locl;
  feature salt;
} aalt;
```



To prevent the panel from docking, hold down the CTRL key while dragging the panel's caption.

Multiple panels can be docked on the same side. Use separator lines to adjust their positions.

With this button you can quickly enlarge a panel. Click the button again **to return the panel to its original size**.

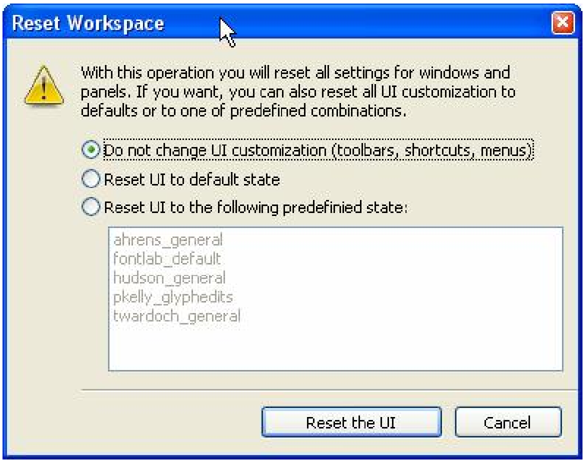
All panels that are not "dockable" stick to the edge of the FontLab Studio window and to each other, so you can easily arrange them to create the most comfortable environment.

Every time you exit FontLab Studio the positions of all toolbars and panels are stored in Windows' registry, so when you run FontLab Studio the next time, the environment will be restored.

You can save the current workspace (the user interface layout) into a file: **Window > Workspace > Export Workspace**

Save the file into the **Workspaces** folder within your **Application user data folder** (the one specified in **Tools > Options > General Options > Folders and paths > FontLab Studio 5 Files**). When you restart FontLab Studio, the workspace will appear in the **Window > Workspace** menu. You can save several workspaces and quickly switch between different UI arrangements. You can also share your workspaces with different users.

To reset your current workspace to the default (factory) state or to launch FontLab Studio with a different workspace, hold Ctrl while starting the application. A dialog box will appear:



Reset Workspace

With this operation you will reset all settings for windows and panels. If you want, you can also reset all UI customization to defaults or to one of predefined combinations.

● Do not change UI customization (toolbars, shortcuts, menus)
○ Reset UI to default state
○ Reset UI to the following predefinied state:

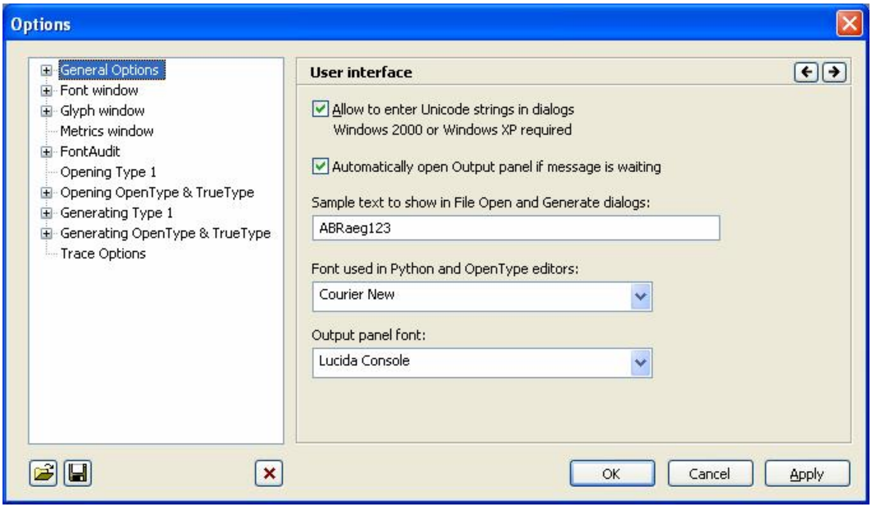
ahrens_general
fontlab_default
hudson_general
pkelly_glyphedits
twardoch_general

and you will be able to choose to start FontLab Studio with the current or the default UI, or to load one of the workspaces.

FontLab Studio Options

Most of the features, behavior, import and export algorithms of FontLab Studio are customizable in the Options dialog box. In FontLab Studio 5 the Options dialog box has been significantly expanded. There are more options, so there are more choices. We encourage you to experiment with the settings and adapt them to your preferences. However, note that the authors have carefully chosen the factory settings so if you don't feel like poking around the Options, in most cases you will be fine with the defaults.

To open the Options dialog box, select the **Options** command in the **Tools** menu:



User interface

☑ Allow to enter Unicode strings in dialogs
Windows 2000 or Windows XP required

☑ Automatically open Output panel if message is waiting

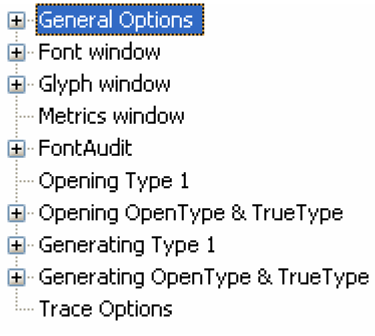
Sample text to show in File Open and Generate dialogs: ABRaeg123

Font used in Python and OpenType editors: Courier New

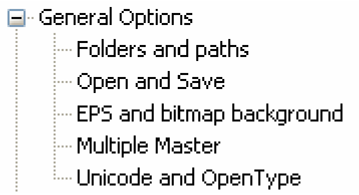
Output panel font: Lucida Console

The dialog structure is quite simple. There is a list of pages combined in categories on the left, the contents of the currently selected page on the right and some buttons on the bottom. You will notice that the structure of this dialog bears resemblance to the structure of the Font Info dialog.

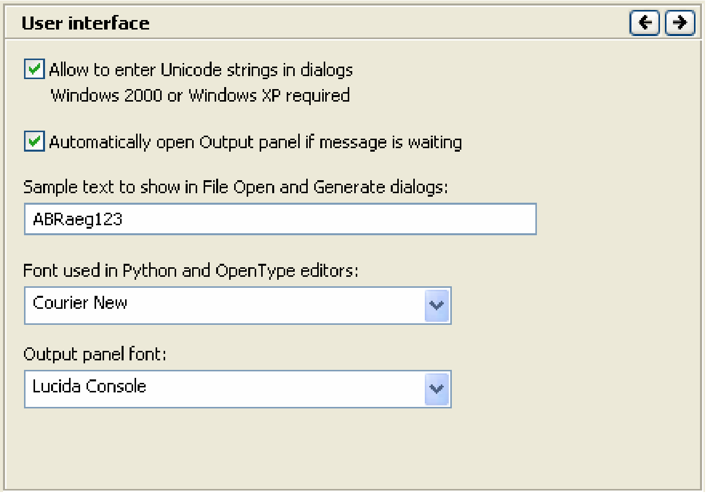
To select a page use the list on the left:



Expand one of the categories to see all the pages:



Select a page and you will see its contents appear at the right of the list:



User interface

☑ Allow to enter Unicode strings in dialogs
Windows 2000 or Windows XP required

☑ Automatically open Output panel if message is waiting

Sample text to show in File Open and Generate dialogs: ABRaeg123

Font used in Python and OpenType editors: Courier New

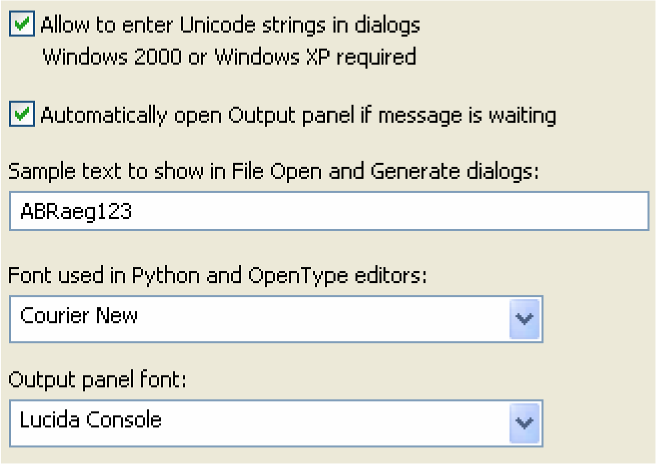
Output panel font: Lucida Console

You can browse pages continuously by clicking on ← → buttons.

Other buttons and their meaning are described in the table:

📂	**Import options**	Allows you to select a profile file that holds a particular configuration of all options and loads that profile. You can create different profiles for different occasions and load them when needed – for example, separately for each format or foundry that you work with
💾	**Export options**	Exports current options to a profile file. In a workgroup environment, you can export a profile file and give it to your colleague who then can load it and generate fonts in the same environment. When sending technical problem reports to Fontlab Ltd., please always export your options into a profile file and attach that file with your report
✕	**Reset options**	Resets all options to the factory defaults
	Apply	Applies the changes without closing the dialog box. Many interface changes become visible immediately in the corresponding windows
	Cancel	Closes the dialog box without applying changes
	OK	Applies the changes and closes the dialog box.

General Options



☑ Allow to enter Unicode strings in dialogs
Windows 2000 or Windows XP required

☑ Automatically open Output panel if message is waiting

Sample text to show in File Open and Generate dialogs: ABRaeg123

Font used in Python and OpenType editors: Courier New

Output panel font: Lucida Console

Allow to enter Unicode strings…	Normally, you cannot directly type extended Unicode characters into the various text fields within FontLab Studio, e.g. the Preview panel or the Metrics Window – you need to use the /glyphname and \Unicode notation. With this option enabled, you will be able to directly enter the subset of extended characters that is supported by the current system codepage. You can set your system codepage in **Control Panel > Regional and Language Options > Advanced > Language for non-Unicode programs**. E.g. when you are working on a Cyrillic font and would like to enter Cyrillic characters directly instead of the slash/backslash notation, enable this option, set Russian in Control Panel, and restart your machine. You may want to disable this option when making changes to **Font Info > Names and Copyright > Additional OpenType names**. With this option disabled, you will always see the hexadecimal codes for extended characters
Automatically open Output panel…	Python macros, OpenType compilation operations and some other elements of FontLab Studio write out text outputs into the Output panel. With the option enabled, the Output panel will appear every time a new message appears. With the option disables, the Output panel will stay always hidden if you close it

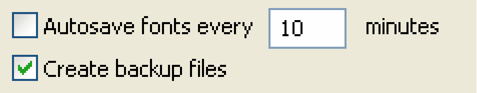
Sample text...	The font previews in the Open and Generate dialog boxes use the string specified here to preview the font
Font used in Python and OpenType editors	Allows you to choose a custom font for use in the Edit Macro panel and the OpenType panel
Output panel font	Allows you to choose a custom font for use in the Output panel.

Folders and Paths

Please refer to the "FontLab User Interface" chapter for information about these settings.

Open and Save

If you want to protect yourself from system or program crashes you can use the Autosave function that will periodically save the current font.



□ Autosave fonts every 10 minutes

☑ Create backup files

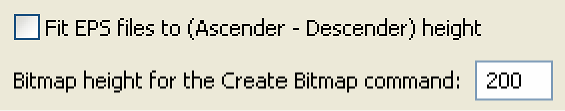
Use the check box to activate Autosave and enter the time interval (in minutes) at which you want to save the font. The font will be saved into the Autosave folder (within the Application user data folder) and will be named using the following structure:

flsX.save.vfb, where fls are the first 3 letters of Font Name and the X is some unique value.

If Autosave was active and you have a system or program crash, you can open your last saved font from the Autosave directory.

When you manually save your font and the **Create backup files** option is enabled, FontLab Studio will save the previous version of your font in the same folder as the currently saved .vfb file but will use the .bak file extension instead. If you would like to go back and open the previous (backup) version of your .vfb file, use **File > Open**, navigate to the folder in that you saved your file and type in ***.bak** in the File name field, then press ENTER. You will then see the backup file and will be able to open it.

EPS and Bitmap Background



□ Fit EPS files to (Ascender - Descender) height

Bitmap height for the Create Bitmap command: 200

Fit EPS files to (Ascender-Descender) height

When enabled, pasted and imported EPS/AI outlines will be automatically scaled to fit between the Ascender and Descender lines of the font. When disabled, pasted and imported EPS/AI outlines will be pasted without scaling, with the assumption that 1 pt in the EPS/AI drawing corresponds to 1 font unit in FontLab Studio.

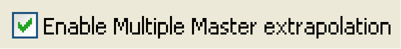
Bitmap height for the Create Bitmap command

Allows you to set the bitmap size in pixels that will be created when the user chooses **Tools > Background > Create**. Higher values will give you a more high-fidelity bitmap rendition of your glyph but will result in larger .vfb files.

Tip: Tweaking this value can be useful if you want to create pixel fonts. Set the value to a lower one, choose **Tools > Background > Create**, then **Tools > Mask > Swap Outline with Mask**, and finally **Tools > Background > Trace Pixels**.

Please refer to the "Importing and Exporting Glyphs" section of the "Glyph Window" chapter for more information about using the first option.

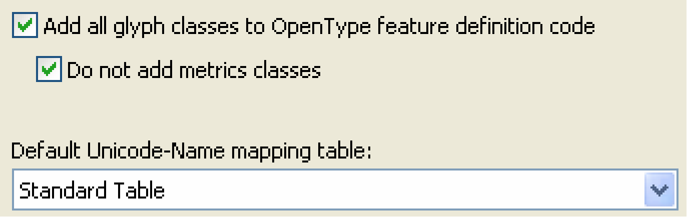
Multiple Master



☑ Enable Multiple Master extrapolation

With this option enabled, you can use the preview or generate MM instances beyond the original boundaries set by the masters. If you're working with a Multiple Master font, choose **Tools > Multiple Master > Generate Instance** and enter -200 as the instance position in the Weight axis to generate an ultra-light variant of your font.

Unicode and OpenType



☑ Add all glyph classes to OpenType feature definition code

☑ Do not add metrics classes

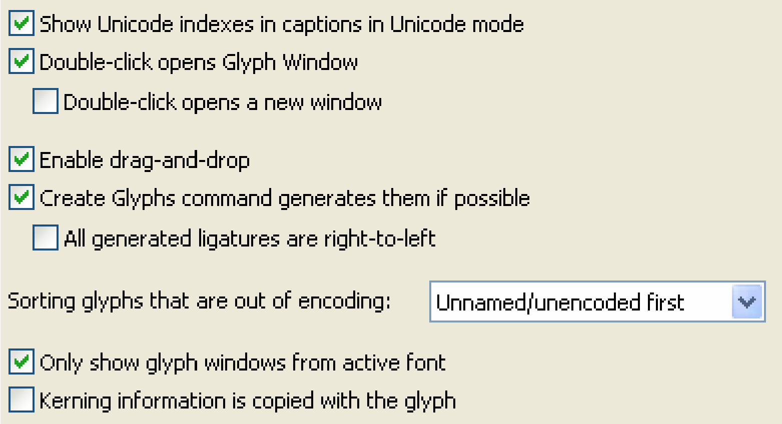
Default Unicode-Name mapping table:

Standard Table

Add all glyph classes to OT feature definition code	With this option enabled, classes defined in the Classes panel are automatically and implicitly added to the OpenType panel when OpenType feature definitions are compiled. Disable this option if you defined your classes explicitly in the lower-right portion of the OpenType panel
Do not add metrics classes	With this option enabled when the above option is enabled, the metric classes (those with names starting with a period) are not added to the OpenType feature definition code. The metric classes are typically used only with the Metrics Assistance feature and are not referenced by OpenType features or class kerning. Disable the option if your feature definition language references any metrics classes that you defined in the Classes panel
Default Unicode-Name mapping table	This allows you to choose the Unicode-to-glyphname mapping file that FontLab Studio uses to generate Unicodes based on glyph names or vice versa. Change this if you created your own .NAM file and prefer to use that one over the default one. Refer to the “Generating Unicode codepoints” section of the "Editing Fonts" chapter for details.

Font Window

The options on the Font Window page control display aspects of the Font Window and define how certain commends work.



☑ Show Unicode indexes in captions in Unicode mode

☑ Double-click opens Glyph Window

□ Double-click opens a new window

☑ Enable drag-and-drop

☑ Create Glyphs command generates them if possible

□ All generated ligatures are right-to-left

Sorting glyphs that are out of encoding: Unnamed/unencoded first

☑ Only show glyph windows from active font

□ Kerning information is copied with the glyph

Show Unicode indexes in captions in Unicode mode

This option sets Unicode indexes in captions as the default choice for the Unicode mode

Double-click opens Glyph Window

If enabled, double-click on a glyph cell in the Font Window opens a Glyph Window. If disabled, double-click does not yield any action

Double-click opens a new window

If this option is enabled, each double-click on a cell on a glyph cell in the Font Window opens a new Glyph Window. If disabled and there is already a Glyph Window open, the glyph that the user double-click on will be displayed in the existing Glyph Window. This option works only if the previous option is enabled

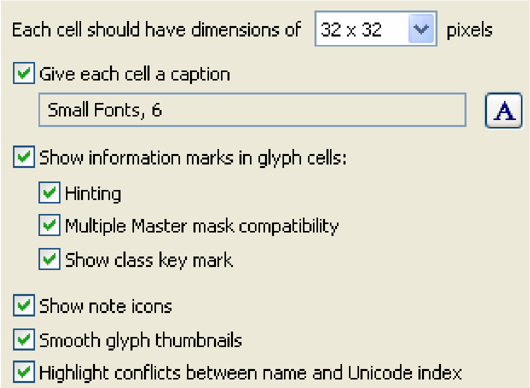
Enable drag-and-drop

When enabled, drag-and-drop operations work in the Font Window. Drag-and-drop in the Index mode physically rearranges glyphs in your font. Drag-and-drop in other modes of the Font Window is used to assign new code positions to existing glyphs. Drag-and-drop between fonts can be used to append (if in Index mode) or copy (other modes) glyphs between fonts

Create Glyphs command generates them if possible	This option controls what happens if the user double-clicks on an empty glyph cell in the Font Window, chooses **Glyph > Create Glyphs** or **Glyph > Create Glyphs If Empty**. When disabled, the resulted glyphs will be always blank (no outlines). If enabled, FontLab Studio will attempt to generate a glyph. Refer to the section about Generating Glyphs for more details
All generated ligatures are right-to-left	This option controls the way FontLab Studio generates ligatures if the previous option is enabled and the user double-clicks or on an empty glyph cell that is intended for a ligature glyph. If enabled, the ligatures generated that way will be right-to-left, i.e. the first component of the generated ligature will be right-most. This does not affect the way ligatures are generated when **Glyph > Generate Glyphs** is called explicitly
Sorting glyphs that are out of encoding	Controls the way glyphs are displayed in the Font Window that are shown outside of the “yellow area”, that is, the glyphs that do not belong to the currently selected encoding, codepage or Unicode range
Only show glyph windows from active font	When multiple fonts are opened, the screen can quickly get cluttered. With this option enabled, FontLab Studio will only display Glyph Windows from the currently active font while it will hide other open Glyph Windows. Disable this option if you want to compare Glyph Windows from different fonts side-by-side
Kerning information is copied with the glyph	This option controls the behavior of FontLab Studio if the user copies any glyphs in the Font Window using the clipboard. If enabled, all kerning pairs associated with the glyph will be copied. If disabled, the kerning pairs will not be copied. Disable this if you only want to copy-and-paste the glyph shapes but not the associated kerning.

Glyph Cell

These options control the appearance details of glyph cells in the Font Window.



Each cell should have dimensions of 32 x 32 pixels

☑ Give each cell a caption

Small Fonts, 6

☑ Show information marks in glyph cells:

☑ Hinting

☑ Multiple Master mask compatibility

☑ Show class key mark

☑ Show note icons

☑ Smooth glyph thumbnails

☑ Highlight conflicts between name and Unicode index

Each cell should have dimensions of... Controls the default size of the glyph cells in all Font Windows. Note that when the local control area of the Font Window is placed at the bottom, you can use the **Increase/Decrease cell size** buttons to temporarily change the size of the glyph cells in the currently active font

Give each cell a caption Shows/hides the caption of the glyph cell (the small rectangular bar shown at the top each glyph cell) and allows you to choose a font that should be used there

Show information marks in glyph cells Shows/hides the small colored information marks in the corners of the glyph cells. Refer to the "Font Window" section for more information about their meaning

Show note icons Glyphs can have notes associated with them. With this option enabled, if a glyph includes a note, a small icon will appear in the corner of the glyph cell

Smooth glyph thumbnails Turns on and off the anti-aliasing of the rendered glyph previews (thumbnails) in the glyph cells

Highlight conflicts between name and Unicode index The default Unicode-Name mapping table (see pages 69 and 91) determines the “ideal” (recommended) mapping between glyph names and Unicodes. In your font, glyph names can be mapped to other Unicodes than those recommended, or glyph may have no Unicode codepoints assigned although they should. With this option enabled, FontLab Studio will show the caption background of the glyph cell in red color for all such problematic cases. To automatically correct the problem, use **Glyph > Glyph Names > Generate Unicode**.

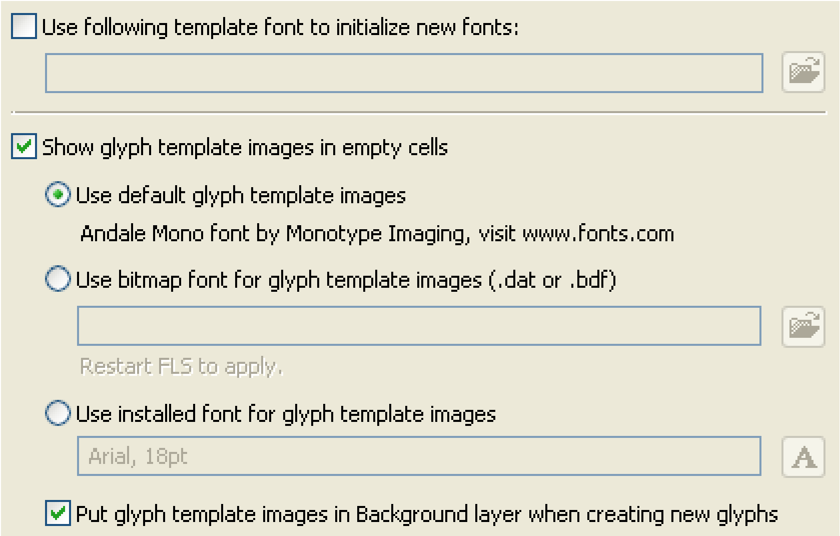
Templates

This section regards two different sorts of templates used in FontLab Studio.

New font template: a .vfb file that can be used as basis for all new fonts that are created in FontLab Studio. If you regularly create new fonts for the same foundry, you can save any of your fonts as a new font template. You may want to set an encoding, fill in the designer and vendor information but perhaps clean font naming and all the glyphs. Later, when creating new fonts in FontLab Studio, the new font template will be automatically opened so all the values that are specific to your foundry are already filled-in.

Glyph template images: the dark gray bitmap images that appear in Font Window glyph cells if a glyph in the font is empty. The glyph template images can be used as an orientation during your type design process. For example, if you open a Western font, switch to the Unicodes mode and choose the Cyrillic range, you will see what your Cyrillic glyphs should roughly look like.

FontLab Studio 5 ships with a very extensive set of pre-installed default glyph template images. These are based on the Andale Mono WTG font (courtesy of Monotype Imaging**,** http://www.monotypeimaging.com/) and cover the entire Unicode 3.2 character set. Note that the default glyph template images are low-resolution, monospaced and in a “sanserif” style. They should not be used as direct source of information about the typographically correct shape of glyphs – but only as an orientation.



☐ Use following template font to initialize new fonts:

☑ Show glyph template images in empty cells

● Use default glyph template images

Andale Mono font by Monotype Imaging, visit www.fonts.com

○ Use bitmap font for glyph template images (.dat or .bdf)

Restart FLS to apply.

○ Use installed font for glyph template images

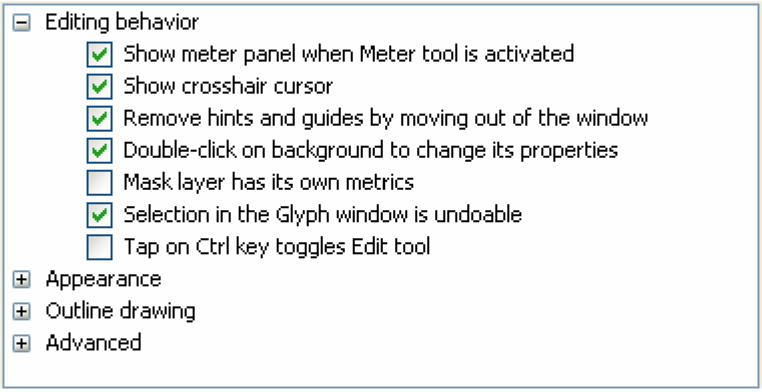
Arial, 18pt

☑ Put glyph template images in Background layer when creating new glyphs

Use template font to initialize new fonts	When enabled, allows you to choose any .vfb file as a new font template when the user chooses **File > New**. When disabled, a blank .vfb file is created
Show glyph template images in empty cells	When enabled, glyph template images are shown in empty glyph cells. You can also choose if the default or a custom set of glyph template images is used. You can use any font installed on the system or a bitmap font file. For bitmap font files, .bdf files are supported as well as .dat files that can be created with BitFonter
Put glyph template images in Background layer when creating new glyphs	When enabled, whenever you create a new glyph, the corresponding glyph template image will be placed as a bitmap in the Background layer.

Glyph Window

This section controls the behavior of the Glyph Window.



⊟ Editing behavior

- ☑ Show meter panel when Meter tool is activated
- ☑ Show crosshair cursor
- ☑ Remove hints and guides by moving out of the window
- ☑ Double-click on background to change its properties
- □ Mask layer has its own metrics
- ☑ Selection in the Glyph window is undoable
- □ Tap on Ctrl key toggles Edit tool

⊞ Appearance

⊞ Outline drawing

⊞ Advanced

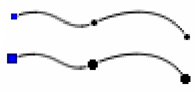
Editing behavior:

Show meter panel when Meter tool is activated	If enabled, the Meter panel is shown when the user activates the Meter tool
Show crosshair cursor	If enabled, a crosshair cursor is shown whenever the user moves any nodes
Remove hints and guides by moving out of the window	When enabled, the user can remove hints and guidelines by moving them out of the window
Double-click on background to change its properties	When enabled, the user can double-click on the bitmap placed on the Background layer to position or scale it. When disabled, this is only possible via **Tools > Background > Move and Scale**
Mask layer has its own metrics	When enabled, the Mask layer has its own advance width information. When disabled, the Mask layer always has the advance width of the Outline layer
Selection in the Glyph window is undoable	While editing a glyph, the user often selects some contours or nodes. With this option enabled, the step of selection is stored as a separate undo step so can be undone separately from other editing actions
Tap on Ctrl key toggles Edit tool	When enabled, the user can press the **TAB** key to temporarily enable the Edit tool if a different tool is currently active, and press the **TAB** key again to revert back to that tool

Appearance options:

Small nodes

Nodes may be small or large:



Node shape shows point and connection type

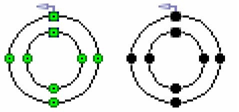
When enabled, each node symbol will indicate both the type of the adjacent contour and the connection type. When disabled, each node symbol will only indicate the type of preceding contour while the connection type will be indicated with a separate small symbol next to the node.

Enable this option to see tangent points shown as such. Disable this option to revert to the FontLab 4.x behavior.

Refer to the "Node Type" section of the "Glyph Window" chapter for more information about node symbols

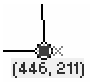
Black/white nodes

When disabled, node symbols are displayed using color as in FontLab 3.x. When enabled, node symbols are displayed using color as in Fontographer



Show node position

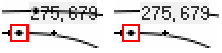
One node may be selected as the current node. It will be highlighted and its position will appear on screen:



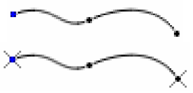
To deselect the node, click anywhere in the empty space of the editing field or click the **Esc** key

Node position is on top of the outline

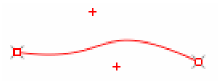
Position of the node (see above) may appear below or above the path:



Highlight first node of an open contour
When this option is on, start and end nodes of the open contour are highlighted with a small diagonal cross:



Bezier control points are visible in selection
When this option is on and **Show Layers>Control Vectors** is off, the control points become visible when the curve is selected:



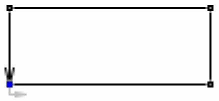
Show selected nodes in inactive masters
When enabled, Multiple Master fonts will highlight selected nodes in all masters. When disabled, only selected nodes in the active master will be highlighted

Connect selected nodes in all masters
When this option is active, nodes that are selected in the current master are connected by straight line segments to nodes in all visible masters

Show anchor names
When enabled, anchor names are displayed in the Glyph Window. When disabled, they are only visible in the Properties panel

Show nodes on mask layer
When enabled, nodes on the mask layer will be shown even if the user is in the Outline layer

Show arrow on closepath
Activate this option to see small arrows on every closepath line:

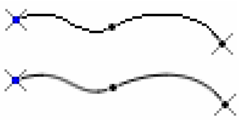


Show measurement line
Shows/hides the measurement line: the red horizontal line that can be used for calculating sidebearings.

Outline drawing options:

Smooth outline

Allows one to select between non-anti-aliased and anti-aliased rendering of the outline:

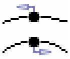


Mask and inactive masters are smooth too

If enabled, the Mask layer and inactive masters in a MM font are also anti-aliased

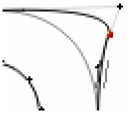
Show contour direction

An outline consists of several contours and each contour is directional. The direction of the contour is marked with a small arrow:



Leave echo while editing

When editing contours the original contours shape/position is shown gray:



Fill open contours

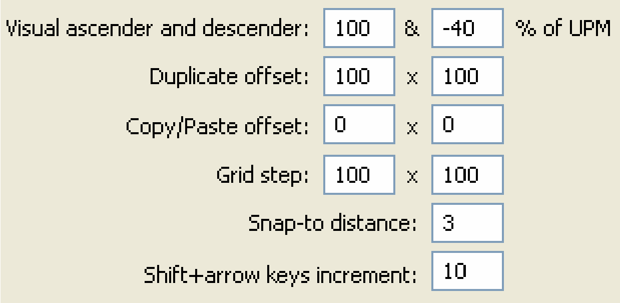
When this option is off, the open contour appears unfilled in fill outline (preview) mode:

Advanced options:

Move selected nodes individually	When enabled, the user can individually move nodes even if several nodes are selected. When disabled, all selected nodes move the same way
All BCPs are fixed	When using non-node editing and you drag any location on a curve, its control vectors may change direction. You can right-click on the node and enable **Connection > Fixed** to fix the direction of the control vectors for that particular node. With the option **All BCPs are fixed**, you can fix the direction of all control vectors in a font for the purposes of non-node editing
When curve is selected keyboard adjusts BCPs	When enabled, you can select a curve segment and use the arrow keys to move the BCPs
Align to all contour points if snap to contour is on	When disabled, **View > Snap to Layers > Outline** makes nodes snap only to other nodes. When enabled, the nodes snap to all locations on a contour, not just nodes
Edit/Delete command breaks contour	When disabled, the **Edit > Cut** command breaks (opens) a contour but **Edit > Delete** only removes nodes but leaves the contour closed. When enabled, both **Cut** and **Delete** break the contour
Keep smooth connection smooth at all times	Enable this to prevent smooth node connections to turn into sharp connections when blending is used
VectorPaint tools have separate view settings	With this option FontLab Studio will provide separate set of the view setting for the Vector Paint mode.

Dimensions

These settings control visual dimensions in the Glyph Window:



Visual ascender and descender: 100 & -40 % of UPM

Duplicate offset: 100 x 100

Copy/Paste offset: 0 x 0

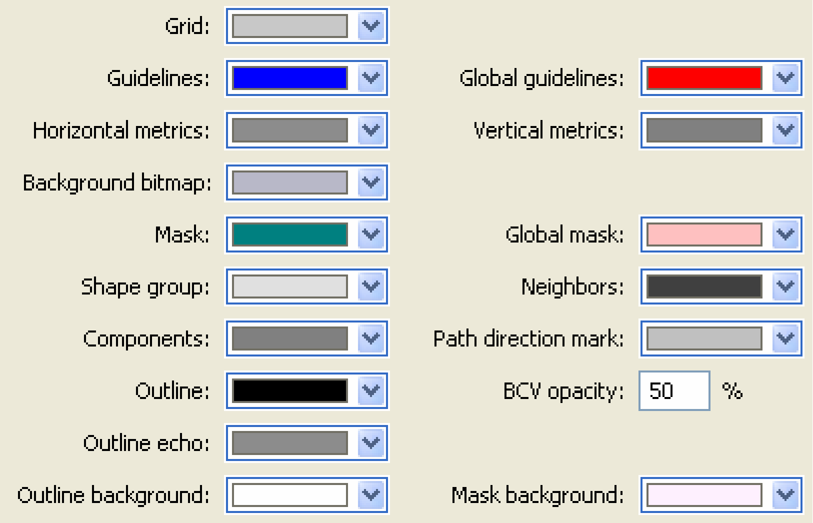
Grid step: 100 x 100

Snap-to distance: 3

Shift+arrow keys increment: 10

Visual ascender and descender	When you select 100% as the zoom value in the Glyph Window, FontLab Studio needs to choose a scaling factor to fit the font unit space in the Glyph Window. This is done by always fitting the Visual ascender is to the top of the Glyph Window and fitting the Visual descender to the bottom of the window. If you think that the 100% zoom level shows you a too small portion of your glyph (because for example your font has extremely long ascenders and descenders), you can increase these values. This is only a visual setting and does not modify and metric information in the font
Duplicate offset	This setting controls the distance (in font units) by which outlines are duplicated
Copy/Paste offset	This setting controls the distance (in font units) by which outlines are moved when the user does copy-paste
Grid step	This setting controls the grid step in font units. You can show/hide the grid and enable snapping to grid from the **View** menu
Snap-to distance	If any of the editing layers has the "snap-to" property turned on, moving a node will cause it to snap to the objects on that particular layer if the distance between the node and the object is not larger than the distance (in pixels) specified here. **Tip:** Enabling "snap to grid" and increasing the snap-to distance may be helpful when designing pixel fonts
Shift+arrow keys increment	This setting defines the distance (in font units) by which objects are moved when **SHIFT+ARROW** keys are used.

Colors



Grid:

Guidelines: | Global guidelines:

Horizontal metrics: | Vertical metrics:

Background bitmap:

Mask: | Global mask:

Shape group: | Neighbors:

Components: | Path direction mark:

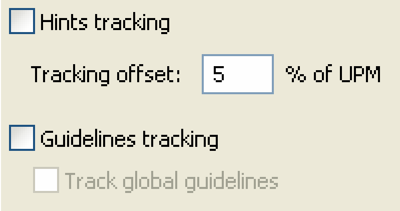
Outline: | BCV opacity: 50 %

Outline echo:

Outline background: | Mask background:

In FontLab Studio, the color of practically each element of the Glyph Window can be customized – so for example, you can edit white outlines on a black background. You can also control the opacity of the control vectors here.

Tracking



□ Hints tracking

Tracking offset: 5 % of UPM

□ Guidelines tracking

□ Track global guidelines

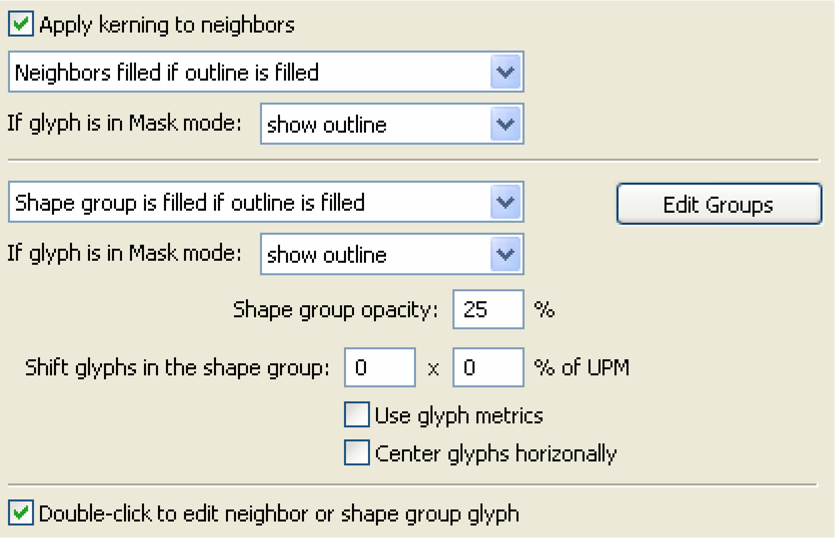
Hints tracking When enabled and you move a hint by a distance less than the Tracking offset setting, all nodes that are on the hint will be moved with it. Use it to keep an outline on the hint when you modify the hint's width

Guidelines tracking When enabled and you move a guideline by a distance less than the Tracking offset setting, all nodes that are on the guideline will be moved with it

Track global guidelines When enabled and you move a global guideline by a distance less than the Tracking offset setting, all nodes that are on the global guideline will be moved with it. Note: this may affect all glyphs in your font.

Shape Groups and Neighbors

The shape groups layer displays a number of semi-transparent glyphs stacked behind, or above-and-below the outline of the current glyph. The neighbors layer shows glyphs left and right of the current outline. The composition of shape groups and neighbors changes automatically for each glyph that you edit. This composition can be fully customized:



☑ Apply kerning to neighbors

Neighbors filled if outline is filled

If glyph is in Mask mode: show outline

Shape group is filled if outline is filled

If glyph is in Mask mode: show outline

Shape group opacity: 25 %

Shift glyphs in the shape group: 0 x 0 % of UPM

☐ Use glyph metrics

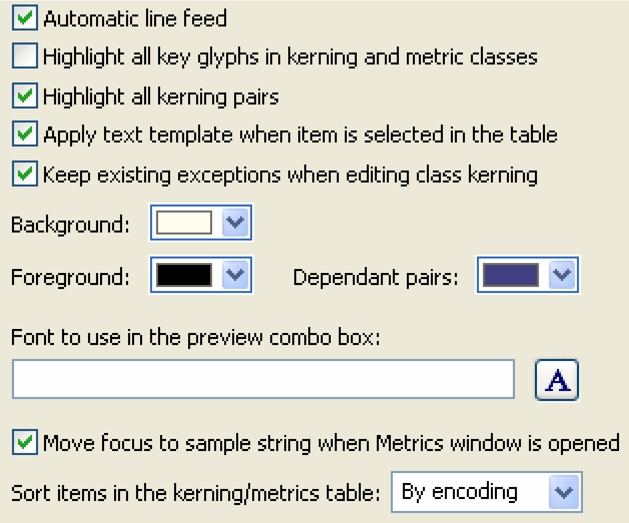
☐ Center glyphs horizonally

☑ Double-click to edit neighbor or shape group glyph

Apply kerning to neighbors	When enabled, the neighbors will be positioned taking kerning pair values into account
Filling neighbors	These settings control when the neighbors should be filled
Mask layer view	These settings control the behavior of neighbors if the user is in the Mask layer
Filling shape groups	These settings control when the shape groups should be filled
Edit Groups button	Click on the button to open the shape groups definition file in a text editor (e.g. Notepad). After you finished editing the shape groups definition file, save it in the text editor, switch back to FontLab Studio and click on **Apply** in the Options dialog box to load the new shape groups
Mask layer view	These settings control the behavior of shape groups if the user is in the Mask layer
Shape group opacity	This controls the opacity (transparency) level of the shape groups
Shift glyphs in the shape group	With the settings 0 x 0, all shapes in the shape group are shown stacked behind the current glyph. Increase the first value to position the shape group on the sides of the current glyph. Increase the second value to position the shape group above and below the current glyph
Use glyph metrics	When activated, the shapes within a shape group will be positioned next to each other using their advance widths
Center glyphs horizontally	When disabled, all shapes in the shape group are aligned by their left sidebearing. When enabled, all shapes in the shape group are centered
Double-click to edit neighbor or shape group glyph	When enabled, you can quickly switch between editing of each glyph in a shape group by double-clicking on the shapes.

Metrics Window

These settings control the behavior of the Metrics window:



☑ Automatic line feed

□ Highlight all key glyphs in kerning and metric classes

☑ Highlight all kerning pairs

☑ Apply text template when item is selected in the table

☑ Keep existing exceptions when editing class kerning

Background:

Foreground: Dependant pairs:

Font to use in the preview combo box:

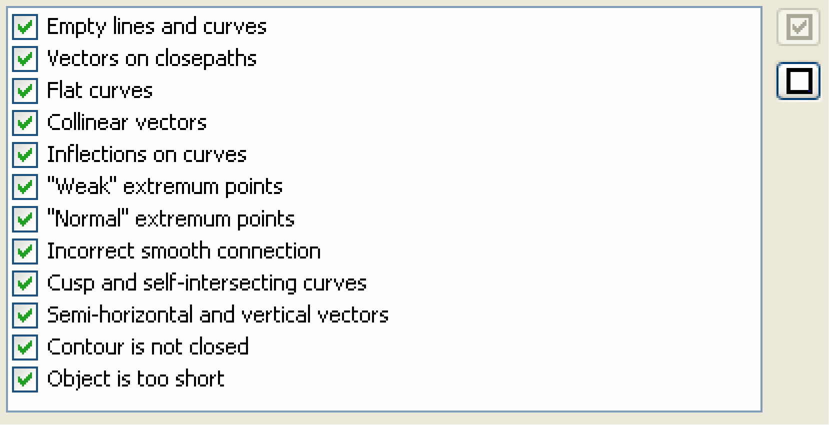
☑ Move focus to sample string when Metrics window is opened

Sort items in the kerning/metrics table: By encoding

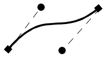
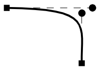
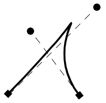
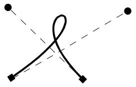
Automatic line feed	When disabled, all glyphs in the Metrics Window are displayed as a long line of text unless a line break is inserted explicitly by the user (\n). When enabled, the Metrics Window has an automatic line feed so glyphs are moved to the next line to fit within the current size of the Metrics Window
Highlight all key glyphs…	When enabled, all glyphs that are defined as key glyphs in the Classes panel are highlighted
Highlight all kerning pairs	When enabled, all glyph combinations that have kerning pairs defined will be highlighted in the Metrics Window using a short horizontal line below the glyphs. When disabled, the line will not be shown
Apply text template…	When the user clicks on a kerning pair on the Metrics Table, FontLab Studio automatically displays a text template that presents the kerning pair in context of other glyphs – if this option is enabled. When disabled, FontLab Studio will not display the additional text
Keep existing exceptions…	If the “Class kerning” setting is active in Metrics Window and this option is disabled, modifying a pair of dependent glyphs that had an exception defined will remove that exception. If enabled, the exceptions will be kept
Background	Changes the background color of the Metrics Window
Foreground	Changes the color of the glyphs displayed in the Metrics Window
Dependant pairs	Changes the color of the glyphs displayed in the Metrics Window that are dependant glyphs in classes
Font to use in the preview combo box	Customize the font to use in the preview combo box
Move focus to sample string when Metrics window is opened	Disable it to preventing the text cursor jump the sample string when Metrics window is opened
Sort items in the kerning/metrics table	Controls the sorting order by which the items in the Metrics Table are displayed.

FontAudit

If you turn the FontAudit layer on in **View > Show Layers**, this built-in glyph checker will on the fly detect potential errors in your glyph geometry and highlight the problems with red arrows. These options control which potential problems FontAudit should check against.

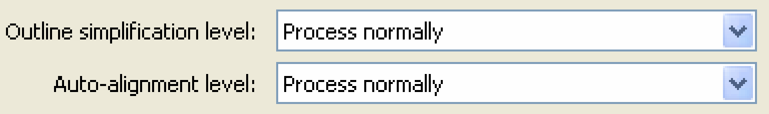


- ☑ Empty lines and curves
- ☑ Vectors on closepaths
- ☑ Flat curves
- ☑ Collinear vectors
- ☑ Inflections on curves
- ☑ "Weak" extremum points
- ☑ "Normal" extremum points
- ☑ Incorrect smooth connection
- ☑ Cusp and self-intersecting curves
- ☑ Semi-horizontal and vertical vectors
- ☑ Contour is not closed
- ☑ Object is too short

Empty lines and curves	Lines or curves that have no length (I.e. two nodes on top of each other.)
Vectors on closepaths	Unnecessary vectors that should be removed. In Type 1 fonts this error can cause problems with rasterization
Flat curves	Curves that can be replaced with a straight vector without loss of quality (I.e. a "curve" that is really a straight line.)
Collinear vectors	Two sequential vectors are collinear; therefore the first vector can be removed (Straight lines with extra nodes in the middle.)
Inflections on curves	Detects curves that have inflections. It is better to replace such curves with a combination of two curves  *Curve with an inflection*
"Weak" extremum points	There are "invisible" extreme points on curves. This error can cause problems with rasterization of the glyph  *Curve with an invisible extreme point*
"Normal" extremum points	Curves need nodes at extreme points
Incorrect smooth connection	A vector and curve or two curves are connected very close to a smooth connection, but not precisely. I.e. what looks like it should be a smooth connection is labeled as a sharp connection.
Cusp and self-intersecting curves	  *Cusp curve* *Self-intersecting curve*
Semi-horizontal and vertical vectors	The direction of the vector is close to vertical or horizontal but is not parallel to one of the axes (i.e. not *exactly* horizontal or vertical)
Contour is not closed	Contour appears to be closed (visually) but is defined as open. Use the **Fix** button on the error reporting dialog box to automatically correct this situation
Object is too short	Curve or line is short enough to be deleted.

Optimize

These settings allow you to fine-tune the parameters of the Optimize command (**Contour > Optimize** or as part of **Tools > Actions**).



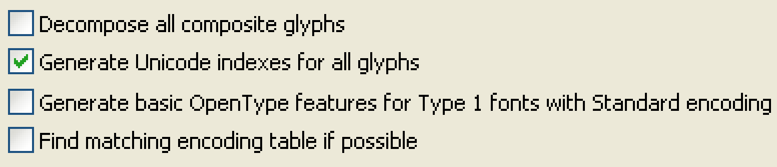
Outline simplification level: Process normally

Auto-alignment level: Process normally

Outline simplification level	The degree to which Optimize will attempt to simplify the outline by removing nodes that are potentially redundant
Auto-alignment level	The degree to which Optimize will attempt to align nodes for segments that are not exactly horizontal or vertical.

Opening Type 1

These settings control what happens when you open a Type 1 font or a Multiple Master font in FontLab Studio.



□ Decompose all composite glyphs

☑ Generate Unicode indexes for all glyphs

□ Generate basic OpenType features for Type 1 fonts with Standard encoding

□ Find matching encoding table if possible

If the option **Decompose all composite glyphs** is on, FontLab Studio will decompose all composite glyphs in the imported font. Composite glyphs have no unique outline themselves, but “borrow” outlines from other font glyphs. Good examples of composite glyphs are accented glyphs, like ‘À’, ‘å’ or ‘ñ’. In each of these the composite character is composed of a character glyph outline and an accent glyph outline from elsewhere in the font. FontLab Studio has all the necessary tools and operations to work with composite glyphs, so it's usually not necessary to decompose them on import. But if you want to significantly modify the glyphs and do not want to worry about composites you can use this option. Of course you can always decompose or recompose the glyphs later using FontLab Studio commands.

The option **Generate Unicode indexes for all glyphs** should be usually on. We strongly recommend keeping it that way if you plan to convert your Type 1 font to TrueType or OpenType format. TrueType and OpenType formats uses Unicode indexes to access characters, so having the indexes set properly is paramount. However, if you do not plan to make a TrueType font you may switch this option off. As in the case of the first option, you can always make Unicode indexes later.

How FontLab Makes Unicode Indexes

FontLab Studio uses a file STANDARD.NAM that is a mappingfile that contains a list of PostScript names and corresponding Unicode indexes.

When you import a Type 1 font and the option Generate Unicode indexes for all characters is on FontLab takes the name of every imported character and looks for it in the names database. If it locates the name there it takes the associated Unicode index and adds it tohte character's list of indexes.

Note 1: The Names' database has more than 4000 records and includes almost all known names for all European, Cyrillic, Arabic and Hebrew languages and for most symbol and dingbats fonts.

Note 2: The names' database is a text file that can be edited. You can add new records to this file at any time. Be very careful when you edit this file because incorrect records may make e xported fonts unusable in some environments.

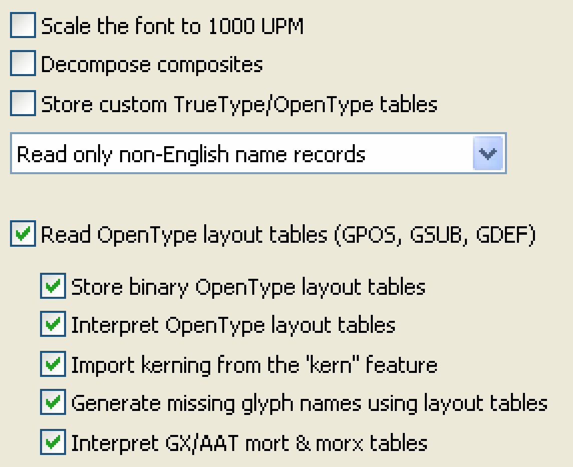
Note 3: It is possible to link more than one Unicode index to a name. If FontLab Studio finds several indexes linked to the name, it will assign all theindexes to the character. (Refer to the Encoding Modes section for a description of the multi-Unicode indexing method.) For glyph names preceded with "!" in the mapping file, FontLab Studio will generate Unicode indexes based on these glyph names but will not generate glyph names for the Unicode indexes if the user chooses Glyph > Glyph Names > Generate Names. In that operation, only glyph names without exclamation marks are considered.

Note 4: The default mapping file can be changed using Options > General Options > Unicode and OpenType > Default Unicode-Name mapping table.

Generate basic OpenType features…	When enabled and the user opens a Type 1 font that is encoded using the Adobe StandardEncoding, FontLab Studio will generate a basic set of pre-defined OpenType Layout features. This can be useful for quick conversions of Type 1 fonts into OpenType, or as a starting point for writing your own OpenType Layout feature definitions
Find matching encoding table if possible	When enabled, FontLab Studio will try to match one of the encodings available from the combo box in the Names mode to the encoding that the font uses. If FontLab Studio cannot match the encoding, the opened Type 1 font will show the encoding "Imported".

Opening OpenType & TrueType

These settings control what happens when you open a TrueType / OpenType TT (.ttf) or an OpenType PS (.otf) font in FontLab Studio.



☐ Scale the font to 1000 UPM

☐ Decompose composites

☐ Store custom TrueType/OpenType tables

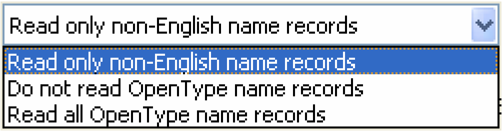
Read only non-English name records

☑ Read OpenType layout tables (GPOS, GSUB, GDEF)

- ☑ Store binary OpenType layout tables
- ☑ Interpret OpenType layout tables
- ☑ Import kerning from the 'kern" feature
- ☑ Generate missing glyph names using layout tables
- ☑ Interpret GX/AAT mort & morx tables

Scale the font to 1000 UPM	Typically TrueType fonts have UPM (Units Per eM – the size of the grid on which all glyph coordinates are defined) equal to 2048. Type 1 fonts have UPM equal to 1000. You can change the UPM value at any time using the FontLab commands, but if you turn this option on, UPM will be converted during the font import
Decompose composites	When enabled, all composite glyphs will be automatically decomposed. Refer to the previous section for more information about automatic decomposition. Note: When FontLab opens TrueType / OpenType TT fonts with rotated or slanted components, it will always decompose them
Store custom TrueType/ OpenType tables	Some TrueType fonts have additional tables that are not a part of the TrueType or OpenType specification, or that FontLab Studio cannot interpret. If you want to read these tables and have them written in an unchanged form into the generated font, enable this option. To view the stored custom tables, go to **Font Info > Binary and custom tables**. This feature is very useful if you are working with additional tools, like Microsoft VOLT or VTT programs. If the “Store custom TrueType/OpenType tables” option is active, FontLab will not change or destroy tables that these tools include in TrueType fonts. Please refer to the “OpenType Fonts” chapter for more discussion on this.

Reading Name Records



Read only non-English name records

Read only non-English name records
Do not read OpenType name records
Read all OpenType name records

All font naming (family and style names, copyright and version strings etc.) in OpenType and TrueType fonts are stored in the “name” table. In most cases, the “name” table contains separate sets of names for the Macintosh and Windows platforms, sometimes also non-English names are stored separately.

When FontLab Studio opens an OpenType or TrueType font, it interprets the “name” table, extracts the most important names and in any case, presents them to the user in a “friendly” manner in the **Names and Copyright** section of the **Font Info** dialog.

However, if several language versions of the same name entry (e.g. style name) are found in the font, FontLab Studio will only present the English names in the Style name field. If different names are stored for the Macintosh and Windows platform, FontLab Studio will pick one of them. In such cases, the user may with to also store and edit the “native” form of the “name” table. The “native” form of the “name” table can be then viewed and edited in **Font Info > Names and Copyright > Additional OpenType names.**

With the setting **Read only non-English name records names (recommended for Western fonts)** the Additional OpenType names page will only contain non-English names while the English names will be presented in the “friendly” manner.

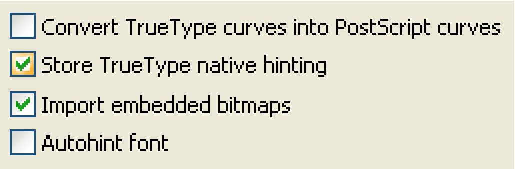
The setting **Do not read OpenType name records** discards all non-English name entries so the Additional OpenType names page will be empty. English names will be presented in the “friendly” manner.

With the setting **Read all OpenType name records (recommended for non-Western or multilingual fonts)** the Additional OpenType names page will contain all names found in the original font’s “name” table. In addition, the English names will be also presented in the “friendly” manner.

Read OpenType layout tables	Please refer to the “OpenType Fonts” chapter for detailed description of this and the subsequent options.

TrueType/OpenType TT

These settings only apply when you open a TrueType / OpenType TT (.ttf) font but not an OpenType PS (.otf) font.



☐ Convert TrueType curves into PostScript curves
☑ Store TrueType native hinting
☑ Import embedded bitmaps
☐ Autohint font

Convert TrueType curves into PostScript curves
In FontLab Studio, you can work with PostScript Bezier curves or TrueType quadratic curves. If you open a TrueType / OpenType TT font and plan to generate the font in the same format, disable this option to keep the original outlines to avoid conversion errors. But if you plan to generate your font as a Type 1 or OpenType PS font, you can enable this option to convert the outlines on import. In any case, you can always convert the outlines in either direction at any time during editing

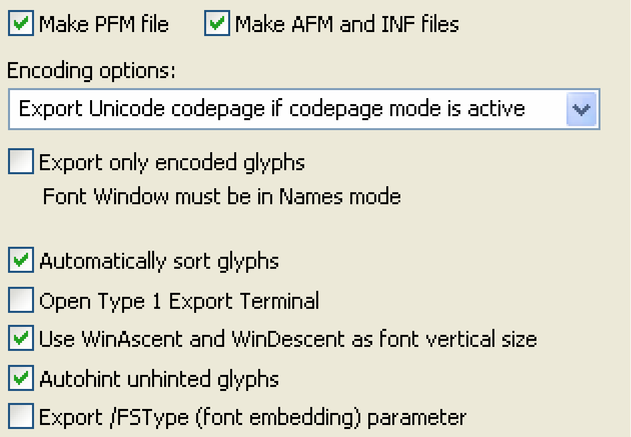
Store TrueType native hinting
Leave this option on if you want to store the original TrueType instructions and outlines. FontLab Studio will keep the stored TrueType data until you change the glyph's outline or hints. If you open a TrueType font to rearrange glyphs or to add some new glyphs we highly recommend storing the original TrueType hinting data

Import embedded bitmaps
If this option is on, FontLab will Studio read all embedded bitmaps defined for the source TrueType font. You can edit them using the TrueType hinting tool and optionally include them in the generated TrueType font. Embedded bitmaps may help to improve font readability at low point sizes and in some cases can be used instead of TrueType hinting

Autohint font
To prepare an imported TrueType font for Type 1 editing and export, you may ask FontLab to automatically make Type 1 hints for all the glyphs. FontLab will use the current Type 1 hinting settings and will make hints for TrueType or Type 1 outlines depending on the conversion setting (Convert TrueType curves into PostScript curves).

Generating Type 1

These settings control some technical parameters of fonts that you generate in the Type 1 or Multiple Master format.



☑ Make PFM file ☑ Make AFM and INF files

Encoding options:

Export Unicode codepage if codepage mode is active

□ Export only encoded glyphs

Font Window must be in Names mode

☑ Automatically sort glyphs

□ Open Type 1 Export Terminal

☑ Use WinAscent and WinDescent as font vertical size

☑ Autohint unhinted glyphs

□ Export /FSType (font embedding) parameter

Make PFM file

Switch this option on to create a PFM (Printer Font Metrics) file when exporting a Type 1 font. PFM files are used in Windows to install Type 1 fonts. They contain metrics, kerning and, partially, font header information. On Windows, you cannot install a Type 1 font without a PFM file. If you have Adobe Type Manager 4.1, it can automatically generate a PFM file based on an AFM and INF file but in general, we recommend leaving this option on at all times

Make AFM and INF files

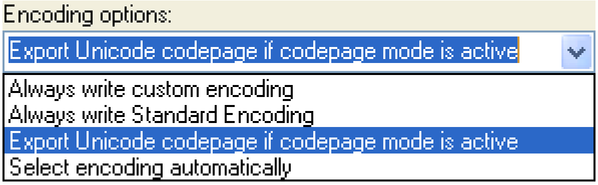
Switch this option on to make AFM (Adobe Font Metrics) and INF (font INFormation) files when exporting a Type 1 font. These files are text files and contain descriptions of the font metrics, kerning and header (font names, weight, width, encoding and other information). It is possible to install a Type 1 font with Adobe Type Manager if you don’t have the PFM file but do have the AFM and INF files, because ATM will automatically build the PFM file using data from the AFM and INF files.

The AFM file is necessary to install a Type 1 font (in ASCII form, with “.pfa” extension) in most Unix-based operating systems.

To install an exported Type 1 font in Windows you must have the PFM or at least AFM+INF files. We recommend making all these files when you finally produce a font so that your font will be compatible with various environments.

Encoding Options

The dialog has a list of possible encoding options when a Type 1 font is generated:



Encoding options:

Export Unicode codepage if codepage mode is active

Always write custom encoding
Always write Standard Encoding
Export Unicode codepage if codepage mode is active
Select encoding automatically

When you generate a Type 1 font, the most important encoding choice is to choose between one of two encoding forms:

- Standard Encoding
- custom encoding

Standard Encoding is a special Type 1 encoding created by Adobe Systems. Instead of enumerating all the code positions in the font, the Standard Encoding font leaves the actual encoding to the system font driver, and on the other hand, the system font driver knows what characters can be expected in the font. StandardEncoding is the recommended choice if your font is a typical Western Roman font. If you generate a Mac Type 1 font (on FontLab Studio for Mac) with Standard Encoding, Mac OS will “know” that the font is a standard Western Roman font and will automatically match the font’s encoding to the system Mac Roman codepage. Similarly, when you generate a Windows Type 1 font with Standard Encoding, Windows will know that the font is a standard Western Roman font and will automatically match the font’s encoding to the system Windows 1252 Western (ANSI) codepage. Also, if the user of such fonts create documents in some applications (e.g. QuarkXPress for Mac and Windows), the applications will automatically re-encode the documents when moving between platforms.

Custom encoding is any Type 1 encoding that is explicitly specified in the font. If the primary character set of your Type 1 is not Western Roman but Central European, Cyrillic, Greek, or Arabic, you need to select the appropriate encoding in the Names mode encoding selector in Font Window, and generate the font with custom encoding.

How Windows ATM Interprets a StandardEncoding

When a Type 1 font has StandardEncoding ATM assumes that this font includes all the glyphs from the first 128-glyph range (digits, alphabet and basic punctuation) and the European glyphs (128 -255 range). The first 128 glyphs are called the “*top zone*”. The 128-255 range is called the “*bottom zone*”. The Adobe StandardEncoding includes very few glyphs from the bottom zone compared to the number of glyphs in the WinANSI (actual Windows encoding) encoding. When a Type 1 font in StandardEncoding is installed with ATM, ATM uses a special encoding instead of the “real” StandardEncoding as it is documented in the Type 1 format specification. This special Windows encoding is called the Default Encoding in FontLab. So if you create a StandardEncoding font and want to see how it will work in Windows, select the Default Encoding in FontLab.

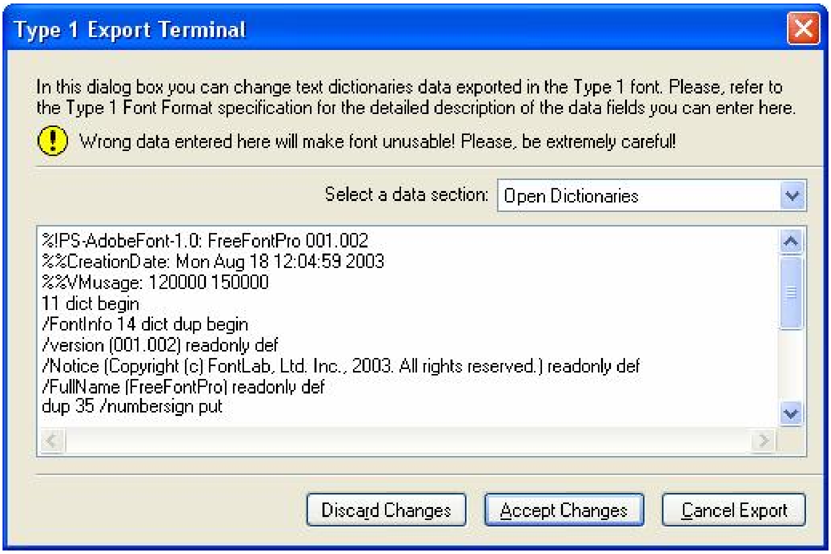
Here is an explanation of the possible encoding export options:

Select encoding automatically	**This is the recommended setting.** Generates the font with Standard Encoding if the Font Window is in Names mode and the encoding selector shows one of the following: “Adobe Standard Encoding”, “Default Encoding”, “MS Windows 1252 Western (ANSI)” or “Mac OS Roman”. Otherwise, a custom encoding will be generated
Always write custom encoding	FontLab Studio will always generate a custom encoding – even for Western Roman fonts – with the encoding currently selected in the Font window Names mode. Note: Western Roman Type 1 fonts generated with custom encoding may not work as expected
Always write Standard Encoding	Always generates the font with the Standard Encoding regardless of what is selected in the Font window Names mode
Export Unicode codepage if codepage mode is active	Exports a custom encoding based on the currently selected codepage if the Font window is in Codepages mode.

We recommend setting the **Select encoding automatically** option as the default, because it covers most exporting situations very well.

Export only encoded glyphs	When enabled, all glyphs that are outside of the encoded “yellow area” will not be included in the generated font. **Tip:** This can be used to quickly generate a series of Type 1 fonts from a large multilingual .vfb file that includes an extensive character set.
Automatically sort glyphs	This option allows FontLab to sort glyphs accordingly to the selected encoding on export. It is recommended to leave this option enabled.

If the **Open Type 1 Export Terminal** option is switched on and you generate a Type 1 or Multiple Master font, the following dialog box appears:



In this dialog box you can change text dictionaries data exported in the Type 1 font. Please, refer to the Type 1 Font Format specification for the detailed description of the data fields you can enter here.

Wrong data entered here will make font unusable! Please, be extremely careful!

Select a data section: Open Dictionaries

```
%!PS-AdobeFont-1.0: FreeFontPro 001.002
%%CreationDate: Mon Aug 18 12:04:59 2003
%%VMusage: 120000 150000
11 dict begin
/FontInfo 14 dict dup begin
/version (001.002) readonly def
/Notice (Copyright (c) FontLab, Ltd. Inc., 2003. All rights reserved.) readonly def
/FullName (FreeFontPro) readonly def
dup 35 /numbersign put
```

As you can see, this dialog box previews and allows you to edit text data contained in the “open” and “private” sections of the exporting Type 1 font file. Use the **Select a data section** control to choose the part of the Type 1 font file that you want to edit and modify the text in the edit field below.

Note that there is no external control of changes you make in the export terminal. Use it only if you really know what you are doing or you may create a font which will not only be unusable, but can even crash your operating system.

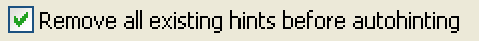
Refer to the Type 1 font format specification

http://partners.adobe.com/asn/developer/pdfs/tn/T1_SPEC.PDF

for information about the contents of the Type 1 font file.

Use WinAscent and WinDescent as font vertical size	When disabled, the Type 1 font will be generated with the vertical metrics information based on **Font Info > Metrics and Dimensions > Key dimensions > Ascender / Descender.** When enabled, the Type 1 font will be generated with the vertical metrics information based on **Font Info > Metrics and Dimensions > TrueType-specific metrics > WinAscent / WinDescent.** This can be used to generate a Type 1 and a TrueType / OpenType TT font that both have identical vertical metrics. Note: We recommend **disabling** this option
Autohint unhinted glyphs	When enabled, all glyphs that include no hints will be autohinted
Export FSType (font embedding) parameter	When enabled, the embedding information (**Font Info > Names and Copyright > Embedding**) will be written in the Type 1 font. Note that this is a custom extension to the Type 1 font format and is not supported by all devices so we recommend keeping this option disabled.

Type 1 Autohinting



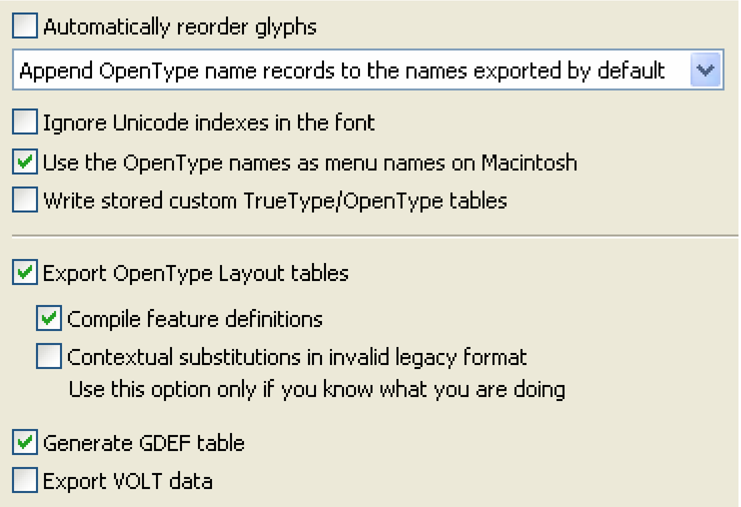
☑ Remove all existing hints before autohinting

When this option is enabled and a glyph is autohinted, existing hints will be removed.

When disabled, the automatically generated hints will be added to the existing hints. Note that this may cause some unwanted interferences.

Generating OpenType & TrueType

These settings control some technical parameters of fonts that you generate in the TrueType / OpenType TT (.ttf) or OpenType PS (.otf) format:



☐ Automatically reorder glyphs

Append OpenType name records to the names exported by default

☐ Ignore Unicode indexes in the font

☑ Use the OpenType names as menu names on Macintosh

☐ Write stored custom TrueType/OpenType tables

☑ Export OpenType Layout tables

☑ Compile feature definitions

☐ Contextual substitutions in invalid legacy format

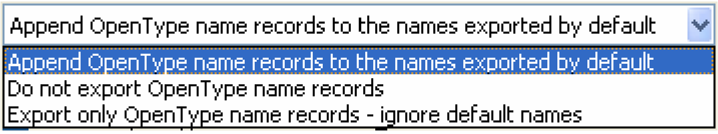
Use this option only if you know what you are doing

☑ Generate GDEF table

☐ Export VOLT data

Automatically reorder glyphs	If this option is enabled, FontLab Studio will try to reorder glyphs to match the Mac cmap encoding table. Technically, this is a requirement of the Apple TrueType specification but it is not required on Mac OS X or Windows.

Writing Name Records



Append OpenType name records to the names exported by default

Append OpenType name records to the names exported by default
Do not export OpenType name records
Export only OpenType name records - ignore default names

All font naming (family and style names, copyright and version strings etc.) in OpenType and TrueType fonts are stored in the “name” table. In most cases, the “name” table contains separate sets of names for the Macintosh and Windows platforms, sometimes also non-English names are stored separately.

In the Font Info dialog, naming entries are stored in the “native” form of the OpenType “name” table (**Font Info > Names and Copyright > Additional OpenType names**) as well as in a “friendly” form (all the other sections of the **Names and Copyright** section of the **Font Info** dialog).

With the setting **Do not export OpenType name records**, the generated font will obtain its naming only from the “friendly” portions of the Font Info dialog, i.e. the Basic set of font names page, the OpenType-specific names page, the Copyright information page etc. The Additional OpenType names page will be ignored.

With the setting **Append OpenType name records to the names exported by default** (recommended), the generated font will obtain its naming from the “friendly” portions but the information from the Additional OpenType names page will be appended.

With the setting **Export only OpenType name records - ignore default names**, only the “native” naming defined on the **Additional OpenType names** page will be written into the font and the “friendly” information will be ignored. This is a setting suitable for complicated multilingual, esp. Asian fonts.

Encoding Options

Ignore Unicode indexes in the font	When disabled (recommended), the font will be generated in Unicode mode. The Unicode indexes assigned to the glyphs will be used as base for the encoding. When enabled, the encoding selected in the Names mode will be used as source of the encoding of the generated font instead of the Unicode indexes assigned to glyphs.

There are two possible methods of making TrueType Unicode mapping tables. *Unicode* mode (This works when **Ignore Unicode indexes in the font** is disabled) and *Names* mode (when the option is enabled).

The Unicode mode is preferred and recommended. In Unicode mode FontLab uses the Unicode indexes that you assigned to the glyphs while moving glyphs in the Unicode mode of the Font window or by entering Unicode indexes in the **Rename Glyph** dialog box. In the Names mode FontLab will encode all glyphs in the encoding currently selected in the Font window ("yellow" glyphs) and put them in the first 256 range of the TrueType Unicode table. FontLab will put all other glyphs into the unencoded zone of the Unicode table (starting from the code E000h).

The Unicode TrueType exporting mode is usually used to export fonts that were imported from TrueType font files and already have Unicode information. The Names mode is useful when you convert a Type 1 font to the TrueType format and do not want to worry about assigning Unicode indexes.

The general rule is simple: if you work with the Font window in Names mode use the Names TrueType exporting mode. If you work in Unicode mode use the Unicode exporting mode. Actually, FontLab will show a warning message if you try to export a font in Unicode mode while you are in the Names mode of the Font window and vice versa.

What is the "First 256 Glyphs Range"?

When we talk about the "first 256 glyphs" we do not mean those with Unicode indexes in the 0000h - 00FFh range. We mean those that Windows will see as having codes 00h -FFh when the default Windows codepage is selected. In most cases the default codepage is the 1252 Latin 1 codepage.

So even if you export a TrueType font in the Names mode the Unicode indexes for the encoded glyph will be selected from the Windows 1252 codepage.

We recommend opening a Windows TrueType font, switching to the Codepages mode of the Font window and selecting codepage 1252 to better understand what the "standard" Windows glyphs are.

Windows Symbol Encoding

If you want to have full control over glyph codes and you want to occupy all 256 glyph cells of the first-byte range, you should create your font using the Windows Symbol codepage. The Symbol codepage begins from Unicode index F000h and continues to F0FFh. All glyphs in this range are mapped to the 0000h-000FFh range. So the glyph with code F041h will be seen in Wi ndows as 'A' and so on.

To make a font using the Symbol codepage you have two options:

1. Switch the Font window to the Codepages mode; select the Windows Symbol codepage; and place all glyphs in the codepage. Export the font in TrueType format in Unicode mode.
2. Switch the Font window to the Names mode; select any encoding vector; place glyphs as you want in the "yellow" area; and export the font in Names mode (**Use Unicode indexes as the base for TrueType encoding** should be off).

In either case select **Symbol Microsoft Glyph Set** in the Codepages page of the **Font Info** dialog box. Without this the font will not be exported as Symbol and you will not have access to the glyphs at all.

The Problem of Glyph 183, "middledot"

The glyph cell with decimal code 183 has different behaviors in Windows 95 and Windows NT. In Windows 95 it is mapped to the Unicode index 22C5h, but in Windows NT it is mapped to 00B7h. So, when FontLab exports your font in the Names mode, it automatically assigns both Unicode indexes to this glyph to make the font compatible with both operating sy stems.

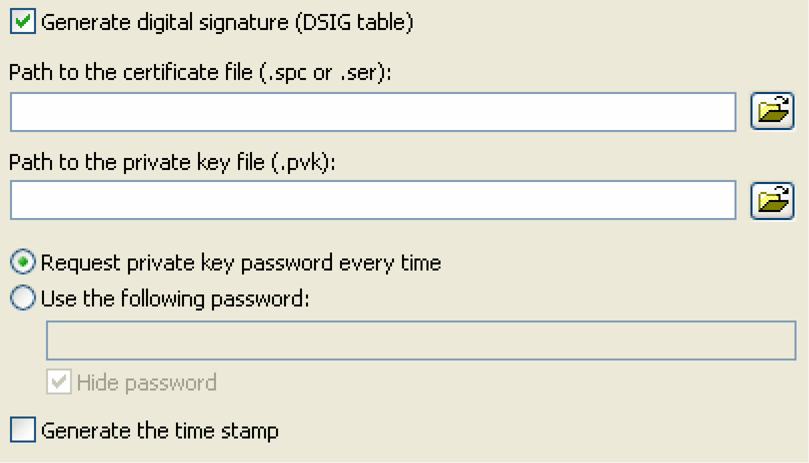
Use the OpenType names as menu names on Macintosh	When enabled (recommended), the family name and style name for the Macintosh platform will be taken from the **OpenType-specific font names page** rather than the Basic set of font names page. With this setting, Mac OS applications may group all font styles into one large font family. When disabled, the naming defined on the **Basic set of font names** page will be used as naming records for both Macintosh and Windows
Write stored custom TrueType/OpenType tables	When enabled, stored custom TrueType/OpenType tables will be written into the generated font. To view the stored custom tables, go to **Font Info > Binary and custom tables**
Export OpenType layout tables	Please refer to the "OpenType Fonts" chapter for a discussion of these settings.

Digital Signature

This section controls settings for digital signatures that can be included in the OpenType (TT or PS) fonts that you generate. Please refer to

http://www.microsoft.com/typography/developers/dsig/default.aspx

for more information about digital signatures.



☑ Generate digital signature (DSIG table)

Path to the certificate file (.spc or .ser):

Path to the private key file (.pvk):

● Request private key password every time

○ Use the following password:

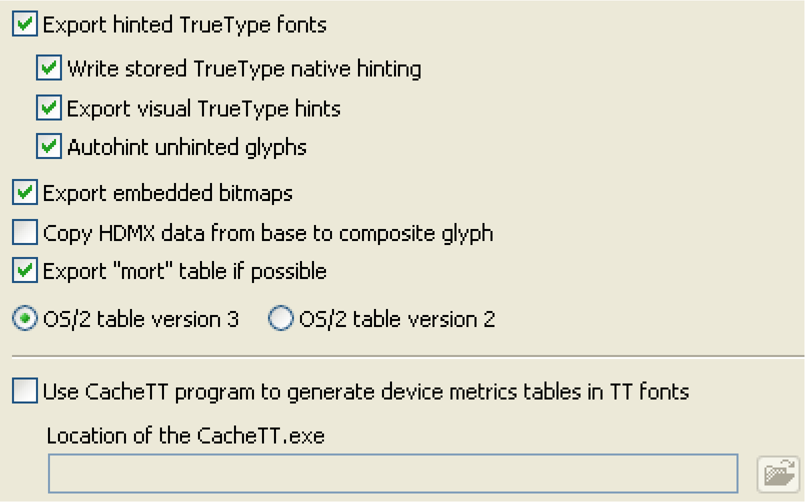
☑ Hide password

□ Generate the time stamp

Generate digital signature	When enabled, a DSIG table will be generated that includes an digital signature. Note that you need to own a valid Authenticode code signing digital certification to be able to digitally sign fonts. You should point FontLab Studio to your certificate file and private key file that you will receive from your certification authority. It is a good idea to store the private key file in a safe location, e.g. on a floppy disk or USB key, although you can use any location. Please refer to the link above for more information
Request private key password every time	When selected, FontLab Studio will ask you for the password for your private key every time you generate a font
Use the following password	When selected, FontLab Studio will remember the password for your private key
Generate the time stamp	When selected, a time stamp will be generated. Please refer to the link above for more information.

TrueType/OpenType TT (.ttf)

These settings only apply to fonts that you generate in the TrueType / OpenType TT (.ttf) format:



☑ Export hinted TrueType fonts

☑ Write stored TrueType native hinting

☑ Export visual TrueType hints

☑ Autohint unhinted glyphs

☑ Export embedded bitmaps

□ Copy HDMX data from base to composite glyph

☑ Export "mort" table if possible

● OS/2 table version 3 ○ OS/2 table version 2

□ Use CacheTT program to generate device metrics tables in TT fonts

Location of the CacheTT.exe

Export hinted TrueType fonts	FontLab will export TrueType instructions of any type (original, manually edited or automatically generated) only if this option is on. To create a completely unhinted TrueType font switch off this option (may be useful for pixel fonts)
Write stored TrueType native hinting	If this option is on and the original TrueType instructions were stored when the font was opened, then FontLab will try to restore the original instructions where possible. If you want to discard all the original TrueType instructions, switch this option off
Export visual TrueType hints	FontLab Studio will compile the visual TrueType instructions only if this option is on
Autohint unhinted glyphs	If this option is on, FontLab will try to automatically generate TrueType instructions for all unhinted glyphs.

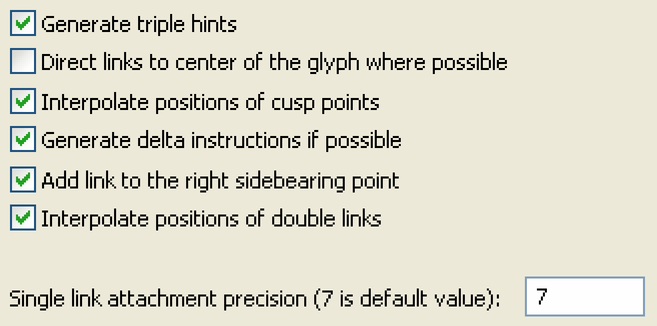
How FontLab Autohints TrueType Fonts on Export

When autohinting is allowed and FontLab finds a glyph that has no TrueType hints of any kind (original hints imported from the TrueType font file or manually edited visual hints) it begins to make TrueType hints automatically. If this glyph has Type 1 hinting information, then FontLab converts this information to visual TrueType instructions and converts the instructions to the TrueType hinting code. If Type 1 hints are not present then FontLab automatically generates Type 1 hints as the first step, then converts the Type 1 hints into TrueType visual instructions and converts the visual instructions into TrueType native instructions.

Export embedded bitmaps	If this option is on, FontLab Studio will export embedded bitmaps if they are present. If you don't want to save bitmaps in the font, switch this option off
Copy HDMX data from base to composite glyph	If this option is active, FontLab Studio will copy HDMX data (device and point-size specific font metrics) from the base component of the composite glyph to the composite glyph if their metrics are the same
Export "mort" table if possible	FontLab Studio will attempt to generate the AAT "mort" table and include it in the generated font
OS/2 table	Allows you to select the version of the "OS/2" table in the generated font. Select table version 2 for maximum compatibility of your font with older systems
Use CacheTT program to generate device metrics tables	Please refer to section about Device-Dependent Metrics of the "Font Header" chapter for information.

TrueType Autohinting

This section controls the way FontLab Studio performs TrueType autohinting.



☑ Generate triple hints

□ Direct links to center of the glyph where possible

☑ Interpolate positions of cusp points

☑ Generate delta instructions if possible

☑ Add link to the right sidebearing point

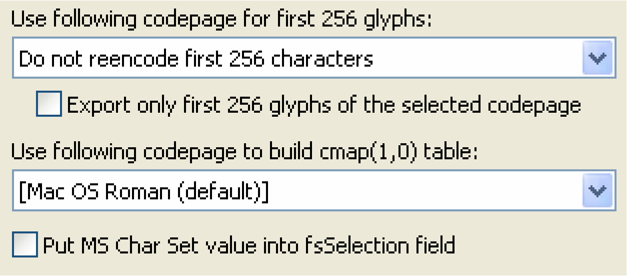
☑ Interpolate positions of double links

Single link attachment precision (7 is default value): 7

Please refer to the "Autohinting Options" section of the "Hinting" chapter for detailed description of these options.

OpenType TT Encoding

These settings control some advanced re-encoding features for fonts that you generate in the TrueType / OpenType TT (.ttf) format. These settings do not apply to OpenType PS fonts.



Use following codepage for first 256 glyphs:

Do not reencode first 256 characters

□ Export only first 256 glyphs of the selected codepage

Use following codepage to build cmap(1,0) table:

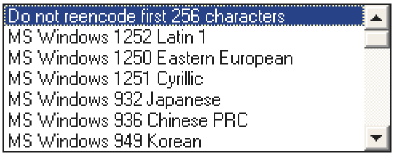
[Mac OS Roman (default)]

□ Put MS Char Set value into fsSelection field

Use following codepage for first 256 glyphs

FontLab can optionally reencode the first 256 glyphs of the font, letting you create a “single-codepage” font for some codepages. This is very similar to using the **Glyph** > **Glyph Names** > **Reencode glyphs** command before export.

The list located below this label contains several choices:



Do not reencode first 256 characters
MS Windows 1252 Latin 1
MS Windows 1250 Eastern European
MS Windows 1251 Cyrillic
MS Windows 932 Japanese
MS Windows 936 Chinese PRC
MS Windows 949 Korean

The first option, “Do not reencode the first 256 characters” means that reencoding is off. All other options in the list let you select a remapping table to perform reencoding

Export only first 256 glyphs

This option is enabled only if you choose one of the remapping codepages in the list above.

When this option is on FontLab will export only glyphs whose codes are in the 0-255 range

Use following codepage to build cmap table

This is a “hack” used in older operating systems (Windows 95/98) to improve handling of single-codepage non-Latin fonts. It is not required and **not recommended**, but if you find that you need to use this hack to get your font to work in an old OS, just switch on this option and re-export the font

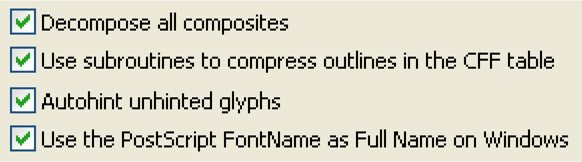
Put MS Char Set value into fsSelection field

Encoding information is stored in TrueType and OpenType fonts in a “cmap” table. Every Windows TrueType font contains at least two of these tables. One is the Unicode table and it “assigns” Unicode information to Glyphs. The other is a single-byte table that is used by older versions of the Mac OS and by some non-Unicode-compatible Windows programs.

Use the control to select the codepage that will be used to build this table. There are two special options: Mac OS Roman (which is the codepage used on the Mac and the default choice) or Current codepage in the Font Window, which means that FontLab will use the encoding (yellow zone) currently selected in the Font window.

OpenType PS (.otf)

These settings only apply to fonts that you generate in the OpenType PS (.otf) format.



☑ Decompose all composites

☑ Use subroutines to compress outlines in the CFF table

☑ Autohint unhinted glyphs

☑ Use the PostScript FontName as Full Name on Windows

Decompose all composites

When enabled, all composite glyphs in the font will be decomposed. Recommended for maximum compatibility.

When disabled, the composite glyphs will be exported as such

Use subroutines to compress outlines in the CFF table

Allow to automatically generate outline subroutines if font is generated as CFF-flavored. Outline subroutines store repetitive parts of outlines and allow to reuse with references from outline definition code

Autohint unhinted glyphs

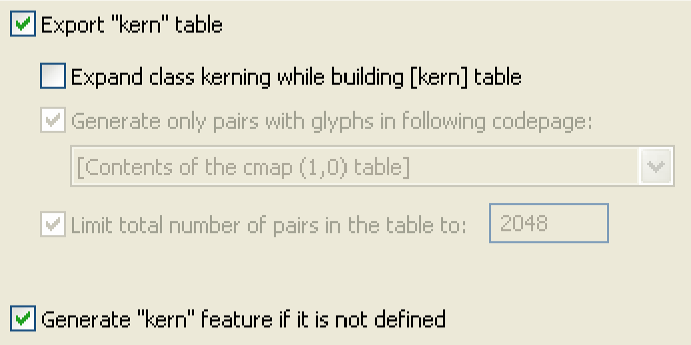
When enabled, all glyphs that contain no hints will be autohinted

Use the PostScript FontName as Full Name on Windows

When enabled, the PostScript Font Name record will be copied to the Full Name record for the Windows platform. It is recommended to keep it enabled on all the time as this is a requirement of the OpenType specification.

Kerning

These settings control what types of kerning are written into TrueType / OpenType TT (.ttf) and OpenType PS (.otf) fonts:



☑ Export "kern" table

□ Expand class kerning while building [kern] table

☑ Generate only pairs with glyphs in following codepage:

[Contents of the cmap (1,0) table]

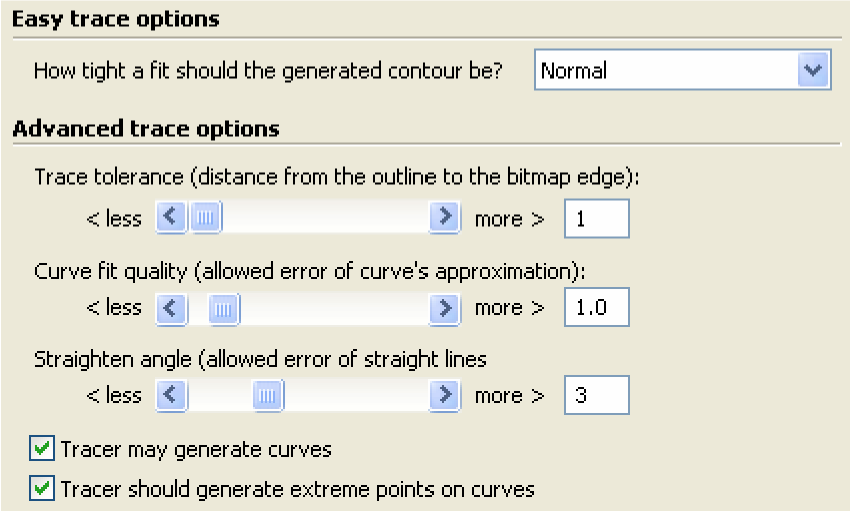
☑ Limit total number of pairs in the table to: 2048

☑ Generate "kern" feature if it is not defined

Export "kern" table	When enabled, a plain "kern" table will be included in the font with the kerning information from the Metrics Window. When disabled, the "kern" table will not be included. It is highly recommend to enable this option for TrueType / OpenType TT fonts. For OpenType PS fonts, the OpenType specification does not envision the "kern" table to be part of OpenType PS fonts but it is possible to include the table nonetheless. Mac OS X and Adobe applications will read and use this table. If the plain "kern" table is not included in the OpenType TT font and the font is used in a non-OpenType-savvy application, no kerning will be available. If the plain "kern" table is not included in the OpenType PS font and the font is used in a non-OpenType-savvy application, the Adobe font driver will automatically build a kern table on the fly by using the Western subset of the OpenType GPOS "kern" feature kerning
Expand class kerning	When enabled, the plain "kern" table kerning will include plain kerning generated from the kerning information available in the Metrics window combined with the class information from the Classes panel. This may result in a very large number of kerning pairs

Generate only pairs with glyphs in following codepage	With this setting, you can subset the expanded kerning. Only kerning pairs for glyphs included in the specified codepage will be included in the expanded plain “kern” kerning
Limit total number of pairs in the table	With this setting, you can limit the number of kerning pairs included in the expanded plain “kern” kerning table to a certain number. The kerning pairs with lesser absolute value will be removed until the overall number of kerning pairs is not larger than the limit specified here
Generate "kern" feature if it is not defined	FontLab Studio checks if a “kern” OpenType feature is specified in the OpenType panel. If found, the “kern” feature will be included as GPOS OpenType kerning. This option controls what happens if the “kern” feature is not defined in the OpenType panel. With this option enabled, FontLab Studio will automatically generate the “kern” OpenType feature based on the kerning specified in the Metrics Window and the class information specified in the Classes panel. With this option disabled, no “kern” feature will be written into the font if the feature is not specified in the OpenType panel.

Trace Options



Easy trace options

How tight a fit should the generated contour be? Normal

Advanced trace options

Trace tolerance (distance from the outline to the bitmap edge):

< less   more > 1

Curve fit quality (allowed error of curve's approximation):

< less   more > 1.0

Straighten angle (allowed error of straight lines

< less   more > 3

☑ Tracer may generate curves

☑ Tracer should generate extreme points on curves

How tight a fit should the contour be?	This setting includes some presets for the advanced trace options
Trace tolerance	Allows you to change the distance between the generated outline and the edge of the original bitmap
Curve fit quality	Allows you to change the accuracy of curve fitting in the generated outline
Straighten angle	Defines the angle between two lines less than which the autotracer will replace several lines with one line
Tracer may generate curves	This option (active by default) allows the autotracer to generate curves
Tracer should generate extreme points on curves	This option (active by default) forces the autotracer to insert nodes at the extreme points of curves.

Editing Fonts

In this chapter we will discuss the editing of fonts. A font is a collection of glyphs with similar design and some encoding and header information. The information includes font identification names, copyright data, character encoding information and other data that is necessary for font usage. Generating fonts is not discussed in this chapter. Refer to the "Generating Fonts" chapter for this information.

2

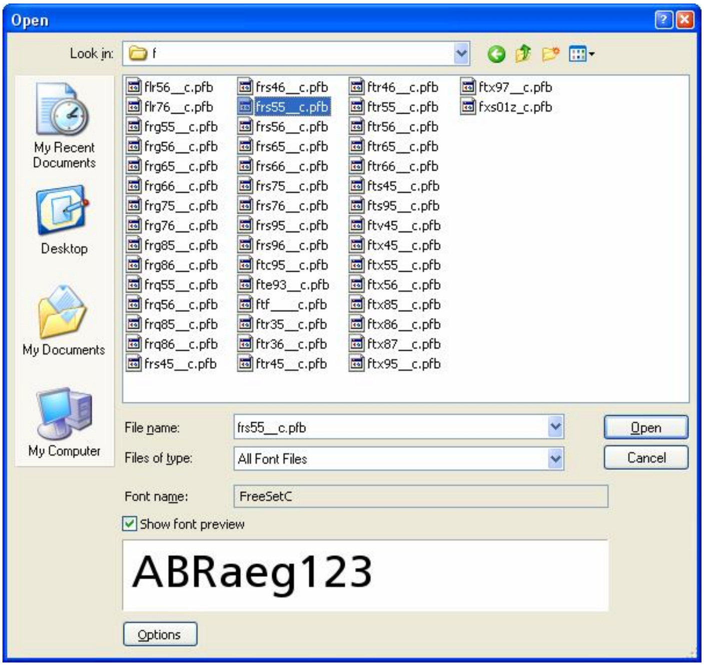
Opening Fonts

With FontLab Studio you can create new fonts or open existing fonts for modification. When you open an existing font, however, please be sure that modifying it does not violate copyright laws: some fonts are copyrighted as software so it is not legal to change them in any font editor. Carefully read the license agreement that comes with every font.

You can find two (one serif and one sans-serif) royalty-free, non-copyrighted fonts that you can use as a basis for your own fonts or characters in the Sample folder or on our website (http://www.fontlab.com/).

To open a font for editing, select the **File > Open** command, or click the 📂 button on the toolbar.

You will see the **Open File** dialog box in which you can select a font file to open. In this dialog box, you will see all the fonts that can be opened: TrueType/OpenType TT (.ttf), Windows Type 1 and Windows Multiple Master (.pfb), Unix/ASCII Type 1 (.pfa), OpenType PS (.otf), Ikarus files (.ik), FontLab 2.5 font files (.vfa), FontLab 3.x/4.x/Studio 5 font files (.vfb), as well as FontLab Studio Project files (.flw).



Look in: f

File name: frs55__c.pfb

Files of type: All Font Files

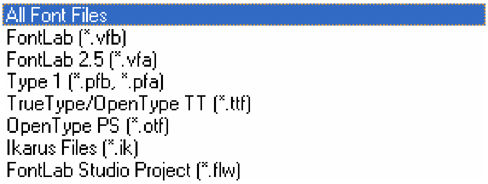
Font name: FreeSetC

☑ Show font preview

ABRaeg123

If you want to quickly open a font from the list of the most recently opened fonts, select that font in the **File name** combo box.

If you want to list only fonts in a particular format, select that format in the **Files of type** combo box:



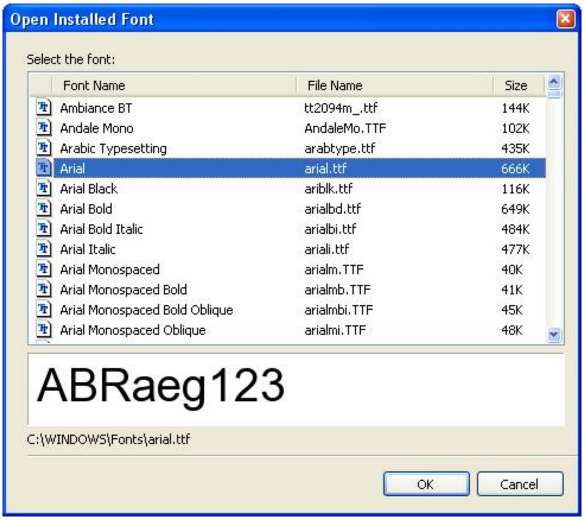
All Font Files
FontLab (*.vfb)
FontLab 2.5 (*.vfa)
Type 1 (*.pfb, *.pfa)
TrueType/OpenType TT (*.ttf)
OpenType PS (*.otf)
Ikarus Files (*.ik)
FontLab Studio Project (*.flw)

When you select a font file in the files area, you will see the font name and preview below. Switch off the **Show Font Preview** option to not see the font preview.

You can open many fonts with a single operation: just select all of them in the list with a selection rectangle or using CTRL-click.

You can set the opening options here by clicking on the **Options** button. Please refer to the "FontLab Studio Options" section for a detailed discussion of the opening options.

You cannot use **File > Open** to open fonts located in the system font folder (typically C:Windows\Fonts). To open any of these fonts, use **File > Open Installed**. This will show a dialog box that displays all fonts installed on your system – choose one and click on **OK** to open the font.

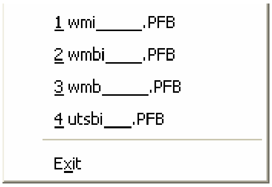


Font Name	File Name	Size
Ambiance BT	tt2094m_.ttf	144K
Andale Mono	AndaleMo.TTF	102K
Arabic Typesetting	arabtype.ttf	435K
Arial	arial.ttf	666K
Arial Black	ariblk.ttf	116K
Arial Bold	arialbd.ttf	649K
Arial Bold Italic	arialbi.ttf	484K
Arial Italic	ariali.ttf	477K
Arial Monospaced	arialm.TTF	40K
Arial Monospaced Bold	arialmb.TTF	41K
Arial Monospaced Bold Oblique	arialmbi.TTF	45K
Arial Monospaced Oblique	arialmi.TTF	48K

C:\WINDOWS\Fonts\arial.ttf

Most Recently Used Fonts

All fonts that you recently opened in FontLab Studio are added to the list of the most recently used font. This list is used in the **File Open** dialog and also at the bottom of the **File** menu:

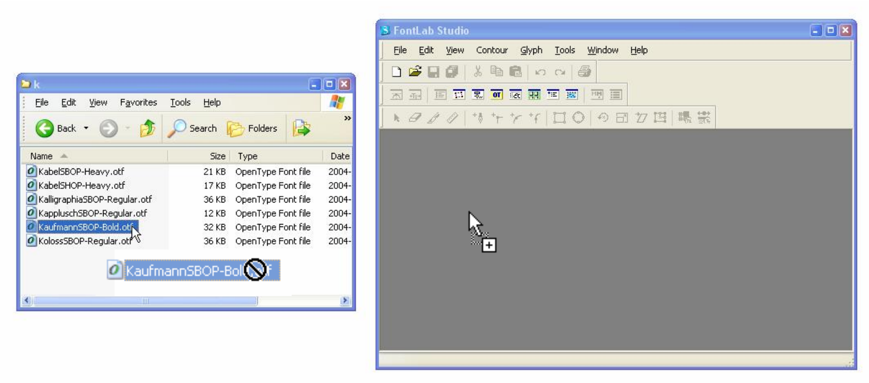


1 wmi_____.PFB
2 wmbi____.PFB
3 wmb_____.PFB
4 utsbi___.PFB
Exit

Next time you want them, just select the font file in the **File** menu and FontLab Studio will open them.

Opening Fonts with Drag-Drop

An easy way to open fonts in FontLab Studio is to drag-drop font files from Windows Explorer onto the FontLab Studio application window:



Name	Size	Type	Date
KabelSBOP-Heavy.otf	21 KB	OpenType Font file	2004-
KabelSHOP-Heavy.otf	17 KB	OpenType Font file	2004-
KalligraphiaSBOP-Regular.otf	36 KB	OpenType Font file	2004-
KappluschSBOP-Regular.otf	12 KB	OpenType Font file	2004-
KaufmannSBOP-Bold.otf	32 KB	OpenType Font file	2004-
KolossSBOP-Regular.otf	36 KB	OpenType Font file	2004-

k
File Edit View Favorites Tools Help
Back
Search
Folders
KaufmannSBOP-Bol f
FontLab Studio
File Edit View Contour Glyph Tools Window Help

Font Formats

The **.vfb file format** used in FontLab Studio 5 is fully **backwards-compatible**, so FontLab Studio 5 can open any .vfb file created in FontLab 3.x and 4.x. The format is also **cross-platform**-compatible so .vfb files saved from the Windows version can be opened in the Mac version and vice versa. In addition, the format is largely **upward-compatible**. This means that a .vfb file saved from FontLab Studio 5 can be opened in FontLab 3.x or 4.x, as well as other Fontlab Ltd. products such as TransType or TypeTool. Only those elements of the format that were supported by the old version will be retained and some information may change slightly. However, the most important elements of the font such as key Font Info entries, glyph outlines and kerning pairs will be retained.

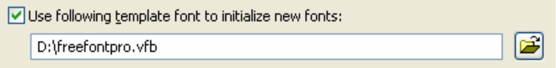
For example, .vfb files saved from FontLab Studio 5 for Windows can be opened in FontLab 4.6 for Macintosh and vice versa, with as much as possible information retained.

FontLab Studio 5 also opens .vfa files saved from FontLab 2.5 (but not 2.0). If you have fonts saved in a proprietary format of another application and would like to open these fonts in FontLab Studio, the best way is usually to create a Windows-compatible Type 1 font from your other application and open the Type 1 font in FontLab Studio. If you wish to move your .fog files created in Fontographer 3.5 or 4.1 to FontLab Studio, you can use our FogLamp product that converts Fontographer .fog files into FontLab Studio-compatible .vfb files, retaining not only outline information but also mask layers, guidelines, background bitmaps etc.

Creating a New Font

If you want to create a new font from scratch, you select the **New** command from the **File** menu. FontLab Studio will create an empty font that will not have any characters and will open an empty Font Window.

You can use an existing .vfb file as a new font template for all new fonts that are created. You can do this in **Tools > Options > Font Window >Templates:**



☑ Use following template font to initialize new fonts:

D:\freefontpro.vfb

Enable the option and select the .vfb file to use as the new font template by pressing the 📂 button. Whenever you create a new font, the selected new font template will open. Remember that after the new font template opens, you should choose **File > Save As** and save the file under a different name.

When you have created a new font, it is a good idea to first go to **File > Font Info > Names and Copyright**, fill in the Family Name and the Style Name (even if they are temporary). Then press **Build Names** (you can fill in the remaining Font Info entries later). Then click on **OK**, choose **File > Save As** and save the new font in the .vfb format under a new filename in a folder of your choice.

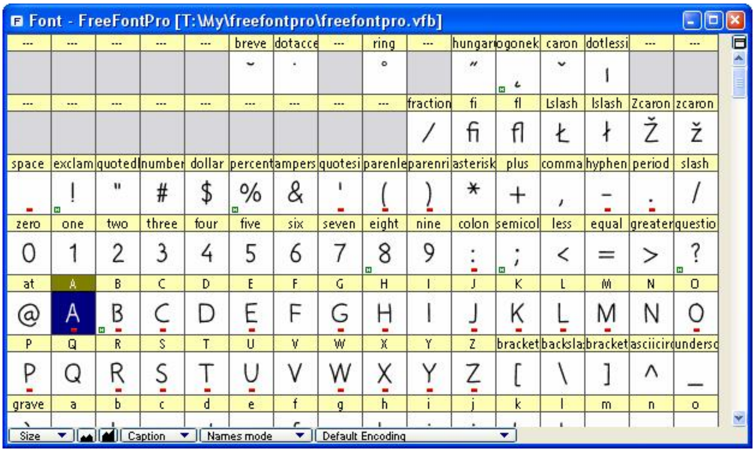
Now you can start to create your glyphs (in the Font Window), design them (in the Glyph Window), letterspace them (in the Metrics Window). Also, you should fill in the important Font Info fields (see the "Font Header" chapter for details). When this is done, you can generate your font in the font format of your choice, e.g. OpenType PS (.otf), install it on your system and test it.

The Font Window

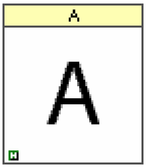
The Font Window is used to display an entire font. It opens automatically when you open an existing font for editing or choose to create a new font.

In FontLab Studio you can open many fonts at once and every font will have its own Font Window. The Font Window is a representation of the font, so when you close this window the font will also close.

You can do a lot of things using the Font Window — from browsing a font for a desired character to rearranging and remapping the font to editing the Font info fields. The following sections of this chapter will tell you how to use this window.


Font - FreeFontPro [T:\My\freefontpro\freefontpro.vfb]
--- --- --- --- --- breve dotacce --- ring --- hungar ogonek caron dotlessi --- ---
--- --- --- --- --- --- --- --- --- fraction fi fl Lslash lslash Zcaron zcaron
space exclam quoted number dollar percent ampers quotesi parenle parenri asterisk plus comma hyphen period slash
zero one two three four five six seven eight nine colon semicol less equal greater questio
at 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 bracket backsla bracket asciicir undersc
grave a b c d e f g h i j k l m n o
Size
Caption
Names mode
Default Encoding

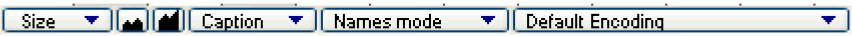
The Font Window consists of the *command bar* at the bottom, and a glyph *table,* where a single cell represents each glyph:

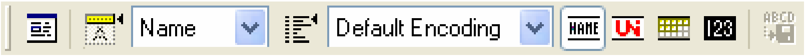


Each cell has a *caption* at the top that shows some identification information – it may be the name of the glyph, its code in various forms or some other character information.

✎ **Tip:** You can change the font size used to display the caption in **Tools > Options > Font Window > Glyph Cell.**

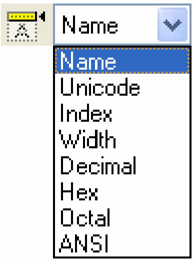
The Font Window command bar has two alternate forms – it can be placed either at the top or at the bottom of the Font Window.





You can switch between the top and the bottom location of the command bar by clicking on this button ▣ in the top-right corner of the Font Window.

The **left combo box** located on the Font Window command bar (if in top position) or the Caption popup menu (in the bottom position) lets you **select one of the caption modes**:



Depending on the selection, a different text string will appear in the caption:

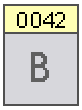
Name	The glyphname (the so-called PostScript name of the glyph)
Unicode	The Unicode codepoint assigned to the glyph, in hexadecimal form
Index	The glyph index, i.e. the physical location of the glyph in the font
Width	The glyph's advance width
Left SB	The glyph's left sidebearing
Right SB	The glyph's right sidebearing
Decimal	The local character code in decimal form
Hex	The local character code in hexadecimal form
Octal	The local character code in octal form

ANSI	The ANSI character that corresponds to the local character code
Macro	A custom entry that can be shown using a special Python macro (defined in the init.py file inside of the Macros/System folder). By default, the entry option shows the number of components in composite characters but the user can write his own macro to display other information here.

The glyph cells may have different colors. By default, the background of the glyph cell may be grey or white, and the caption may be white, red or yellow. Additional colors may appear if the user used the Mark command to color-mark the glyph cells.

A **grey cell background** means an **empty glyph**. This means that the glyph does not exist in the font and that the glyph cell is displaying a glyph placeholder. The placeholder usually consists of a glyph template image.

FontLab Studio 5 ships with a very extensive set of pre-installed default glyph template images. These are based on the Andale Mono WTG font (courtesy of Monotype Imaging, http://www.monotypeimaging.com/) and cover the entire Unicode 3.2 character set. Note that the default glyph template images are low-resolution, monospaced and in a "sanserif" style. They should not be used as direct source of information about the typographically correct shape of glyphs – but only as an orientation.



You can select another set of glyph template images in **Tools > Options > Font Window > Templates** page – refer to the “FontLab Studio Options” section for details.

A **white cell background** means that a glyph exists in the font.

If the glyph cell background is white and there is **no image** in it, we speak of a **blank glyph**. A blank glyph means that the glyph exists in the font but does not contain any outlines or components. If the white cell includes a **pale grey image**, it means that the glyph there is a bitmap background in the glyph but no outline or components.

If the cell includes a **black image**, it means that the glyph exists and is non-blank, i.e. it contains an outline or a component.

A yellow caption of a glyph cell means that the glyph is part of the currently selected encoding, codepage or Unicode range, or, as we say, is “in the yellow zone” (see next section). Glyphs that are not part of the current encoding have a **grey caption**.

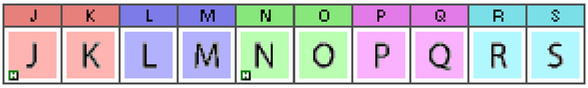
A strong red caption with yellow text of a cell means that the character has some naming conflict: one name is used for different glyphs or the glyph’s Unicode codepoint does not correspond to its name. You should usually correct either the glyph name or the Unicode codepoint for glyphs with red captions.

The small marks that appear in the glyph cell mean:

Left-Top	**Blue** mark	Glyph has more than one Unicode codepoint assigned
Right-Top	**Yellow-red** or **yellow-green** mark	Glyph has compatible mask layer
Left-bottom	**Green** or **red** ‘H’ mark	Glyph has hint replacement program or overlapping Type 1 hints. A Green mark means that the program is correct. The **red “H” mark** means that you should correct the hint replacement program.
Right-bottom	**Brown** or **blue** ‘T’ mark	Glyph has TrueType hints, either original (blue mark) or manually set visual (brown mark)
Middle-bottom	**Red** rectangular mark	Glyph is a key glyph in the kerning class

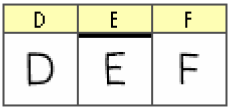
The meaning of all the small marks will be discussed in full detail later.

Some characters may be *marked* with a different color for the caption and background:



Marking is very useful when you need to show visible differences among characters for easy identification. Read more about that later in the "Marking Glyphs" section.

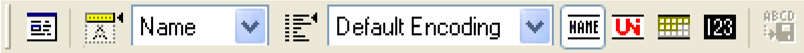
When you modify a glyph in any way, a black bar below their caption appears. The black bar indicates glyphs modified since the last save. When you save a font, all black bars disappear.



The "E" glyph has been modified.

Font Window Command Bar

On the Font Window command bar in the **top position** you see one button on the left and five buttons in the right area:



You can switch between the top and the bottom location of the command bar by clicking on this button ▭ in the top-right corner of the Font Window.

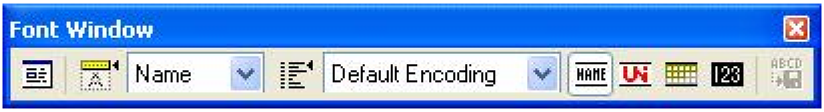
The left button ▤ opens the **Font Info** dialog box for the current font. This is the same as choosing the **Font Info** command in the **File** menu.

The first four buttons on the right allow you to select one of the encoding modes:

NAME	Switch to the Names mode
UNI UNICODE	Switch to the Unicode Ranges mode
▦	Switch to the Codepages mode
123	Switch to the Glyph Index mode

The last button ABCD in the Font Window command bar is used **to save current encoding** to the .enc file. This command can be reached via **Glyph > Glyph Names > Save Encoding**.

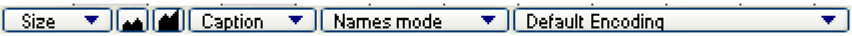
The Font Window command bar is not fixed to the top edge of the window. You may drag it to any place on the screen or “dock” it to the bottom of the window:



You may also close it at all to get more space for characters on your screen.

You can switch between the top and the bottom location of the command bar by clicking on this button ▭ in the top-right corner of the Font Window.

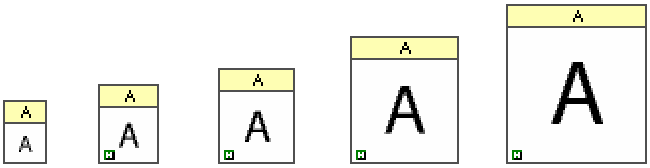
In the **bottom position** of the Font Window command bar, the bar does not have the Font Info button.



It does however contain a **Size** popup menu that allows you to temporarily change the size of the glyph cells in the current Font Window. Possible sizes vary from 16x16 up to 128x128 pixels. Smaller cells occupy less space but hide details. If you select the smallest size (16x16) you will not be able to see the additional marks which are visible in cells at larger sizes.

You can also use the next two buttons to decrease (◢) or increase (◢) the glyph cell size in the current Font Window.

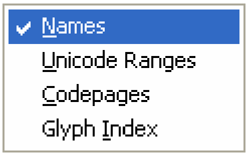
A sample of the different cell sizes:



16x16 24x24 32x32 48x48 64x64

To permanently change the size of glyph cells in all Font Windows, go to **Tools > Options > Font Window > Glyph cell > Each cell should have dimensions of**, and set the size of the glyph cells.

As mentioned previously, the **Caption** popup menu allows you to choose the caption text. The next combo box allows you to switch between the different modes, and is equivalent to the four buttons in the top position:



The third popup menu is equivalent for the Encoding menu in the top position of the command bar, and is discussed later. The current glyph name and Unicode codepoint as well as the total quantity of glyphs are shown in the right part of the command bar in the bottom position.

Glyph Naming and Character Encoding

Support for almost all known character indexing methods is one of the key FontLab Studio features.

Here’s how it works:

A font is just a big collection of glyphs that are used to represent many characters (more about that in the following section). On an average screen the Font Window can show just a few hundred character cells, so we need to have some method to browse the font “through” the Font Window. And on the other hand, different font formats use different methods to encode characters.

In FontLab Studio you can choose one of four so-called Encoding modes that allow you to select a subset of the glyph collection and show it in the top part of the Font Window for easier access. Four buttons in the Font window top command bar or the Mode popup menu in the bottom command bar are used for the encoding modes selection in FontLab Studio.

In the following sections you will find more information about encoding modes, Unicode and name-based identification and the character-glyph model.

Characters, Codes and Glyphs

A font is a collection of glyphs that usually have a common design. In addition to storing each glyph, a font has some header information that stores general information about the font such as the family name, the style name, the copyright string, the ascender and descender values, and others. For more discussion about the font header information see the "Font Header" chapter.

Simply speaking, text in digital form is a collection of *character codes* (or "*codepoints")* — integer numbers. When you enter text into a computer, the computer turns the keystrokes that you press on the keyboard into integer number and assigns a number (character code) to each character that you enter. When the computer needs to show some text on screen or print it, it accesses a font and turns the character codes into visual shapes.

A *character encoding standard* is (simply speaking) a table that defines the relation between characters and the codes that are used to represent these characters in the computer.

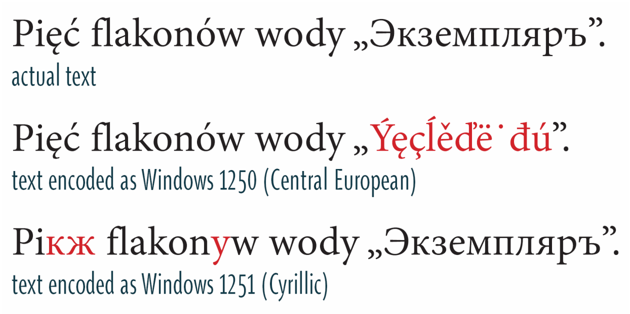
Character Encodings Standards

There are many other character encoding standards (sometimes called *codepages*) used in the world to help use different languages – in fact, the huge amount makes the use of the word "standard" questionable.

The main difference between the encoding standards is the size of the code. There are one-byte, double-byte and multi-byte mapping standards. With a one-byte mapping standard, each character in the text is encoded using exactly one byte (8 bits of information). This means that only 256 different characters can be encoded in a particular one-byte encoding standard.

A double-byte mapping standard uses two bytes (16 bits) for every character. So it's possible to map 65,536 characters. Multi-byte mapping standards use from one to four bytes for every character — expanding the code space to billions of characters.

The biggest problem of single-byte encoding standards (codepages) is the limited capacity. With only 256 slots (available codepoints), usually only characters from one alphabet (writing system) can be encoded. It is not possible to encode e.g. Latin and Cyrillic text in the same codepage.



Pięć flakonów wody „Экземпляръ”.

actual text

Pięć flakonów wody „Ýęçĺěďë˙đú”.

text encoded as Windows 1250 (Central European)

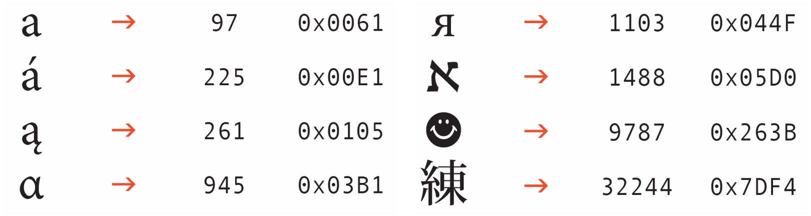
Pikж flakonyw wody „Экземпляръ”.

text encoded as Windows 1251 (Cyrillic)

256 character codes are not even sufficient to encode various accented (diacritic) characters from different languages that use the Roman alphabet. This is why separate codepages were created for Western European languages (English, German, French etc.), Central and Eastern European languages (Polish, Czech, Hungarian etc.), Baltic languages (Latvian, Lithuanian, Estonian etc.) and so on. In addition, different companies assigned character codes differently. For example the letter **ä** (adieresis) is represented using the character code 228 in the Windows Western codepage used by Microsoft and using the character code 138 in the MacOS Roman codepage used by Apple. The confusion becomes evident if you realize that the same code (138) in the Windows Western codepage is used to represent the **Š** (Scaron) that... does not have its own codepoint at all in MacOS Roman. On the Macintosh, it is only available in the MacOS Central European codepage, under the code 225.

The Unicode Standard

Fortunately, one predominant character encoding standard has gained popularity in the past years: the *Unicode Standard* (or short, Unicode). It assigns unique character codes (codepoints) to practically all characters used by humanity. **ä** has the character code 00E4 (in hexadecimal notation, which corresponds to 228 in decimal notation but for Unicode codepoints, usually the hexadecimal notation is used) and **Š** uses the codepoint 0160 (352 in decimal).



a	→	97	0x0061	я	→	1103	0x044F
á	→	225	0x00E1	א	→	1488	0x05D0
ą	→	261	0x0105	☻	→	9787	0x263B
α	→	945	0x03B1	練	→	32244	0x7DF4

Unicode *is* a character coding system designed to support the interchange, processing, and display of the written texts of the diverse languages of the modern world. In addition it supports classical and historical texts of many written languages. Modern operating systems such as Mac OS X or Windows 2000/XP use the Unicode Standard as the default way to store text. Similarly, modern font formats such as OpenType and TrueType use Unicode to store character information.

Unicode can use up to four bytes to encode a character, it is theoretically possible to encode 4,294,967,296 characters, although the Unicode Consortium agreed that no more than 1,114,109 codepoints will ever be assigned. In the current (as of September 2005) version 4.1 of the Unicode Standard, a total of 97,786 codepoints have been assigned (less than 9% of the possible space). The vast majority of the codepoints are Asian (CJK: Chinese, Japanese, Korean) characters.

65,535 codepoints are encoded in the so-called Basic Multilingual Plane (BMP). The codepoints in the BMP are two-byte, so four hexadecimal digits are used to write the codepoint (e.g. `0160`). In addition, more characters are encoded in supplementary planes. They use 5- or 6-digit codepoints, e.g. `1D56C`.

Visit the Unicode Consortium official Web site for more information:

http://www.unicode.org

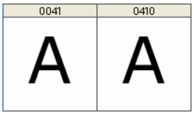
The Character and Glyph Model

People recognize and process characters by their shapes. Thus, people normally closely associate a character and its shape. Information technology, in contrast, makes distinctions between the concepts of a character's meaning (the "character") and its shape (the "glyph"). In information technology, *characters* are abstract information elements used for data coding and interchange while *glyphs* are presentation elements used for displaying and printing the data.

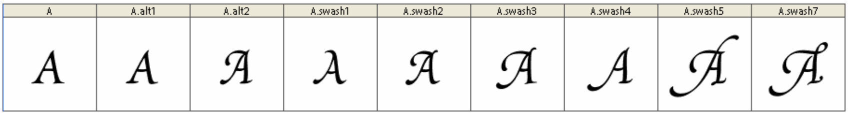
Unfortunately, different literature and different standards define the border between characters and glyphs differently. For the purpose of font technology, a glyph is a single element of the glyph collection stored within a digital font file while a character is a text encoding codepoint used in text processing. Glyphs are used to visualize characters. Each font has a different glyph for the same character, for example all the glyphs: A A A A A A A A are used to visually represent the same character 'A' (Unicode codepoint 0041).

In short: *characters are codes, glyphs are images.*

Even within the same font, there is no 1:1 relation between characters and glyphs. The same glyph can be used to represent two characters, the Latin letter A (Unicode codepoint 0041) and the Cyrillic letter A (Unicode codepoint 0410).

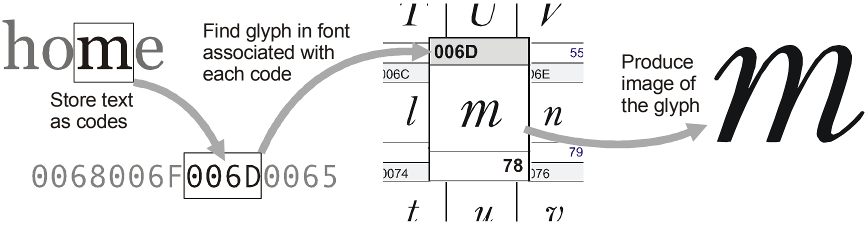


On the other hand, multiple glyphs can be used to represent the same character – an OpenType font can include alternate glyphs.



Characters and Glyphs in FontLab Studio

When a text editor displays text on screen using a font, a process of character-to-glyph mapping must occur. The application sends a request to the font rasterizer for a rendering of a character code. The font rasterizer looks up the character code in the *character mapping table* that is included in the font. The mapping table maps character codes to glyph indexes of individual glyphs. Then, the rasterizer located the glyph using its glyph index in the glyph collection of the font. Finally, the rasterizer produces the image of the glyph at a specified size and sends it back to the application.


home
Store text as codes
0068006F006D0065
Find glyph in font associated with each code
006D
m
78
Produce image of the glyph
m

As discussed earlier, captions of glyph cells in FontLab Studio may display various kinds of information. The following ones represent important properties of glyphs that are all involved (one way or the other) in the character-to-glyph mapping process.

The **glyph index** represents the physical location of the glyph in the font's collection of glyphs. The glyph with the index 0 is physically the first glyph in the font. Some applications such as Adobe InDesign display the physical order of glyphs in a Glyph Palette so it is wise to keep control of the glyph order.

The **glyphname** is a short text identifier for the glyph. For example, the glyphname for the character **a** is a, and for the character **ä** is adieresis.

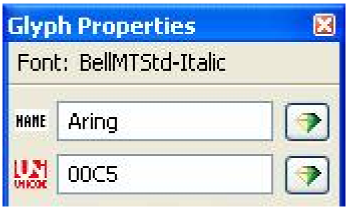
It is a good idea to assign meaningful glyph names to all glyphs in your font regardless of the font format. They are mandatory in Type 1, Multiple Master and OpenType PS fonts. Theoretically, they can be omitted in TrueType or OpenType TT fonts it is a good idea to use them everywhere.

In most situations, FontLab Studio automatically assigns glyph names to glyphs when you create a new glyph so you don't need to worry about them too much. However, many user interface elements of FontLab Studio use glyph names as the primary way to refer to glyphs, for example the Classes panel or the Metrics Table in the Metrics Window. Therefore, you should get used to thinking about glyphs in terms of glyph names.

Certain conventions must be obeyed when devising glyph names for custom and non-standard glyphs (e.g. swashes or ligatures), and they will be discussed later in this chapter.

The **Unicode codepoint** is a hexadecimal number associated with a glyph. Hexadecimal (short: *hex*) numbers are written using the digits 0-9 and the letters A-F (usually uppercase). A Unicode codepoint can have 4 to 6 hex digits. Typically, each glyph has one Unicode codepoint. However, fonts may include glyphs with no Unicode codepoint assigned (so-called *unencoded glyphs*) or glyphs with more than one Unicode codepoints assigned (so-called *double-encoded glyphs*).

The glyph Properties panel (**Edit > Properties**) displays the glyphname and the Unicode codepoint of the glyph that is currently active in FontLab Studio (either selected in the Font Window or opened in a Glyph Window).



Glyph Properties

Font: BellMTStd-Italic

NAME: Aring

UNICODE: 00C5

In addition to the Unicode codepoint, each glyph usually has an additional **local character code** that is depending on the encoding or codepage currently selected in the Font Window.

✐ The rule of thumb is: the encoding of **OpenType** fonts depends on the **Unicode codepoints** assigned to the glyphs. The encoding of **Type 1** fonts depends on the **local character codes** of each glyph.

Font Window Modes

The Font Window can be presented in four modes that can be used to browse the font's glyph collection using certain criteria. In some cases, the Font Window mode also influences the encoding of the final generated font – particularly for Type 1 fonts. The four modes of the Font Window are the following:

1. **Names mode.** This mode lists encoding tables. Each encoding table is an ordered list of glyph names and may also include local character codes that correspond to some of the glyphs.

   An encoding table performs one of two functions: it serves as a **Type 1 encoding table** that is used to determine the character encoding in Type 1 fonts, or it can serve as a **glyph arrangement table**. The latter is used by type designers to visually arrange glyphs in the design stage, usually of an OpenType font, and is not directly used as the source of the font's encoding (as OpenType fonts are based on Unicode).

   Since an encoding table is based on glyph names, it can reference both **encoded glyphs** (i.e. those with at least one Unicode codepoint assigned) and **unencoded glyphs** (those without Unicode codepoints).

2. **Codepages mode.** This mode lists codepages. Each codepage is a mapping of local character codes to Unicode codepoints. The codepage can use one- or two-byte local character codes. Two-byte codepages are used to reference characters in Far-East fonts: Chinese, Japanese, Korean or Traditional Vietnamese.

   A codepage selected in the Codepages mode can be used as the source of encoding of a Type 1 font, or as the source of encoding of a Mac TrueType mapping table, but generally, the selection does not influence the encoding of an OpenType or TrueType font.

   A codepage can only reference **encoded glyphs** (i.e. those with at least one Unicode codepoint assigned).

3. **Unicode Ranges mode.** This mode lists Unicode Ranges. Since the Unicode Standard is a huge code space, it is divided into a number of blocks, so-called *ranges* to help users navigate between the codepoints. Usually, a range is designed to cover a single writing system (script), such as Cyrillic, Armenian or Thai.

   The selection in this mode does not in any way influence the actual encoding of an OpenType or TrueType font.

   A Unicode range can only reference **encoded glyphs** (i.e. those with at least one Unicode codepoint assigned).

4. **Index mode.** This is the simplest glyph identification mode: all glyphs are shown in the exact physical sequence as they are stored in the font file.

   Glyph indexes are used to reference glyphs in Python scripting, they are used internally in TrueType and OpenType tables to reference glyphs, and they are sometimes exposed to the users, e.g. in the glyph palette in Adobe InDesign.

   The Index mode shows all glyphs in the font, both **encoded** and **unencoded**.

Names Mode

To switch the Font window to the Names mode, click the NAME button on the Font Window command bar (top position) or choose the Names mode from the Mode popup menu (bottom position).

The **Encoding** combo box (top position) or Encoding popup menu (bottom position) shows the encoding table currently assigned to the font. When you open the combo box/popup menu, you will see many encodings that are installed and available in FontLab Studio. In the bottom position of the Font Window command bar the encodings are shown in groups.

An encoding table performs one of two functions:

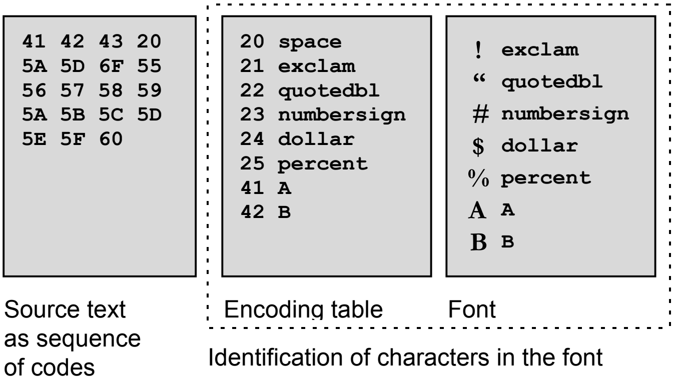
- Type 1 encoding table
- glyph arrangement table

As a **Type 1 encoding table**, an encoding table is used as the source of the character encoding in Type 1 fonts or (in some rare cases) TrueType fonts.

As a **glyph arrangement table**, type designers use an encoding table to visually arrange glyphs in a particular order during the design process of a font (Type 1, TrueType or OpenType). Such a glyph arrangement table can be used as a "visual map" for the font family so the designer knows what glyphs need to be designed in all members of the family – this way, you will not miss an important glyph.

There is no visual distinction in the Encodings list between Type 1 encoding tables and glyph arrangement tables. Any encoding table can theoretically serve either function. In order, in FontLab Studio the same user interface element (the encoding tables) serve two different purposes.

An encoding table is either just a sequential list of glyph names or maps local character codes to glyph names. FontLab Studio will look up the glyphs in the current font that have glyph names specified in the encoding table and will present the glyphs visually in the sequence specified by the encoding table. If the encoding table is used as a Type 1 encoding table, the same mapping will be written to the Type 1 font and used as its encoding.



We will now discuss the most common encoding tables included in FontLab Studio.

Type 1 Encoding Tables

Type 1 encoding tables are used as source for the character encoding in Type 1 fonts as well as Multiple Master fonts (whenever we speak of Type 1 encoding, the same applies to Multiple Master).

Type 1 fonts have two fundamentally different kinds of encoding: **Standard Encoding** and **custom encoding.**

The rule of thumb is that a Western Roman Type 1 font should be encoded using Standard Encoding, and a non-Western Type 1 font (e.g. Central European, Cyrillic, Greek) should use custom encoding.

With the default settings of FontLab Studio, if any encoding from the Type 1 Western/Roman group is active in the Font Window, the Type 1 font will be generated using Standard Encoding. If a different encoding is active, the font will be generated using custom encoding that will exactly reflect the active encoding table.

Type 1 Western/Roman group

If **Tools > Options > Generating Type 1 > Encoding Options** is set to **Select encoding automatically** or **Export Unicode codepage…**, then FontLab will generate a Standard Encoding-encoded Type 1 font if one of the encodings from this group is active. Please refer to the "FontLab Studio Options" section for more discussion on this. Use any of these encodings when you are working on a typical Western Roman Type 1 font. If you are working on a Western Roman Type 1 font that will be generated as Windows Type 1 and as Mac Type 1, use MacOS Roman as your encoding since this will give you the entire character set that is required to be present in your font.

Adobe Standard Encoding	The "native" representation of the Adobe Standard Encoding
Default Encoding	The simulation of what a Standard Encoding-encoded Type 1 font will appear to the user if installed on the current operating system
MS Windows 1252 Western (ANSI)	The simulation of what a Standard Encoding-encoded Type 1 font will appear to the user if installed on Microsoft Windows
MacOS Roman	The simulation of what a Standard Encoding-encoded Type 1 font will appear to the user if installed on Mac OS. Use this when you are working on a typical Western Roman Type 1 font.

Type 1 non-Western groups

If any of the encodings from these groups is active, the Type 1 font will be generated with custom encoding if **Tools > Options > Generating Type 1 > Encoding options** is set to any value except **Always write Standard Encoding**.

These encodings can be used as the source of encoding for single-codepage non-Western Type 1 fonts, e.g. Mac Cyrillic or Windows Greek. If you're creating a non-Western Type 1 font, make sure to select the appropriate encoding here, and also set the matching character set in **File > Font Info > Encoding and Unicode > Microsoft Character Set** and **Mac script and FOND ID**. Only a combination of the correct encoding in the Font Window and the correct character set setting in Font Info will give you a working non-Western Type 1 font.

Example encodings in this group:

MS Windows 1251 Cyrillic	Encoding for a Windows Cyrillic Type 1 font
MacOS Cyrillic	Encoding for a Mac Cyrillic Type 1 font
Adobe Symbol	Encoding for fonts that include mathematical and symbol characters, defined by Adobe.

"Imported" Encoding

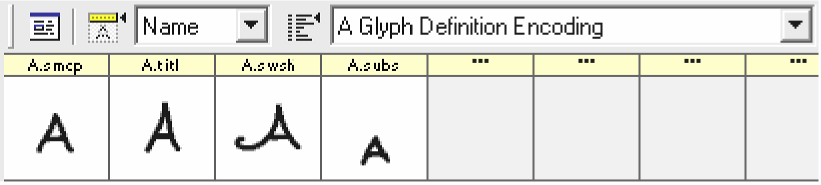
If **Tools > Options > Opening Type 1 > Find matching encoding table if possible** is enabled, when FontLab Studio opens a custom-encoded Type 1 font, it will try to match the font's encoding to known custom encodings. If the encoding cannot be matched, "Imported" is shown. The "Imported" encoding will also appear if the user opens a .vfb file that uses an encoding not present on this user's machine.

The user can choose **Glyph > Glyph Names > Save Encoding** to save the imported encoding into a new .enc file so next time, FontLab Studio will match the encoding correctly.

Glyph Arrangement Tables

Type designers use any encoding table as a **glyph arrangement table**, i.e. to visually arrange glyphs in a particular order during the design process of a font (Type 1, TrueType or OpenType). Such a glyph arrangement table can be used as a "visual map" for the font family so the designer knows what glyphs need to be designed in all members of the family – this way, you will not miss an important glyph.

For example, if your font contains several glyphs representing the 'A' character, like "A.smcp" (for use with the small caps feature), "A.titl" (for use with the titling alternates feature), "A.swsh" (for use with the swash feature), "A.subs" (for use with the subscript feature), it could be a good idea to have them appear close to each other in the Font Window:



You can easily build a glyph arrangement table yourself – this is explained in the next section.

Remember that if you choose any glyph arrangement table in the Names modes, the glyphs will be displayed in FontLab Studio in the order that you specified, but the physical arrangement (sequence) of the glyphs in the font is still determined by the Glyph Indexes. To view the Glyph Indexes sequence, switch Font Window to the Index mode. You can automatically sort glyphs according to your glyph arrangement table by choosing **Glyph > Sort Glyphs > By Encoding.**

Also remember that when you create OpenType or TrueType fonts, the encoding table in the Names mode serves as a glyph arrangement table and not as a source of encoding

Normally, OpenType and TrueType are based on Unicode, so the Unicode codepoints that you assign to each glyph are the source of the character encoding. To make sure the encoding of your OpenType or TrueType font is correct, switch to the Unicode Ranges or Codepages mode. You can automatically assign Unicode codepoints to your glyphs by using **Glyph > Glyph Names > Generate Unicode**.

✐ ***Note*:** Type 1 encoding tables can be also used as source for TrueType encoding if **Tools > Options > Generating OpenType and TrueType > Ignore Unicode indexes in the font** is enabled. This may be useful if you need to generate a single-codepage non-Western TrueType font for **old** systems such as Windows 3.1 or Windows 95, but in most cases, it's recommended to keep the said option disabled and use Unicode encoding rather than Type 1 encoding tables as source of TrueType.

When you activate a different encoding in the Font Window, you will see that the characters in the Font Window are rearranged. Some characters will move below "the yellow zone". Remember that only characters that are "in the yellow zone" are covered by the currently selected encoding.

Unicode Ranges

In Unicode the standard character space is divided into *planes (*defined by the first byte of the three-byte codes*)*. Each plane (indexes 0 — 65,535) is divided into *ranges*. Each range typically covers characters that belong to one alphabet or have common properties, like the Cyrillic range or the Hebrew or the Extended Latin.

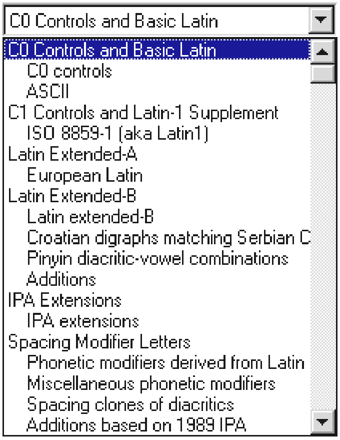
Ranges may be of various lengths — from a few characters to several thousand characters (in the case of Kanji characters).

In FontLab Studio you can select any Unicode range and view your font as organized by the range. All characters with Unicode codepoints in the selected range will be arranged in order in the yellow zone at the top of the Font window.

In order to simplify working with Unicode ranges in FontLab Studio all the "official" ranges in the Unicode standard are subdivided into subranges. You can work with the whole range or select one of the subranges. For example, you can select the whole Cyrillic range that includes all currently used and historic Cyrillic characters, or you can select just the historic letters or only the Russian alphabet.

To select a range in the Font Window:

1. Switch the Font Window to the Unicode Ranges mode by clicking the **Ranges** button.
2. The encoding selection combo box will show the names of all available Unicode ranges and subranges:



C0 Controls and Basic Latin

- C0 Controls and Basic Latin
    - C0 controls
    - ASCII
- C1 Controls and Latin-1 Supplement
    - ISO 8859-1 (aka Latin1)
- Latin Extended-A
    - European Latin
- Latin Extended-B
    - Latin extended-B
    - Croatian digraphs matching Serbian C
    - Pinyin diacritic-vowel combinations
    - Additions
- IPA Extensions
    - IPA extensions
- Spacing Modifier Letters
    - Phonetic modifiers derived from Latin
    - Miscellaneous phonetic modifiers
    - Spacing clones of diacritics
    - Additions based on 1989 IPA

   Range names are aligned to the left of the list box and the subranges' names are indented to the right.

3. Select the range or subrange that you want to work with and you will see the Font Window change so that only characters from the selected range are in the yellow (encoded) area.

The definitions of the Unicode ranges and subranges may be changed. They are placed in a text file that you can edit in any text editor. You can add your own ranges or subranges that, for example, may include only one character whose placement is very important to you.

Codepages

Codepages are tables that map character codes (one byte long) to the Unicode indexes. Depending on the size of the page, these tables may have 256 or 65,536 records, one for each possible character code. Long codepages are called double-byte codepages and are primarily used to represent codes used in Chinese, Japanese, Korean or Vietnamese languages.

Codepages are necessary because we need to somehow encode text written in different languages in the one-byte code space. So when we have a text file encoded according to some codepage, we use the codepage table to find which characters were used in this text. We may have two different texts with the same code 192 (decimal), but in one case it may mean the Russian ‘A’ and in the other case it may mean ‘À’ (Agrave).

Codepages are used not only to identify characters, but also to simplify text sorting, conversion of lowercase to uppercase characters, spell-checking and in many other applications where it is necessary to know which characters are used in the text.

Because the Unicode character identification standard covers most languages it is usually used as the destination information in the codepage tables. Here is an example of fragments from two different codepages that map the same codes to different Unicode codepoints:

MS Windows 1252 Western		MS Windows 1251 Cyrillic	
0xC0	0x00C0	0xC0	0x0410
0xC1	0x00C1	0xC1	0x0411
0xC2	0x00C2	0xC2	0x0412
0xC3	0x00C3	0xC3	0x0413
0xC4	0x00C4	0xC4	0x0414
0xC5	0x00C5	0xC5	0x0415
0xC6	0x00C6	0xC6	0x0416
0xC7	0x00C7	0xC7	0x0417
0xC8	0x00C8	0xC8	0x0418
0xC9	0x00C9	0xC9	0x0419
0xCA	0x00CA	0xCA	0x041A
0xCB	0x00CB	0xCB	0x041B
0xCC	0x00CC	0xCC	0x041C

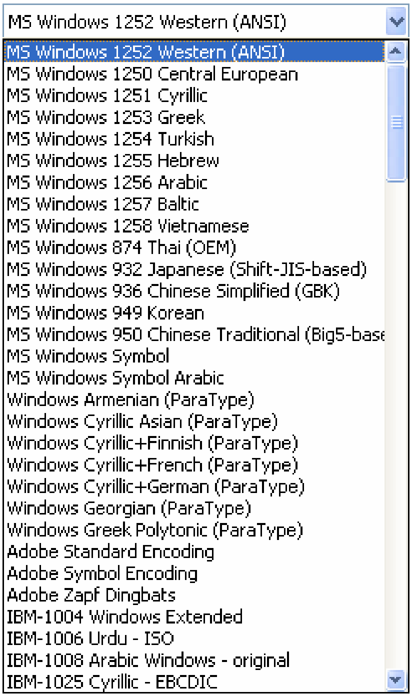
Many different codepages have been defined for many languages and different operating systems. FontLab Studio 4.6 includes descriptions for 300+ codepages — all the known Windows, OS/2, MS DOS, Mac OS codepages plus a few others like the Polytonal Greek, Russian KOI-8 and NeXT Step codepages.

In FontLab Studio a codepage is a filter through which you can "look" at your font to see how it will work in different environments. For example, you might include many Unicode characters in your font and see how it would work if it was installed in OS/2 with the Arabic language selected. This gives you the opportunity to easily create fonts that will be properly encoded and will always work correctly.

To select a codepage in the Font Window:

1. Switch the Font Window to the Codepages mode by clicking the Codepages ▦ button.

2. The encoding selection combo box will show the names of all available codepages:



MS Windows 1252 Western (ANSI)

MS Windows 1252 Western (ANSI)
MS Windows 1250 Central European
MS Windows 1251 Cyrillic
MS Windows 1253 Greek
MS Windows 1254 Turkish
MS Windows 1255 Hebrew
MS Windows 1256 Arabic
MS Windows 1257 Baltic
MS Windows 1258 Vietnamese
MS Windows 874 Thai (OEM)
MS Windows 932 Japanese (Shift-JIS-based)
MS Windows 936 Chinese Simplified (GBK)
MS Windows 949 Korean
MS Windows 950 Chinese Traditional (Big5-base
MS Windows Symbol
MS Windows Symbol Arabic
Windows Armenian (ParaType)
Windows Cyrillic Asian (ParaType)
Windows Cyrillic+Finnish (ParaType)
Windows Cyrillic+French (ParaType)
Windows Cyrillic+German (ParaType)
Windows Georgian (ParaType)
Windows Greek Polytonic (ParaType)
Adobe Standard Encoding
Adobe Symbol Encoding
Adobe Zapf Dingbats
IBM-1004 Windows Extended
IBM-1006 Urdu - ISO
IBM-1008 Arabic Windows - original
IBM-1025 Cyrillic - EBCDIC

MS Windows codepages come first, MS DOS codepages follow. All other codepages are sorted according to their names.

Since all codepages are divided into groups they are available in submenus of the Encoding menu if the Font window command bar is in bottom location.

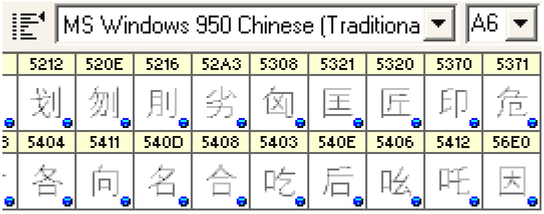
3. Select the codepage that you want from the list and you will see the Font Window change. All the characters that are in the codepage appear “in the yellow zone”. All other characters are in the “white” area below. Select the MS Windows 1252 Western (ANSI) codepage and you will see how your font will look in the Windows standard (Latin 1) codepage.

All codepages in FontLab Studio are defined in editable text files, so you can change any codepage if you think it is wrong (please let us know!) or you can define your own codepage. We do not recommend changing any of the codepages supplied with FontLab Studio. They are extensively tested and are based on the documents from the companies who supply them.

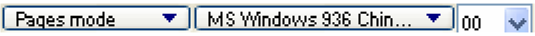
Put your custom codepage definitions (.cpg files) into the [Shared user data folder]\Codepage folder (typically C:\Documents and Settings\Your Username\My Documents\FontLab\Shared\ Codepage) if you want to make the codepages available to all recent Fontlab Ltd. applications, or in the [Application user data folder]\ Codepage folder (typically C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5\Codepage) if you want to make the codepages available within FontLab Studio only. Refer to Tools > Options > General Options > Folders and paths for the actual locations of these folders. All custom .cpg files should be located in one of these folders.

Double-byte

If your font contains many characters from one of the Far-East languages you may need to use double-byte codepages. If you select one of these codepages, you will see an additional control to the right of the codepage selection list in the toolbar:



or on the Font window bottom command bar:



This control allows you to select a “page” of the codepage. Theoretically, we may have 256 pages of 256 codes each, which give us 65,636 codes. In practice none of the known codepages has that many codes and usually less than half of that number.

Advanced Glyph Naming and Encoding

Custom Glyph Naming

General provisions

Theoretically, the OpenType specification permits the designer not to supply any glyph names at all (at least in case of OpenType TT fonts). However, realistically, it is essential to create fonts with glyph names that fulfill the recommendations detailed below.

When fonts are embedded in electronic documents or sent to a printer, under some circumstances only the information about the glyphs (their glyph indexes, names and outlines) are retained, while the encoding information (the associated Unicode codepoints) is lost. The electronic document “looks right” but the underlying text streams are obscured or not available. In such cases, meaningfully constructed glyph names can be used as a help to rebuild or at least approximate the original text. A practical example: the user creates a text document that uses an OpenType PS font. The document is printed to a PostScript file. Since PostScript does not support OpenType PS, the font is embedded in the print stream as Type 1. The OpenType information such as layout tables or Unicode codepoints is lost. If Acrobat Distiller is used to convert the PostScript file to a PDF document, the application first tries to locate the original OpenType PS font on the user’s system: if the font is found, Distiller is able to use its original Unicode codepoints and embed them in the PDF document. But if the original OpenType PS font is not available to Distiller (for example because the PS-to-PDF conversion happens on a different machine), Distiller embeds the Type 1 font found in the PostScript stream, with no Unicode information. Now, when the text in the PDF document is being searched, copy-pasted or otherwise extracted by an application such as Acrobat or Google, the application can attempt to rebuild the Unicode codepoints basing on glyph names included in the embedded Type 1 font. For Latin or Cyrillic scripts, the recreated text will likely be a very close match of the original; for Thai or Hindi, the text recreated that way will probably be only a crude approximation, with letters arranged in incorrect sequence, and some information missing. But yet, some is often better than nothing.

Users of the Unicode Standard familiar with the character-glyph model know that the relationship between glyphs and characters is not a simple one-to-one mapping.

A glyph in a font can represent the default form of a character. Such glyph needs to have the Unicode codepoint of the represented character assigned. For example, the glyph with the glyph index 4 representing the character $ (U+0024, DOLLAR SIGN) has the Unicode codepoint *0024* assigned in the Unicode field of the Properties panel. The glyph's name is *dollar*.

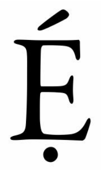
A glyph in a font can also represent a variant form of a character. For example, a font can include a glyph that represents the default form of the character a (U+0061, LATIN SMALL LETTER A) as well as glyphs that depict stylistic variants of that character: a small-cap variant, a swash variant, etc. The glyph that represents the default form should have the name *a* and the Unicode codepoint 0061 assigned in the Properties panel. The variant glyphs should different names constructed according to guidelines outlined below. An appropriate OpenType Layout feature [1] should allow the font user to produce the particular variant on the screen – the use of an application and operating system that supports OpenType Layout features is a prerequisite. To allow the user access to the variant glyphs in applications that support Unicode but do not support OpenType Layout features, each of the glyphs may have a **PUA** (Private Use Area) Unicode codepoint assigned – but they may also remain unencoded.

A glyph in a font can represent the default form of more than one character. Here, several cases need to be differentiated.

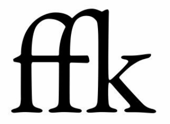
[1] Adobe Systems: OpenType, Advanced Typography. http://store.adobe.com/type/opentype/#adv

First, several characters can have identical appearance, so the same glyph could serve as the default representation of each of those characters. In such case, the Unicode codepoints of all the represented characters are entered in the Unicode field of the Properties panel, separated by spaces. For example, the glyph with the glyph index 66 with the shape of the letter a could represent two characters: U+0061 (LATIN SMALL LETTER A) and U+0430 (CYRILLIC SMALL LETTER A). In this case, the Unicode field in the Properties panel would have the entry 0061 0430. The glyph name is *a*. Generally however, assigning multiple Unicode codepoints to one glyph is not recommended, in particular when creating OpenType PS fonts. The designer should rather duplicate the glyphs, assigning no more than one Unicode index to each of them (note that one of the glyphs can refer to the other one as a component).

Another case is that one glyph represents several Unicode characters at a time. For example, the glyph



represents an accented character LATIN CAPITAL LETTER E WITH ACUTE AND DOT BELOW (used in African languages such as Yoruba). This character does not have its own codepoint in the Unicode Standard so it needs to be encoded as a series of characters. It is encoded as *E*, followed by *dot below*, followed by *acute* (U+0045 U+0323 U+0301). Another example is the glyph



which is a ligature of *f* followed by *f* followed by *k* (U+0066 U+0066 U+006B). In such cases, again, the appropriate OpenType Layout features must be used to produce the glyphs. The glyph name should be constructed accordingly and the glyph may have a PUA Unicode codepoint assigned.

The following sections present a summary of the Adobe/FontLab glyph naming guidelines. These guidelines unify recommendations by Adobe Systems and those by Fontlab Ltd.

Glyph name limitations

A glyph name must not be longer than 31 characters. The glyph name consists of a base name, optionally followed by a period (.), which is then followed by a suffix. Both the base name and the suffix may only include: uppercase English letters (A-Z), lowercase English letters (a-z), European digits (0-9), and underscore (_). Other characters such as spaces are not permitted! A glyph name must start with a letter or the underscore character – with the exception of the special glyph name ".notdef" that starts with the period. For example, "twocents", "a1", and "_" are valid glyph names, while "2cents" and ".twocents" are not.

Simple glyph names

Review the Adobe Glyph List for New Fonts (AGLFN):

http://partners.adobe.com/public/developer/en/opentype/aglfn13.txt

If your glyph represents a character listed in AGLFN, use the glyph name listed there. Instead of using arbitrary names (e.g. "middot"), use standardized names listed in AGLFN ("periodcentered").

Review the Unicode Standard code charts. If your glyph represents a default form of a character encoded in the Unicode Standard but not listed in AGLFN:

a) for BMP codepoints (codepoints less than FFFF), use the name "uniXXXX", that is lowercase "uni" followed by a four-digit Unicode codepoint written using uppercase hexadecimal digits. Note that "uni" must be lowercase and XXXX must use uppercase letters for hexadecimal digits, so "uni01EB" is a valid glyph name but "uni01eb" or "Uni01Eb" are not.

b) for SMP codepoints, use the name "uXXXXX" or "uXXXXXX", that is lowercase "u" followed by 5 or 6 uppercase hexadecimal digits representing the codepoint.

Glyph names with suffix

If your glyph represents an alternate form of a character that is encoded in the Unicode Standard or is listed in AGLFN, use the glyph name of the basic form as the base name, followed by a period, followed by a suffix.

For the suffix, use the tag of the OpenType Layout feature that you would most likely access that glyph through.

For example, for a small-caps A, use “A.smcp”, for a stylistic alternate R use “R.salt”, for a swash Q use “Q.swsh”, for a superior m use “m.sups”, for a tabular 5 use “five.tnum” etc. If there are multiple OpenType Layout features that can be used to access a glyph, pick the one that is the most prominent. If a combination of features should be used to access your glyph, order the appropriate feature tags alphabetically and concatenate them using the underscore glyph (“_”). For example, for a proportional old style 2 use “two.onum_pnum”, for a swash small-cap È use “Egrave.smcp_swsh”.

Compound glyph names

If your glyph represents a “compound character”, i.e. a ligature or an accented character that does not have a precomposed Unicode codepoint, and if the character is not explicitly listed in AGLFN or the Unicode Standard, construct the compound glyph name as follows.

For each element of the compound character, take the base name (or the entire glyph name if there is no suffix). Concatenate these using underscore to make the compound base name.

For each element of the compound glyph that has a suffix, concatenate the suffixes using underscore to make the compound suffix. You may eliminate duplicate suffix elements.

For example, for a ligature of the glyphs “c” and “t”, use “c_t” as glyph name. For a ligature of the glyphs “f”, “f” and “i”, use “f_f_i” as glyph name. For a ligature of “longs” and “i” use “longs_i” as glyph name. For a ligature of the glyphs “F.smcp”, “F.smcp” and “I.smcp”, use “F_F_I.smcp” as glyph name. For a ligature of the glyphs “R.salt” and “s.sups”, use “R_s.salt_sups” as glyph name. For the African Ẹ́ character use the glyph name “E_dotbelowcomb_acutecomb”.

If each element of a compound glyph name represents a BMP character, you can use an alternative way of building the base name, which can potentially produce a shorter glyph name. The glyph name starts with “uni” and must be followed by unseparated groups of four uppercase hexadecimal digits representing the BMP codepoint of each element. So instead of “E_dotbelowcomb_acutecomb”, you can use the name “uni004503230301”.

Remember that a glyph name should be no longer than 31 characters, so you may need to abbreviate the name if needed.

Symbol glyph names

If a glyph does not represent a Unicode character, but rather is an ornament, a non-textual symbol etc., you can use a glyph name of your liking (but adhering to the limitations outlined earlier). If you assign PUA codepoints to these glyphs, you can create the glyph names using the "uniXXXX" scheme, where XXXX represents the PUA codepoint.

Additional naming guidelines

Refer to the Adobe guidelines for additional guidelines on making glyph names, especially for creating complex glyph names that involve "uniXXXX" and "uXXXXX" glyph names as elements:

http://partners.adobe.com/public/developer/opentype/index_glyph.html

Assigning Unicode codepoints

Refer to the Unicode Standard code charts and assign proper Unicode codepoints to the glyphs discussed in the section *Simple glyph names* earlier.

As discussed above, if the more than one Unicode character share the same glyph shape, two approaches are theoretically possible:

a) create multiple glyphs with identical content but different names, and assign one Unicode codepoint per glyph; for example, create a "periodcentered" glyph and encode it as U+00B7, and create a "uni2219" glyph and encode it as U+2219. One of the glyphs can refer to the other one as a component. This is the approach recommended by Fontlab Ltd. for OpenType fonts, in particular for OpenType PS fonts.

b) alternatively, either assign multiple Unicode codepoints to your glyph; for example, for "periodcentered", assign U+00B7 and U+2219.

Private Use Area codepoints

For glyphs discussed in 0 – 0, you may assign custom codepoints from the Unicode Private Use Area (PUA): from U+E000 to U+F8FF. However, you also may choose to leave these glyphs unencoded (not assign any codepoints).

For some applications (e.g. Microsoft Word 2003 for Windows), assigning PUA codepoints may be the only way to display such glyphs in your font, so it is practical to assign PUA codepoints. On the other hand, PUA codepoints are completely custom, so there is no way that exchangeability of documents can be guaranteed. Also, the text that is set using PUA codepoints is "garbled" (spelling, hyphenation, search & replace won't work). So this is only a short-sighted interim measure.

Some font developers (e.g. Adobe) assign PUA codepoints to glyphs that do not have proper Unicode codepoints, while others (Microsoft, Bitstream, Linotype, Tiro Typeworks) leave the glyphs unencoded.

Custom Encoding Tables

Encoding tables are a useful mechanism to filter and view your glyphs in different arrangements. You can put a large number of glyphs into one font, assign a unique name to each character, and supply several encoding tables, allowing you to select different sets of characters in the font when you use different encodings.

For example, in symbol fonts the Greek characters take places that are usually occupied by Latin characters. With the encoding tables you can include both sets of characters. Just assign the correct names (like alpha for the 'A' character and A for the 'A' character) and later you can choose the symbol encoding to work with the Greek version of your font or choose Roman encoding to use the Latin characters.

In FontLab Studio you can include up to 6,400 glyphs in a font. If you need a font editor that supports more glyphs (up to 65,535), Fontlab Ltd. offers AsiaFont Studio a multibyte font editor that is the "bigger brother" of FontLab Studio.

All encodings are stored in text files that can be edited in any text processor.

To create a custom encoding file:

1. Copy the .enc file located in the **Common Files\FontLab\Encoding\T1 non-Western** folder to use as the basis for your new encoding file.
2. Open the copied file in any text editor (Windows Notepad will do) and then edit it, following the same structure that you find in the original file.
3. Change the name of the encoding and the encoding index in the first line of the file. The first line should have the following structure:

   %%FONTLAB STUDIO ENCODING: 7; Adobe Symbol Encoding

   "%%FONTLAB STUDIO ENCODING: "is the prefix of the file used to detect properly made encoding files and must not be changed. Note the space between ':' and the encoding index.

   '**7**' is the index of the encoding vector. You must not change the encoding vector indexes of any of the encoding vectors or they will become unusable. If you make your own encodings the indexes of your files should not be used in any of the other files. The actual value of the index is not important, so you can assign indexes like 1001 or 10001.

   The last part of the first line, "**Adobe Symbol Encoding** ", is the name of the encoding vector. It starts at the first non-space character after ';'. Pick a name on your own and type it there e.g. "A Glyph Definition Encoding" – use plain English letters, digits or simple punctuation such as [ ] ( ) but avoid too many special characters in the encoding name. Do not use ampersand (&).
4. Change the name of the group in the second line of the file:

   %%GROUP:My Custom Encodings

   The group name will become the submenu title in the Encoding popup menu. Note that there is no space after the ':' character. We recommend using your foundry name or your personal name in the encoding group name.
5. Edit the contents of the encoding table, e.g.:

```
%%FONTLAB STUDIO ENCODING: 1001; A Glyph Definition Encoding
%%GROUP:My Custom Encodings
A.smcp
A.titl
A.swsh
A.subs
```

If the encoding table will be used as source of Type 1 encoding, each glyphname should be followed by a space, followed by a decimal character code, e.g

```
%%FONTLAB STUDIO ENCODING: 1001; A Glyph Definition Encoding
%%GROUP:My Custom Encodings
A 65
B 66
C 67
D 68
```

6. Save this encoding file with a different file name but be sure to use the .enc file extension. Put the .enc file in the **[Shared user data folder]\Encoding** folder (typically C:\Documents and Settings\Your Username \My Documents \FontLab\Shared\Encoding) if you want to make the encoding available to all recent Fontlab Ltd. applications, or in the **[Application user data folder]\Encoding** folder (typically C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5\Encoding) if you want to make the encoding available within FontLab Studio only. Refer to Tools > Options > General Options > Folders and paths for the actual locations of these folders. All custom .enc files should be located in this folder!

Restart FontLab Studio to see the new encoding will appear in the Encoding selection combo box.

Custom Unicode Ranges

The Unicode ranges definition file is located in the **Program Files\Common Files\FontLab\Data** folder and has the name URANGES.DAT. To view this file, open it in a text editor. You will see the following text:

```
%%FONTLAB STUDIO UNICODE RANGES
0x0000,0x007F,C0 Controls and Basic Latin
0x0000,0x001F,    C0 controls
0x0020,0x007F,    ASCII
0x0080,0x00FF,C1 Controls and Latin-1 Supplement
0x00A0,0x00FF,    ISO 8859-1 (aka Latin1)
0x0100,0x017F,Latin Extended-A
0x0100,0x017F,    European Latin
0x0180,0x024F,Latin Extended-B
```

The first line of this file is an identification line. It should not be changed or FontLab Studio will not accept this file as a valid Unicode range definition file.

All other strings have the same structure:

<first index of the range>, <last index>,<range's name>

Note that there is no space before a name range's name but there are four spaces before a subrange's name. Using this simple method you cannident ranges' names as you wish.

We do not recommend you to replace the existing URANGES.DAT file. Put your own copy of the file in the **[Application user data folder]\Encoding** folder (typically C:\Documents and Settings\Your Username\My Documents \FontLab\Studio5). Refer to Tools > Options > General Options > Folders and paths for the actual location of the Application user data folder .

Custom Codepage Definitions

Codepage definition files (extension CPG) are text files that have the following structure:

```
%%FONTLAB STUDIO CODEPAGE: 0xFFFF; MS Windows 1251 Cyrillic
%%GROUP:MS Windows

%%UN2/UN2
0x00  0x0000
0x01  0x0001
0x02  0x0002
0x03  0x0003
```

The first line of this file is an identification line that is used to set the codepage name and tell FontLab Studio that this file is a properly composed codepage definition file. This line must be started by the text:

%%FONTLAB STUDIO CODEPAGE: 0xFFFF;

The name of the codepage follows.

The second line identifies the codepage group name. The group name will become the submenu title in the Codepage popup menu. Note that there is no space after the ':' character.

All other strings starting with '%' are comments and are not interpreted by FontLab Studio.

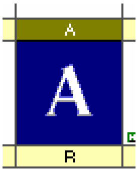
The following strings are formed as pairs of two integer numbers in decimal or hex (startin g with "0x") form. The first number is the code of the character and should be in the 0–255 range. The second number is the Unicode codepoint of the character and should be in the 0–65535 (0-FFFFh) range. The special Unicode codepoint 0xFFFF is used to define codes that are not mapped to any character.

Using the Font Window

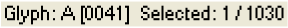
The glyph chart in the Font window is a visual representation of all the glyphs in the font. To modify the font you have to learn how to use the glyph chart: navigate, select glyphs and select commands.

Navigating

One of the glyphs in the Font window is the “current” glyph. It is specially highlighted:



You can see the current glyph name and its Unicode codepoint in the bottom command bar:



Glyph: A [0041] Selected: 1 / 1030

To view different parts of the font in the Font window you can either use the vertical scroll bar or the auto-scroll mode: if you place the mouse anywhere in the chart; press the mouse button; and move the mouse cursor above the top or bottom of the chart it will scroll up or down accordingly selecting the glyphs.

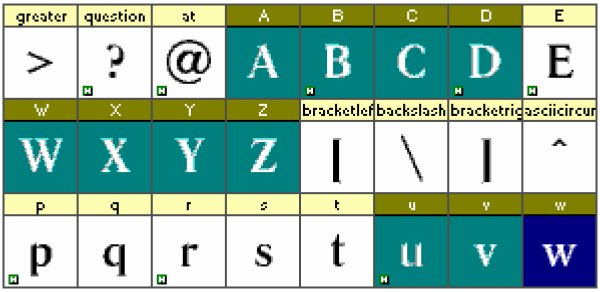
You can also use the SPACE key to scroll the Font window. Press the space key, press the mouse button and drag the mouse to scroll the window vertically. If you have a wheel on your mouse you can use it to scroll the Font window vertically.

Alternatively you can use the keyboard keys to navigate in the font chart:

Arrow keys	Moves the current glyph highlight one cell right, left, up or down, according to the key used
Ctrl+Right arrow	Moves 2 cells right
Ctrl+Left arrow	Moves 2 cells left
Page Up and Page Down	Moves the glyph highlight one screen up or down
Home	Moves the glyph highlight to the leftmost glyph on the current row
End	Moves the glyph highlight to the rightmost glyph on the current row
Ctrl+Home	Moves the glyph highlight to the first glyph on the chart
Ctrl+End	Moves the glyph highlight to the last glyph on the chart

Selecting

In addition to the current glyph you can select sets of glyphs in the font chart. These selections behave similarly to selected text in a text editor – you can copy selected glyphs to another place in the font or to a different font; you can apply different effects to the selection; etc. Selected glyphs have inverted colors. The last selected glyph is the current glyph:



To select one or more cells, press the left mouse button on the first or last cell of your selection and drag the cursor across the cells you want to select. You will see the selection highlighted. If you drag the cursor outside the visible part of the chart, it will scroll accordingly. **To cancel your selection**, click on any glyph cell.

Alternative: Using the navigating keys on the keyboard, set the current cell highlight on the first (or last) cell of a selection, then press the **Shift** key. Move the current cell highlight (as described earlier) to select the cells.

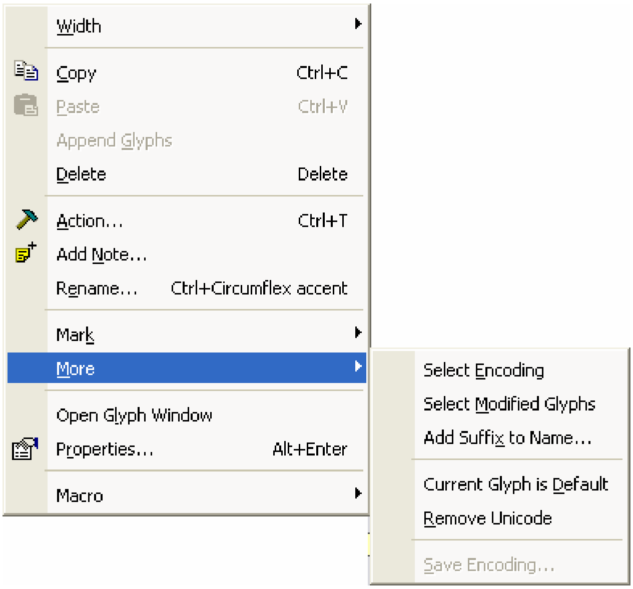
Selection does not have to be continuous. If you press the **Ctrl** key, you can select and deselect cells in any order and combination.

Context Menu

Most commands available in the Font window can be selected from the context menu.

To open the context menu, press the right mouse button anywhere in the chart area or just push the **Space** key once.

Here is a sample of the Font window context menu:



Here is what the commands mean:

Width	Allows you to easily select one of the predefined widths of the Font window. The width is defined in cells.
Copy	Copies the selected glyphs onto the Clipboard. Same as the **Copy** command from the **Edit** menu
Paste	Places glyphs from the Clipboard into the font starting from the first selected cell. Same as the **Paste** command from the **Edit** menu
Append Glyphs	Appends glyphs from the Clipboard to the current font
Delete	Deletes the selected glyphs. Same as the **Delete** command from the **Edit** menu
Action	Opens the **Actions** dialog box. Refer to the "Actions" chapter for more detailed information about actions. Same as the **Action** command from the **Tools** menu
Add Note	Adds a Note to the current glyph
Rename	Opens a rename dialog box
Mark	Marks the selected glyph(s) a color. Allows you to select one of the five predefined colors, one of 255 custom colors, or remove the marking
More	Submenu with more commands (described below)
Open Glyph Window	Creates a new Glyph window and opens the current glyph in it
Properties	Opens the glyph properties panel for the current glyph or selected glyphs.

Contents of the More submenu:

Select Encoding	Selects the current encoding – the yellow zone at the top of the font chart
Select Modified Glyphs	Selects all glyphs which were modified since the last font save
Add Suffix to Name	Opens the **Glyphname Suffix** dialog box allowing to rename selected glyphs by adding suffixes, or replace existing suffixes. Glyphname suffixes are useful when working with OpenType Layout features
Current Glyph is Default	Selects and marks the current glyph as the "default glyph" that is used in Type 1 fonts to represent glyphs that are not present in the font
Remove Unicode	Removes the Unicode codepoints in the selected glyphs
Save Encoding	Saves the currently selected encoding to an .enc file.

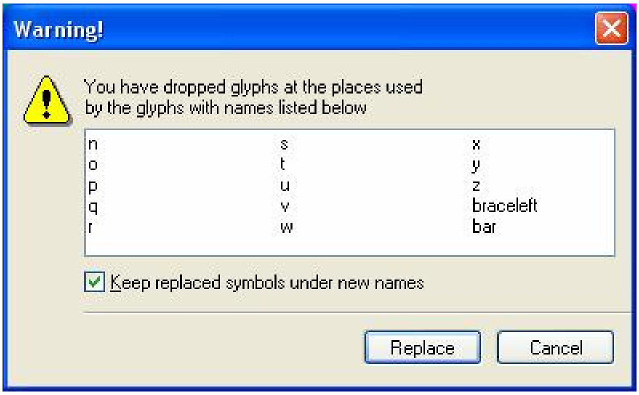
Moving Glyphs

You can change the positions of glyphs in the font chart just by moving them to a new place. Note that moving glyphs is an undoable operation.

To move glyphs in the font chart:

1. Select the glyphs that you want to move.
2. Position the mouse cursor on the selected glyphs.
3. Press the left mouse button.
4. Drag the glyphs to the new position. Release the button to finish moving.

If you move glyphs over the cells of existing glyphs, you will see a dialog box prompting you to choose whether to replace the existing glyphs or save them by moving them to the end of the encoding:



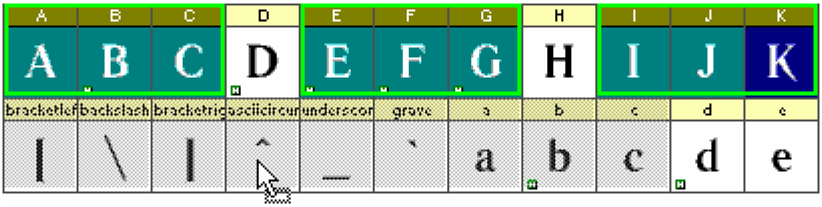
You have dropped glyphs at the places used by the glyphs with names listed below

n
o
p
q
r
s
t
u
v
w
x
y
z
braceleft
bar

☑ Keep replaced symbols under new names

Leave **Keep replaced symbols under new names** checked to save the glyphs (I.e. put the new glyphs in the cells and move the existing glyphs to cells at the end of the encoding) or clear it to replace them (I.e. delete the existing glyphs).

Note that even if source selection is not continuous the destination selection *will* be continuous:



If you are working in the Codepages or Names mode, when you move glyphs they get new names but keep their old Unicode codepoints. You must assign proper codepoints later.

If you are working in the Index mode, moving glyphs is used to manually rearrange their physical sequence in the font. When you move glyphs they will not replace the glyphs at the destination location but instead the moved glyphs will be inserted in front of the existing glyphs. The names and Unicode codepoints of the moved glyphs are retained in this case. To rearrange the physical sequence automatically, use **Glyph > Sort Glyphs**.

Saving the Font

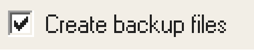
Most of the font-modification operations are not undoable, so we recommend you save your work regularly.

To save a font that you have opened from an existing font file (in FontLab Studio format) **or imported** (from other format), use the **File > Save** command or click on the **Save** 💾 button on the Standard toolbar.

To save all opened fonts click the **File > Save all** command or this button on the Standard toolbar: 💾.

Font(s) will be saved in FontLab Studio format (.vfb extension) to the folder where the original font was opened.

If this option in the **General Options > Open & Save** page of the **Options** dialog box is active:



☑ Create backup files

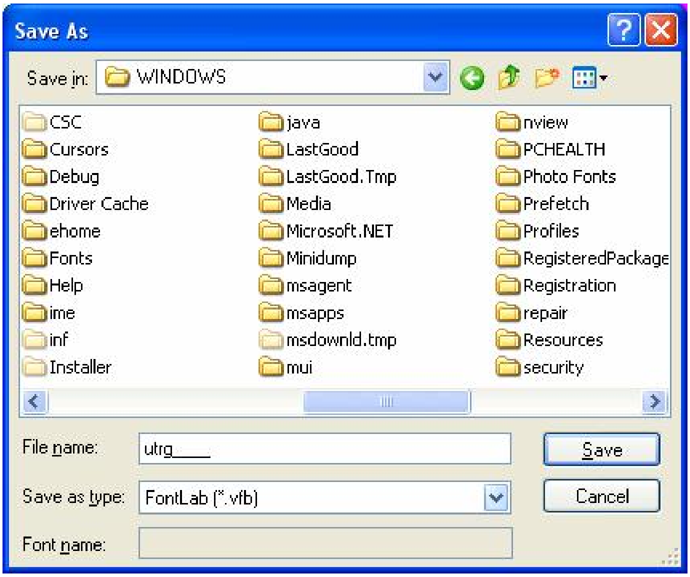
FontLab Studio will save the previous version of your font in the same folder as the currently saved .vfb file but will use the .bak file extension instead. If you would like to go back and open the previous (backup) version of your .vfb file, use File > Open, navigate to the folder in that you saved your file and type in ***.bak** in the File name field, then press Enter. You will then see the backup file and will be able to open it.

If you are working with a new font or you want to select the destination folder or change the name of the file, use the **File > Save As** command.

Please note that you cannot save fonts with more than 6,400 glyphs. If you try to save a bigger font you will see a warning message that will recommend splitting a font into smaller parts. If you want to work with bigger fonts consider using our AsiaFont Studio product. More information about it is available at this page:

http://www.fontlab.com/asiafontstudio/

After you select **File > Save As** in the menu, you will see the standard **File Save** dialog box:



Save in: WINDOWS

File name: utrg____

Save as type: FontLab (*.vfb)

Font name:

Choose the destination folder, enter the file name and click **Save** to save your font in FontLab format (.vfb).

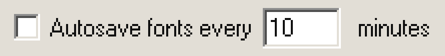
See the "Generating Fonts" chapter to know how to save fonts in other formats.

Autosave

If you want to protect yourself from system or program crashes you can use the Autosave function that will periodically save the current font.

To activate and customize this feature, open the **Tools > Options** dialog box and select the **General Options > Open & Save** page.

You will see the **Autosave** controls:



□ Autosave fonts every 10 minutes

Use the check box to activate Autosave and enter the time interval (in minutes) at which you want to save the font.

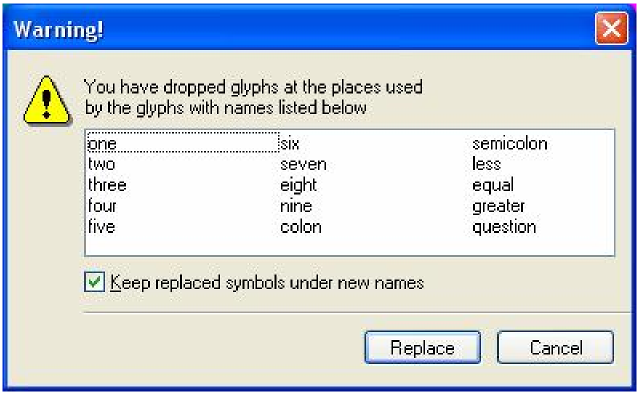
Font will be saved into the Autosave folder within the Application user data folder, typically My Documents\FontLab\Studio5, and will be named using the following structure:

flsX.save.vfb, where **fls** are the first 3 letters of Font Name and the **X** is some unique value.

If **Autosave** was active and you have a system or program crash, you can open your last saved font from the Autosave folder.

Copying and Pasting Glyphs

To copy selected glyphs, select the **Copy** command from the **Edit** menu. Note that this copies not only the glyph outline, but also the glyph information, such as its name. The selected glyphs will be placed in the Windows Clipboard and **can be pasted** into the same font or into another font by the **Paste** command from the same menu. Glyphs from the Clipboard will be placed starting from the first selected glyph in the destination font. If the destination position is occupied by existing glyphs a warning dialog box appears:



Warning!

You have dropped glyphs at the places used by the glyphs with names listed below

one	six	semicolon
two	seven	less
three	eight	equal
four	nine	greater
five	colon	question

☑ Keep replaced symbols under new names

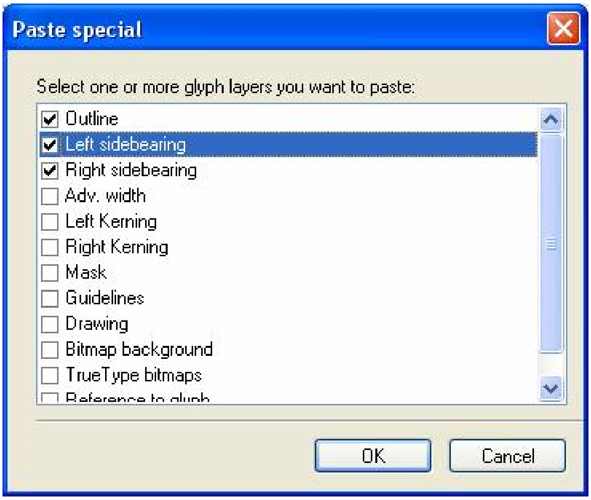
Leave **Keep replaced symbols under new names** checked to save the glyphs (I.e. put the new glyphs in the cells and move the existing glyphs to cells at the end of the encoding) or clear it to replace them (I.e. delete the existing glyphs).

If you select the **Cut** command instead of the **Copy** command the glyphs will be copied to the Clipboard but will be deleted from the source positions.

If you prefer to use the drag-drop method to copy glyphs within a font window you may do this with the help of the **CTRL** key. To make a copy of a glyph, select it (you may select many glyphs at once); position the mouse cursor on the selection; press the left mouse button; press the **CTRL** key; and drag the selection to the place where you want it to be copied. It is important to have the **CTRL** key pressed when you release the mouse button.

The Paste Special Command

When the common **Paste** command is used all the glyphs' layers are pasted from the Clipboard including guidelines, bitmap background, mask etc. To get more control over the pasting procedure use the **Paste Special** command in the **Edit** menu. The Paste Special dialog appears:



Paste special

Select one or more glyph layers you want to paste:

- ☑ Outline
- ☑ Left sidebearing
- ☑ Right sidebearing
- □ Adv. width
- □ Left Kerning
- □ Right Kerning
- □ Mask
- □ Guidelines
- □ Drawing
- □ Bitmap background
- □ TrueType bitmaps
- □ Reference to glyph

to let you choose what glyph information you are pasting. Check the checkboxes in the list for information that you want to be pasted.

Check **Use the measurement line while copying sidebearings** to calculate glyphs' sidebearings on the basis of the measurement line. Read more about this line in the "Glyph Window" chapter.

If you want to replace glyphs with the same names just switch the **Ignore destination selection, map glyphs by name** option.

Click **OK** to finish pasting glyphs.

When pasting with this special command the destination selection does not have to be continuous, i.e. you can select cells to be replaced in any order and combination. The selection is ignored if you choose to map glyphs by their names.

Copying Glyphs to Another Font

You can use two methods to copy glyphs from one font to another:

1) Use the **Copy** and **Paste** (**Paste Special**) commands from the **Edit** menu as described, or

2) Drag them to the other font and drop them there. The drag-drop method is easier and more visual.

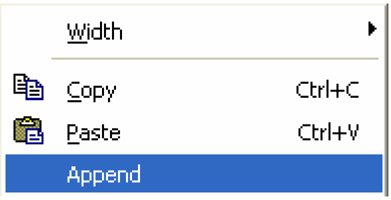
Appending Glyphs to the Font

Instead of the **Edit > Paste** command you can use the **Append** command from the Font window context menu to add glyphs from the Clipboard to the font.

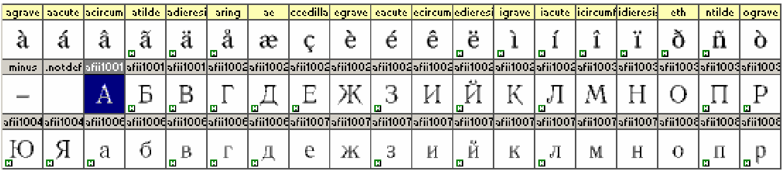
When FontLab Studio appends glyphs, it respects the glyph names and Unicode codepoints, so on the first attempt glyphs will be placed in the expected code positions in the font.

Here is an example. Your first font contains Latin glyphs but has no Cyrillic glyphs. A second font is a Cyrillic font with the matching style and you want to add Cyrillic support to the first font.

1. Select the Cyrillic glyphs in the second font (this will be easy if you select the 1251-Cyrillic codepage or the Cyrillic Unicode range) and copy them to the Clipboard.
2. Return to the first font; right-click the Font window; and click on the **Append** command in the context menu:



3. The Cyrillic glyphs will be appended to the font with their correct Unicode codepoints and names, so you will not have to re-map the font.



agrave	aacute	acircum	atilde	adieresi	aring	ae	ccedilla	egrave	eacute	ecircum	edieresi	igrave	iacute	icircumf	idieresi	eth	ntilde	ograve
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	ð	ñ	ò
minus	.notdef	afii1001	afii1001	afii1001	afii1002	afii1002	afii1002	afii1002	afii1002	afii1002	afii1002	afii1002	afii1002	afii1003	afii1003	afii1003	afii1003	afii1003
–		А	Б	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н	О	П	Р
afii1004	afii1004	afii1006	afii1006	afii1006	afii1006	afii1006	afii1007	afii1007	afii1007	afii1007	afii1007	afii1007	afii1007	afii1007	afii1007	afii1008	afii1008	afii1008
Ю	Я	а	б	в	г	д	е	ж	з	и	й	к	л	м	н	о	п	р

Copying Composite Glyphs

If you copy composite glyphs (instead of having their own outlines composite glyphs are built from references to other glyph outlines) to another font, FontLab Studio will try to not decompose (replace references to glyph with actual glyph copies) them. Instead it will try to find matching components in the glyph set that was copied or, if some components are not present there – in the destination font.

If FontLab Studio can completely restore composites in the destination font it will even keep TrueType hinting programs for these glyphs.

Drag-Drop of the Composite Glyphs

If you prefer to use the drag-drop method to copy composite glyphs you have one additional option: when you drop a composite glyph and FontLab Studio finds that one or more of its components were not selected to copy and do not present in the destination font, it shows a message asking you if you want to copy all the missing components. If your answer is **Copy**, then FontLab Studio will automatically append all the necessary components to the destination font so that all the composites stay unchanged. Otherwise FontLab Studio will decompose glyphs.

✐ ***Note***: The described behavior is possible only when both the source and destination fonts have the same Font UPM value.

Duplicating Unicode codepoints

In FontLab Studio you may assign more than one (up to 63, actually) Unicode codepoints to a glyph. Visually this means that a glyph that has several Unicode indexes will appear several times when one of the Unicode modes (Ranges or Codepages modes) is selected in the Font window. All copies of the glyph are marked by a small blue mark in the left-top corner of the glyph cells.

To make a duplicate of a glyph, select it (you may select many glyphs at once); position the mouse cursor on the selection; press the left mouse button; press the **CTRL** and **ALT** keys; and drag the selection to the place where you want it to be duplicated. It is important to have the **CTRL** and **ALT** keys pressed when you release the mouse button.

You can later correct Unicode codepoints assigned to the glyph by using the Rename Glyph dialog or the Glyph Properties panel (described later).

Deleting Glyphs

To remove glyphs from the font

1. Select the glyphs that you want to remove.
2. Select the **Delete** command from the **Edit** menu or from the popup menu. Or, press the **DELETE** key on the keyboard.
3. A dialog box appears asking you if you are sure that you want to delete.

✐ ***Note 1***: Deleting glyphs from the font is not undoable, so save your work before deleting glyphs.

✐ ***Note 2***: If you are in Unicode mode and deleting glyphs with the blue mark in the top-left corner, they may be removed without any questions because they are just one of the indexes of a multi-Unicode glyph.

Creating New Glyphs

If you want to create a new glyph in an empty place in the font (a grey cell in the Font window), double-click the cell.

If you want to create a group of new glyphs with a single command, select the cells and use the **Glyph > Create Glyphs** command.

If the selected cells are occupied by existing glyphs a warning dialog box appears as when you paste from the Clipboard.

If you are creating glyphs “in the yellow zone”, names and Unicode codepoints are assigned to the newly created glyphs according to the selected encoding table.

You also can use the **Glyph > Create Glyphs If Empty** command to create new glyphs only in the cells that are not occupied by existing glyphs. This command is available only for the encoded glyph cells.

By default, the newly created glyphs will be **blank** and will have a default advance width. If **Tools > Options > Font window > Create Glyphs command generates them if possible** is enabled, FontLab Studio will attempt to generate the glyphs that are being created. For example, if your font includes the basic English letters and some diacritic marks, and you try to create some Western or Central European accented glyphs, they will be automatically generated so the appropriate components will be placed into the glyph. See the section on Generate Glyphs command.

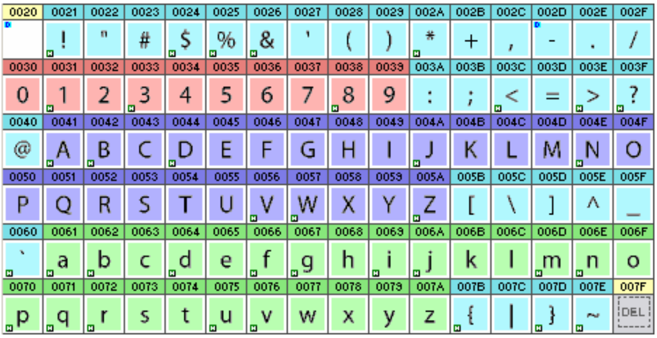
If **Tools > Options > Font Window > Templates > Put glyph template images in Background layer when creating new glyphs** is enabled, FontLab Studio will automatically place the grey glyph template images into the bitmap Background layer. You can use these as reference for drawing your glyphs or autotrace them using one of the **Tools > Background** commands

Marking Glyphs

Sometimes you need to visually differentiate groups of glyphs to easily examine and select them.

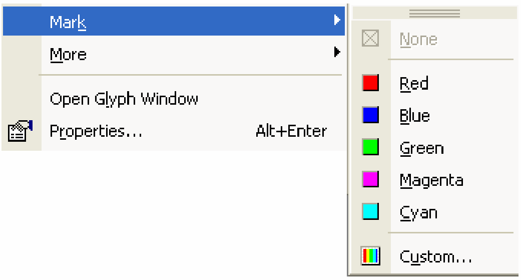
With marking you can add color to a glyph cell in the Font window. There are five predefined colors: **red**, **blue**, **green**, **magenta** and **cyan** and a command for selecting a custom color.

Marking is useful when you want to add structure to a font – for example, make a visual difference between digits, uppercase and lowercase glyphs. If you want to use this information internally (in macros), we recommend you use glyph classes (described in the "OpenType Fonts" chapter), but if you only want to have visual differentiation, marking is OK:



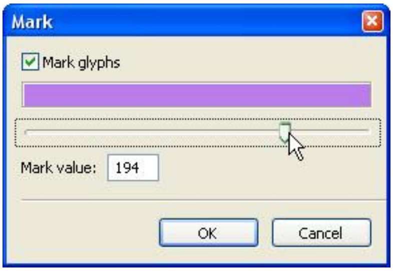
0020	0021	0022	0023	0024	0025	0026	0027	0028	0029	002A	002B	002C	002D	002E	002F
	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
0030	0031	0032	0033	0034	0035	0036	0037	0038	0039	003A	003B	003C	003D	003E	003F
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0040	0041	0042	0043	0044	0045	0046	0047	0048	0049	004A	004B	004C	004D	004E	004F
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	005A	005B	005C	005D	005E	005F
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
0060	0061	0062	0063	0064	0065	0066	0067	0068	0069	006A	006B	006C	006D	006E	006F
`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0070	0071	0072	0073	0074	0075	0076	0077	0078	0079	007A	007B	007C	007D	007E	007F
p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

To mark the glyphs, select them in the Font window; right-click; and select the marking color in the **Mark** submenu of the context menu:



To remove marking, select the marked glyphs; right-click; and select the "empty" rectangle ☒ in the **Mark** menu.

To mark the selected glyphs with a custom color, select the **Custom** command in the **Mark** submenu of the context menu. You will see the following dialog:

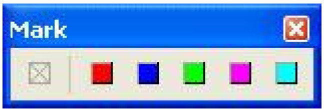


☑ Mark glyphs

Mark value: 194

Enable the checkbox and use the slider to select your custom color or enter its numeric value in the edit box. Click **OK** to mark the glyphs.

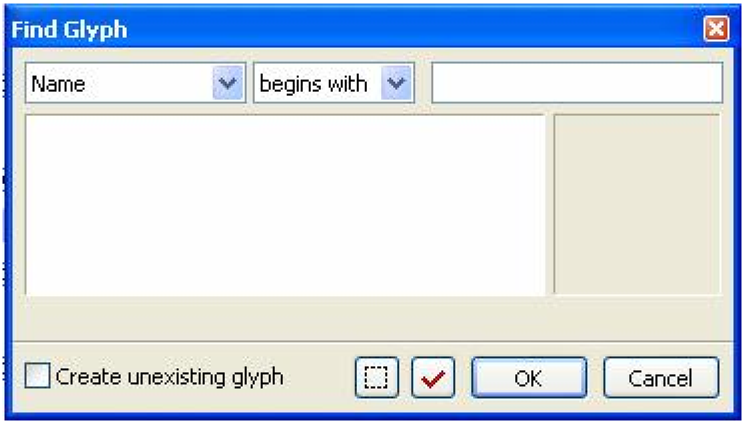
To simplify repetitive marking operations you can drag the mark menu by its tiny header and convert it into a toolbar:



To remove the color mark, click on the "None" button within the Mark submenu/toolbar, or uncheck the checkbox in the Custom Mark dialog.

Searching for Glyphs

Sometimes you need to find a particular glyph in your font, especially in large fonts. Select the **Find** command in the **Edit** menu or press CTRL+BACKSPACE on the keyboard. You will see a dialog box:



To find a glyph:

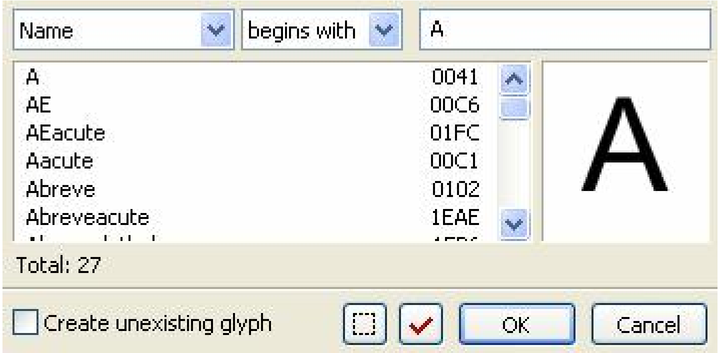
1. In the left-top combo box select the method by which you want to search for the glyph:

Name	Searches for the glyphname
Code	Searches for the decimal local character code of the glyph in the current encoding or codepage
ANSI character	Searches for the glyph that is mapped to one of the ANSI glyphs in the selected codepage or encoding
Unicode index	Searches for glyphs with Unicode codepoint attributes given
Width	Searches for glyphs with the width in the selected range
Bottom, Top	Searches for glyphs whose bottom or top line falls in the specified range
Components	Searches for glyphs that have the specified number of components
Glyph index	Searches for glyphs with their index attributes given.

3. In the combo box to the right of the method select the comparison factor: begins with, equals to, less than, more than, etc.

4. In the right-top editing field enter the information (depending on your selection) that will be used to find the glyph.

5. The names of all the glyphs that match the criterion will appear in the list.



Name | begins with | A

A	0041
AE	00C6
AEacute	01FC
Aacute	00C1
Abreve	0102
Abreveacute	1EAE

Total: 27

□ Create unexisting glyph

Select the glyph name that you want (its preview appears in the preview panel) and press **OK**, or enter more information to narrow your search.

Use the buttons at the bottom of the dialog box for additional features:

⬚ to select all found glyphs in the Font window

✓ to mark all found glyphs in the Font window in red.

These features are very useful for managing big fonts. For example: open the **Find Glyph** dialog box; change it to Names mode and enter ‘A’ as the search pattern. In a standard Latin font it will list all glyphs that begin with the uppercase A:

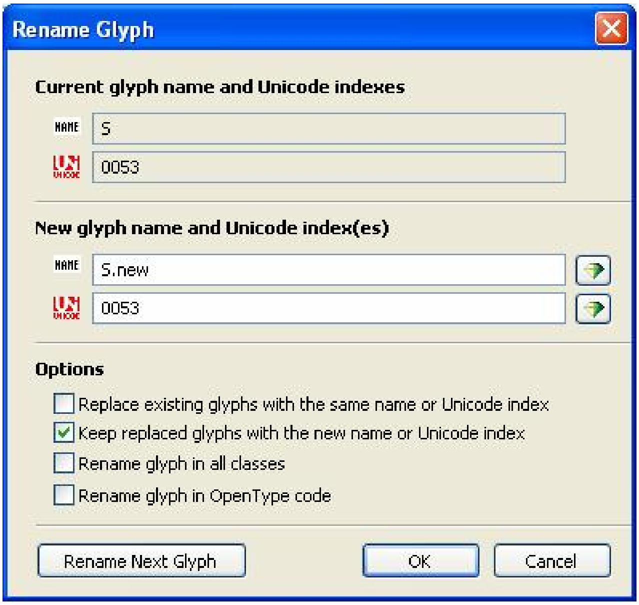
A
Aacute
Acircumflex
Adieresis
AE
Agrave
Aring
Atilde

If you mark or select them, you can easily create a glyph group that you can use in advanced features, like class-based kerning or OpenType features.

Renaming Glyphs

Usually it is not necessary to manually rename glyphs because their names and Unicode codepoints are assigned automatically when you move glyphs in the Font window. But if you want to see the information and correct it, select the **Rename Glyph** command from the **Glyph** menu. Or just press CTRL+\ on the keyboard.

You will see a dialog box:



Rename Glyph

Current glyph name and Unicode indexes

NAME: S

UNICODE: 0053

New glyph name and Unicode index(es)

NAME: S.new

UNICODE: 0053

Options

□ Replace existing glyphs with the same name or Unicode index

☑ Keep replaced glyphs with the new name or Unicode index

□ Rename glyph in all classes

□ Rename glyph in OpenType code

In the top part of the dialog box you see the current name and Unicode codepoint (indexes) of the glyph. In the middle there are two edit fields where you may change the information. Below them lie the options controls.

To change a glyph's name enter a new name in the **Name** field. If this glyph has a properly assigned Unicode codepoint and you want to find the name mapped to that index in FontLab Studio's database press the **Auto** button to the right of the edit field and FontLab Studio will fill in the **Name** field for you.

If the option **Replace existing glyphs with the same name or Unicode codepoint** option is not checked then, if you enter a name that is already assigned to one of the font's glyphs, the **OK** button will be disabled and you will not be able to assign that name. Switch the option on to allow FontLab Studio to replace glyphs. Use the next option to control how FontLab Studio does the replacement.

Use the **Unicode** edit field to change a glyph's Unicode codepoints. You may enter more than one Unicode codepoint separated by a space. Use the **Auto** button to find the Unicode codepoints mapped to a glyph's name in FontLab Studio's database.

Rename glyph in all classes – this option will automatically change the glyph name in all classes that contain the glyph being renamed.

Rename glyph in OpenType code – this option will automatically change the glyph name in all OpenType features that contain the glyph being renamed.

Press the **OK** button to assign a new name to the glyph. You will see that the glyph moves to a new place in the Font window depending on the currently selected encoding vector, Unicode range or codepage.

If you want to rename more glyphs, press the **Rename Next Glyph** button. A new name will be assigned to the current glyph (as if you had pressed the **OK** button) and data from the next glyph will appear for editing.

To just change the existing glyph name **suffix**, choose **More > Add Suffix to Name** from the Font Window context menu, choose a new suffix and enable **Replace existing new suffix**.

To rename glyph names in an OpenType Layout feature definition code, click on the **Rename glyph in OT code** button on the OpenType panel.

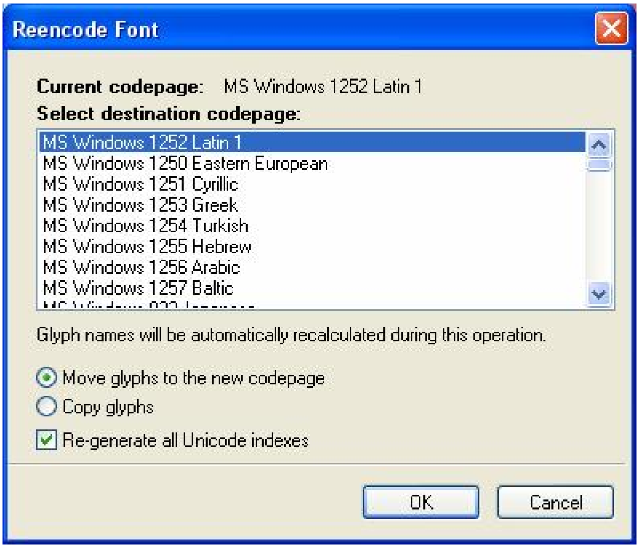
Reencoding the Font

In FontLab Studio you can assign names from the encoding vector to glyphs that are sorted in the Font Window according to a different encoding vector. Or you can assign Unicode codepoints from one codepage to the currently selected (different) codepage if the Font window is in Codepages mode.

In this operation FontLab Studio takes encoded glyphs (glyphs that are in the yellow zone of the Font window's glyph chart) one by one and assigns names or Unicode codepoints from the encoding vector (or codepage) that you select.

To reencode glyphs, select the Names or Codepages mode in the Font window. Select the Names mode to assign new names and the Codepages mode to assign new Unicode codepoints. Then select the **Reencode Glyphs** command from the **Glyph > Glyph Names** menu.

Depending on the selected mode you will see one of the following dialog boxes:



Reencode Font

Current codepage: MS Windows 1252 Latin 1

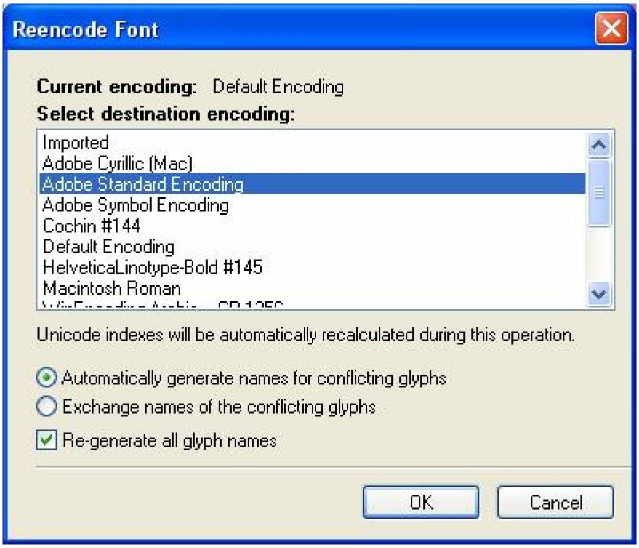
Select destination codepage:

MS Windows 1252 Latin 1
MS Windows 1250 Eastern European
MS Windows 1251 Cyrillic
MS Windows 1253 Greek
MS Windows 1254 Turkish
MS Windows 1255 Hebrew
MS Windows 1256 Arabic
MS Windows 1257 Baltic

Glyph names will be automatically recalculated during this operation.

● Move glyphs to the new codepage
○ Copy glyphs
☑ Re-generate all Unicode indexes

*Codepage version of the **Reencode Font** dialog box*



Current encoding: Default Encoding

Select destination encoding:

- Imported
- Adobe Cyrillic (Mac)
- Adobe Standard Encoding
- Adobe Symbol Encoding
- Cochin #144
- Default Encoding
- HelveticaLinotype-Bold #145
- Macintosh Roman

Unicode indexes will be automatically recalculated during this operation.

● Automatically generate names for conflicting glyphs
○ Exchange names of the conflicting glyphs
☑ Re-generate all glyph names

Encoding version of the ***Reencode Font*** *dialog box*

Select the codepage or encoding table to which you want to reencode the glyphs and set the options necessary to control the reencoding process:

Codepages mode:

Move glyphs to the new codepage	Removes currently assigned Unicode codepoints and assigns new ones. Visually this means that glyphs are moved to their new places
Copy glyphs	Add new Unicode codepoints. Visually this means that glyphs having more than one Unicode codepoint assigned are copied to their new places
Re-generate all Names	All glyphs will get their names based on Unicode.

Encoding mode:

Automatically generate names for conflicting glyphs	If a glyph with the same name as one of the reencoding glyphs needs to be changed a new name will automatically be generated
Exchange names of the conflicting glyphs	If a glyph with the name that needs to be assigned already exists, it will get the name of the reencoded glyph, so visually the glyphs will be exchanged
Re-generate all Unicode codepoints	All glyphs will get Unicode codepoints based on new names.

Some Examples

Situation 1: You want to make a TrueType font that will have a non-windows codepage in Windows, say, one of the DOS codepages:

1. Select the desired new codepage in the Codepages mode of the Font window
2. Place all glyphs as necessary.
3. Save this “properly encoded” version of the font.
4. Select the **Reencode Glyphs** command.
5. Choose the Windows Symbol codepage and the “Move” option. Press **OK**.
6. See the results in the Font window.

Do not forget to set the Symbol glyph set in the Font Info before exporting this font.

Situation 2: You imported a Type 1 font with non-standard encoding andwant to save it with standard encoding to be sure that it will work in all Windows.

1. Select the **Reencode Glyphs** command.
2. Choose the Default Encoding and “Generate Names” options. Press**OK**.
3. See the results in the Font window.

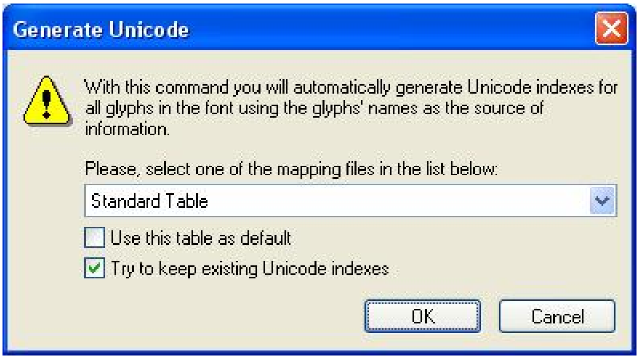
Unicode-Related Operations

Several commands in the **Glyph > Glyph Names** menu work with the font's Unicode information.

Generating Unicode codepoints

To automatically generate Unicode indexes for all the glyphs in the font, select the **Generate Unicode** command from the **Glyph > Glyph Names** menu.

You will see the dialog box:



Generate Unicode

With this command you will automatically generate Unicode indexes for all glyphs in the font using the glyphs' names as the source of information.

Please, select one of the mapping files in the list below:

Standard Table

□ Use this table as default

☑ Try to keep existing Unicode indexes

This dialog lets you choose the mapping file. The structure of a mapping file is described below, but its purpose is simple: to map Unicode codepoints to a set of predefined names.

Set the options helping to control the process:

Use this table as default	The selected mapping file will become the default one. You will not need to select it again the next time the dialog opens
Try to keep existing Unicode codepoints	If this option is on glyphs having Unicode codepoints assigned will keep them untouched
Assign PUA indexes to unencoded glyphs	If this option is on FontLab Studio will assign to unencoded glyphs Unicode indexes from Private Use Area
Apply only to selected glyphs	If this option is on FontLab Studio will apply the operation to the selected cells only.

You select the appropriate file and click **OK**. Then FontLab Studio will:

1. Remove all Unicode data if **Try to keep existing Unicode indexes** is off.
2. Search the selected name-Unicode database for each glyph's name.
3. If the name is in the database it adds the Unicode codepoint linked with this name to the glyph's list of Unicode codepoints.
4. Because the database may link more than one Unicode codepoint with a name, steps 2 and 3 are processed whenever a glyph's name is found in the database.

Structure of the Name-Unicode Database

The database that links Unicode codepoints and glyph names is nothing more than a text file, standard.nam or agl.nam, located in the**Program Files\Common Files\FontLab\Mapping** folder that has the following structure:

```
%%FONTLAB STUDIO NAMETABLE[: Database_name]
0x0000 .notdef
0x0002 nonmarkingreturn
0x0020 visiblespace
0x0020 space
. . . . . . . . .
```

The first line of this file is a signature that is used to show that this file is a properly defined database file. This line may contain the database name like in agl.nam:

```
%%FONTLAB STUDIO NAMETABLE: Adobe Glyph List
```

The lines that follow the signature have a very simple structure:

<Unicode codepoint> <name>

The Unicode codepoint may be in decimal or hex (started with ‘0x’) form. The name should not have any spaces. Names are case sensitive.

One Unicode codepoint may be linked with more than one name and several Unicode codepoints may be linked with one name.

If the name is preceded with the ‘!’, it means that Unicode may be generated from the name but none of the marked names may be generated when the Unicode codepoint is known. This is necessary when none of the glyph’s names is included in the list of standard names supported by Adobe (Adobe Glyph List). This feature makes it possible to generate correct Unicode codepoints for incorrectly named glyphs but will never assign incorrect names.

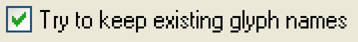
You can extend these files in any text editor, but we strongly recommend not changing them.

Generating Names

This operation is the opposite of the one described in the previous section. If you select the **Generate Names** command in the **Glyph > Glyph Names** menu, FontLab Studio will use the name-Unicode database to automatically find names for glyphs whose Unicode codepoints are in the database.

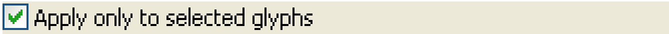
Note that if more than one name is linked to the Unicode codepoint, FontLab Studio will use the one that is first in the database.

If some of the glyphs don't have any Unicode codepoints, FontLab Studio will try to keep their names unchanged. Use the following option in the dialog box to control this feature:



☑ Try to keep existing glyph names

You may generate names for selected glyphs if you use the following option:



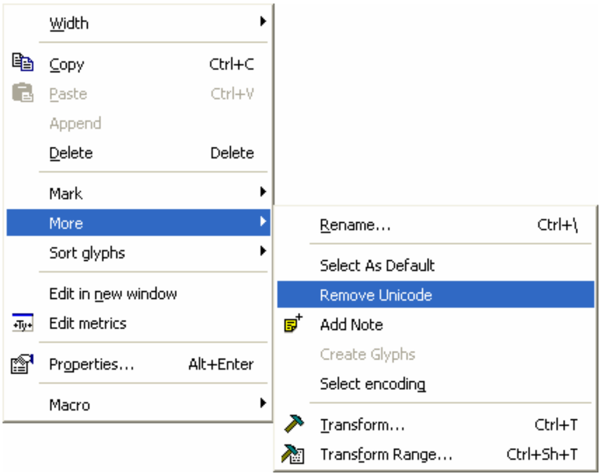
☑ Apply only to selected glyphs

Removing Unicode Information

If you want to reset the Unicode information in your font, select the **Clear Unicode** command from the **Glyph > Glyph Names** menu. All Unicode information will be removed from all glyphs in the font. This operation cannot be applied to selection.

You may **selectively remove Unicode codepoints** from glyphs selected in the Font window:

1. Select the glyphs.
2. Right-click the selection and choose the **Remove Unicode** command from the **More** submenu of the context menu:



FontLab Studio will remove the Unicode codepoints from all selected glyphs.

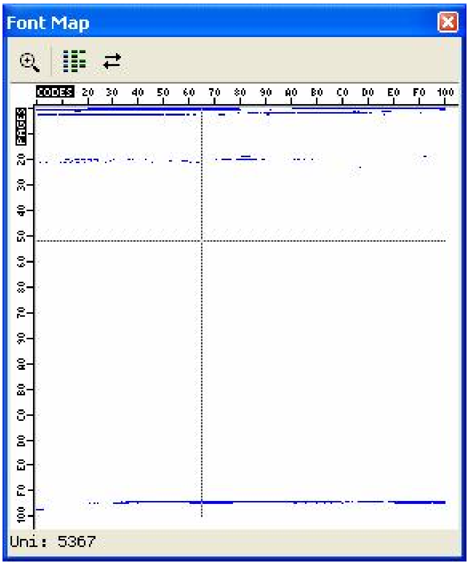
The Font Map Panel

When you work with really big Unicode-encoded fonts, you may need to have an overview of your whole font. FontLab Studio has a special panel, called the Font Map, which can represent the entire Unicode code space as a set of 256 x 256 pictures where every pixel represents a double-byte code and every picture is a plain.

Every pixel row in this picture represents a Unicode page – 256 Unicode codepoints which begin with the same code. For example, codes A700-A7FF will form one row.

Every pixel in the row represents an individual code.

To open the **Font Map** panel, use the **Font Map** command in the **Window > Panels** menu. You will see a panel that consists of the code picture, toolbar and status bar:



Uni: 5367

The picture represents Plain 0 of the whole Unicode codespace: codes 0000-FFFF.

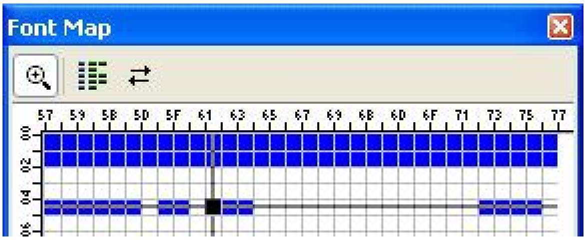
The buttons on the toolbar mean:

🔍 Turns on zoom mode

▦ Changes the Font Map to double-byte codepage mode

⇄ Updates the contents of the Font Map

By clicking the 🔍 button on the toolbar you can zoom in on part of the Font Map:



In this mode it is much easier to manage individual codes. To scroll a zoomed Font Map, press the left mouse button and drag the cursor beyond the Map borders.

If you click the Font Map, you will see the current Unicode codepoint appear on the status bar below the Map picture. The current code is highlighted with a cross hair.

Double click any code in the Map **to jump to the glyph that is mapped to it**.

To switch to another plane of the codespace, use the **Plane** control in the status bar:

Plane: 0

Font Map automatically tracks changes you make to the font. If you are not sure that it is correctly updated (this may happen with some macro programs), click on the ⇄ button **to manually update the Map**.

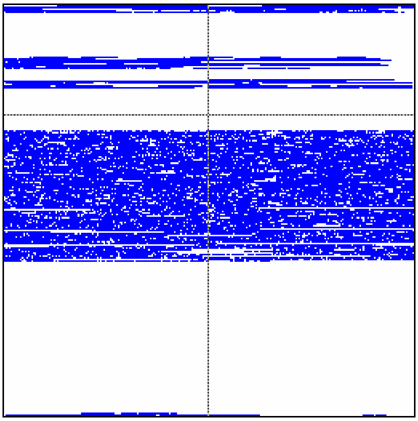
Managing Double-Byte Codepages

If you are working on a CJKV (the acronym for Chinese, Japanese, Korean and Vietnamese) font, you may want to look at your font in a double-byte codepage.

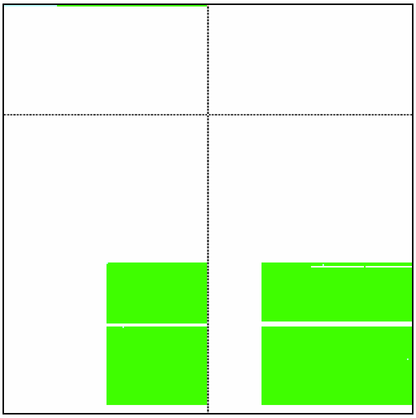
Open the Font Map panel and in the Font window of your font select one of the double-byte codepages.

You will see this button ▦ enabled in the Font Map toolbar. Click it and you will see the Font Map rearrange to represent your font with the applied double-byte codepage. In this mode every row represents 256 glyphs that are “assigned” to the specific first byte.

In the following picture you can see a Traditional Chinese font in Unicode mode (in the left picture) and in Codepage 950 mode (right):



Unicode mode



Codepage 950

In the codepage mode **green pixels** represent codes in the codepage that are covered by one of the glyphs in the font. **Cyan pixels** mean codes in the codepage that are not covered by any glyphs in the font.

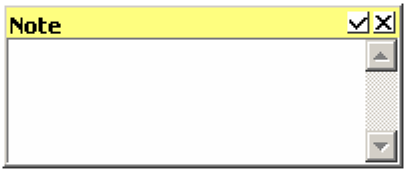
Notes

Sometimes you may need to add a description or some other information to a glyph. In FontLab Studio you can do that using the Notes function.

A Note is a small text box that you can attach to the glyph. It is visible in the Font window and in the Glyph window.

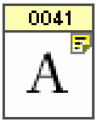
To add a note to a glyph in the Font window: left-click it; press the right mouse button; and select the **Add Note** command in the context menu.

You will see a Note window:



Enter the text of the note and click the ☑ button in the caption bar to accept changes or ☒ to reject the changes and close the window. There are also keyboard shortcuts: **Ctrl+Enter** to accept changes or **Esc** to exit.

If you have entered something in the note box you will see the note icon appear in the glyph cell:



The cell is also marked as changed but not saved.

To open the note, click the right button on the note icon. You will see the note window with the text of the note. The window will disappear when you release the button.

To edit a note, double-click the note icon or select the **Add Note** command from the context menu.

To remove the note, open it for editing and remove the text.

You can make the note icons invisible in the **Font Window > Glyph Cell** section of the Options dialog**.**

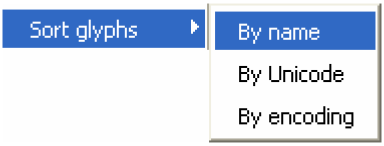
Sorting Glyphs

Sometimes you may want to sort the glyphs in a font file in some order other than their current order. There are two common reasons to do this:

1. You may need to sort glyphs to optimize a font's performance – if you place glyphs that are used most often at the beginning of the glyph collection in some cases it may improve performance.
2. You may need to sort glyphs according to some logical sequence. Some programs (for example, Adobe InDesign) have a "glyph insert" feature that shows the collection of glyphs sorted exactly as it is in the font file.

Please note that sorting of the glyphs has no effect on glyph encoding or names.

To sort the glyphs choose one of the commands in the **Sort Glyphs** submenu of the **Glyph** menu:



This is the list of sorting options:

By Name	Glyphs are sorted alphabetically by their names in ascending order
By Unicode	Glyphs are sorted by the assigned Unicode codepoints in ascending order. Glyphs that don't have Unicode codepoints are stored at the end of the glyph collection
By Encoding	Glyphs are sorted according to the encoding table currently selected in the Names mode. This option allows you to customize the sorting order using the definition encoding tables.

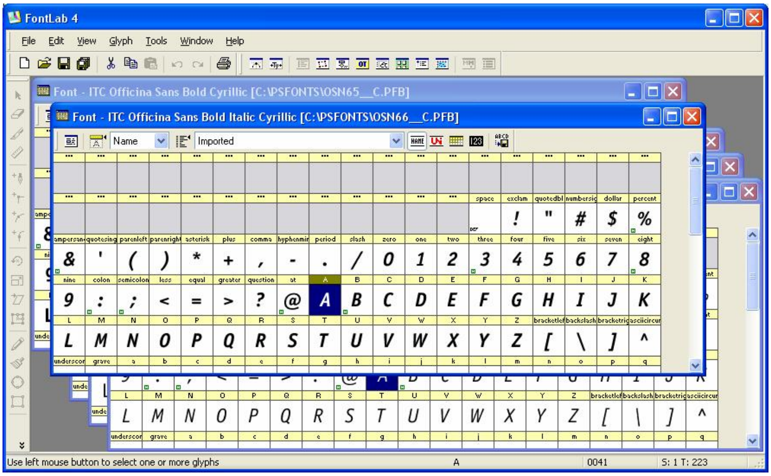
To preview the result of sorting, switch the Font window to the Index mode by clicking this button: 123 in the Font Window command bar.

Working with Multiple Fonts

In FontLab Studio you can open many fonts at once. Since every font has its own Font window sometimes the FontLab Studio workspace becomes so crowded with windows that finding a particular font is not easy. This section will explain how to use FontLab Studio tools that are specially designed to help you manage many open fonts simultaneously.

To open many fonts you can use the standard **File > Open** command, then select many font files using **CTRL** and **SHIFT**-click in the **File Open** dialog box. You can also select font files in Windows Explorer and drag them to the FontLab Studio window – all of them will be opened.

When you open 15 fonts the FontLab Studio window might look like this:



Font - ITC Officina Sans Bold Cyrillic [C:\PSFONTS\OSN65__C.PFB]

Font - ITC Officina Sans Bold Italic Cyrillic [C:\PSFONTS\OSN66__C.PFB]

Use left mouse button to select one or more glyphs A 0041 S: 1 T: 223

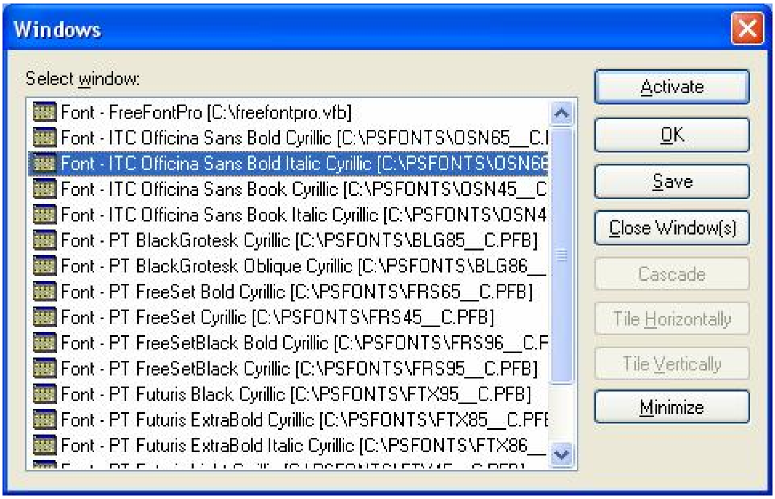
which is not the best way to work. Add to this picture a few open Glyph and Metrics windows and you will see why workspace management is necessary.

Windows List

The easiest way to manage open windows is to use the **Window** menu. It contains some very useful commands:

Cascade	Organizes open windows in a cascade like in the picture above
Tile horizontally **Tile vertically**	Organizes windows like tiles on a rectangular floor
Windows…	Opens the **windows management** dialog box.

Choose the **Windows** command and you will see a dialog box:



Font - FreeFontPro [C:\freefontpro.vfb]
Font - ITC Officina Sans Bold Cyrillic [C:\PSFONTS\OSN65__C.I
Font - ITC Officina Sans Bold Italic Cyrillic [C:\PSFONTS\OSN66
Font - ITC Officina Sans Book Cyrillic [C:\PSFONTS\OSN45__C
Font - ITC Officina Sans Book Italic Cyrillic [C:\PSFONTS\OSN4
Font - PT BlackGrotesk Cyrillic [C:\PSFONTS\BLG85__C.PFB]
Font - PT BlackGrotesk Oblique Cyrillic [C:\PSFONTS\BLG86__
Font - PT FreeSet Bold Cyrillic [C:\PSFONTS\FRS65__C.PFB]
Font - PT FreeSet Cyrillic [C:\PSFONTS\FRS45__C.PFB]
Font - PT FreeSetBlack Bold Cyrillic [C:\PSFONTS\FRS96__C.F
Font - PT FreeSetBlack Cyrillic [C:\PSFONTS\FRS95__C.PFB]
Font - PT Futuris Black Cyrillic [C:\PSFONTS\FTX95__C.PFB]
Font - PT Futuris ExtraBold Cyrillic [C:\PSFONTS\FTX85__C.PFE
Font - PT Futuris ExtraBold Italic Cyrillic [C:\PSFONTS\FTX86__

Most of the dialog box is covered by the list of open windows. Select one of the windows in the list and click the **Activate** button to activate that window and move it to the top.

To close one or more windows, select them in the list and click **the Close Window(s)** button.

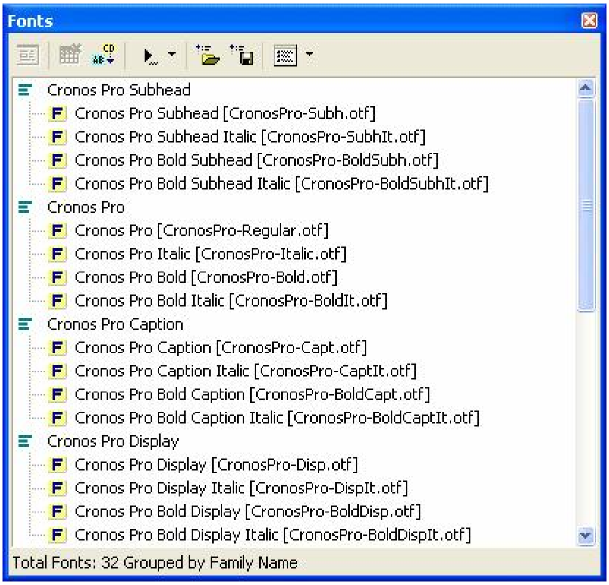
Select two or more windows in the list and click Cascade, Tile Horizontally or Tile Vertically to perform one of the operations only with the selected windows. All other windows will be automatically minimized.

Use the **Minimize** button to minimize selected windows.

Fonts Panel

The **Windows** dialog box is very powerful, but it works only on windows, without paying any attention to the contents of the windows – fonts.

To organize your open fonts, use the Fonts panel. Select the **Fonts** command in the **Window>Panels** menu. When you click on this command you will see the panel:



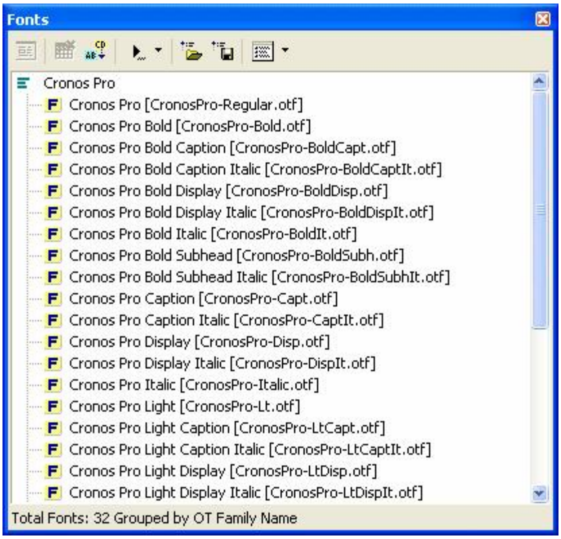
Fonts

- Cronos Pro Subhead
  - Cronos Pro Subhead [CronosPro-Subh.otf]
  - Cronos Pro Subhead Italic [CronosPro-SubhIt.otf]
  - Cronos Pro Bold Subhead [CronosPro-BoldSubh.otf]
  - Cronos Pro Bold Subhead Italic [CronosPro-BoldSubhIt.otf]
- Cronos Pro
  - Cronos Pro [CronosPro-Regular.otf]
  - Cronos Pro Italic [CronosPro-Italic.otf]
  - Cronos Pro Bold [CronosPro-Bold.otf]
  - Cronos Pro Bold Italic [CronosPro-BoldIt.otf]
- Cronos Pro Caption
  - Cronos Pro Caption [CronosPro-Capt.otf]
  - Cronos Pro Caption Italic [CronosPro-CaptIt.otf]
  - Cronos Pro Bold Caption [CronosPro-BoldCapt.otf]
  - Cronos Pro Bold Caption Italic [CronosPro-BoldCaptIt.otf]
- Cronos Pro Display
  - Cronos Pro Display [CronosPro-Disp.otf]
  - Cronos Pro Display Italic [CronosPro-DispIt.otf]
  - Cronos Pro Bold Display [CronosPro-BoldDisp.otf]
  - Cronos Pro Bold Display Italic [CronosPro-BoldDispIt.otf]

Total Fonts: 32 Grouped by Family Name

The Fonts panel contains a small toolbar in the top area and a list of open fonts. All open fonts are automatically arranged in font families using the Family Name entry in the font header (see the "Font Header" chapter).

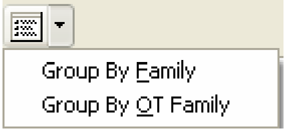
You can choose to group fonts using the OpenType Family Name entry:



Cronos Pro
Cronos Pro [CronosPro-Regular.otf]
Cronos Pro Bold [CronosPro-Bold.otf]
Cronos Pro Bold Caption [CronosPro-BoldCapt.otf]
Cronos Pro Bold Caption Italic [CronosPro-BoldCaptIt.otf]
Cronos Pro Bold Display [CronosPro-BoldDisp.otf]
Cronos Pro Bold Display Italic [CronosPro-BoldDispIt.otf]
Cronos Pro Bold Italic [CronosPro-BoldIt.otf]
Cronos Pro Bold Subhead [CronosPro-BoldSubh.otf]
Cronos Pro Bold Subhead Italic [CronosPro-BoldSubhIt.otf]
Cronos Pro Caption [CronosPro-Capt.otf]
Cronos Pro Caption Italic [CronosPro-CaptIt.otf]
Cronos Pro Display [CronosPro-Disp.otf]
Cronos Pro Display Italic [CronosPro-DispIt.otf]
Cronos Pro Italic [CronosPro-Italic.otf]
Cronos Pro Light [CronosPro-Lt.otf]
Cronos Pro Light Caption [CronosPro-LtCapt.otf]
Cronos Pro Light Caption Italic [CronosPro-LtCaptIt.otf]
Cronos Pro Light Display [CronosPro-LtDisp.otf]
Cronos Pro Light Display Italic [CronosPro-LtDispIt.otf]

Total Fonts: 32 Grouped by OT Family Name

Use the popup menu in the toolbar to select how to arrange fonts in families:



Double-click a font name in the list to activate the Font window containing that font. All other operations are accessible from the toolbar:

Opens the Font Info editor for the font selected in the list

Closes the selected font. If you have unsaved changes FontLab Studio will issue a warning message

Merges fonts – adds glyphs from the font selected in the list to the currently active font (contained in the active Font window)

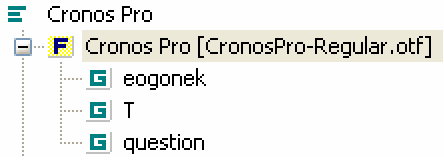
Opens a menu with macro programs that can be applied to the font selected in the list

Opens the FontLab Studio workspace file

Saves the workspace file

Allows you to arrange fonts in families using the Family Name or OT Family Name entry.

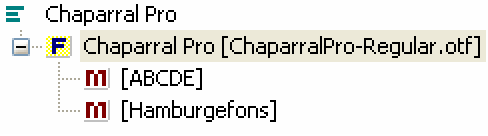
When you open some glyphs for editing, you will see names of those glyphs appear in the Fonts panel:



Cronos Pro
Cronos Pro [CronosPro-Regular.otf]
eogonek
T
question

Each glyph name is a reference to the glyph window opened with that glyph. You can use these references to bring glyph window with some glyph to the front (just double-click on the glyph name) or to close it (select it and click on the close button on the Fonts panel toolbar).

When you open some Metrics windows, you will see they also appear in the Fonts panel:



Chaparral Pro
Chaparral Pro [ChaparralPro-Regular.otf]
[ABCDE]
[Hamburgefons]

Merging Fonts

You can merge fonts – append all the glyphs from one font to another – with the **Merge Fonts** command in the **Tools** menu or in the Fonts panel. Merging fonts is very useful when you have several fonts that cover different scripts and want to combine them into one big Unicode font. Smaller fonts are easier to manage and open/save.

During this process FontLab Studio will try to keep hinting information, composite glyphs and kerning pairs. FontLab Studio will also try to keep the Unicode codepoints and names of the appended glyphs.

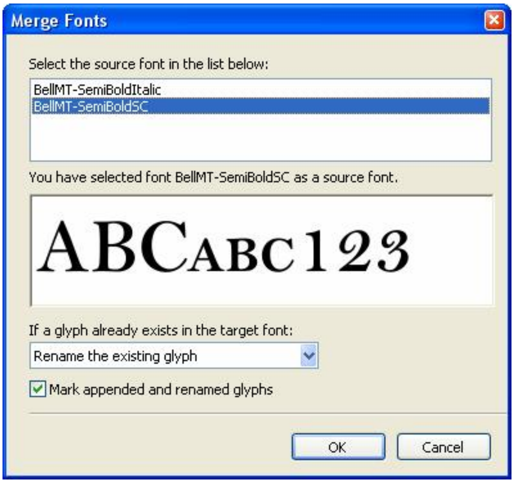
To merge fonts in the Fonts panel:

1. Open the two fonts you want to merge.
2. Open the Fonts panel.
3. Activate the font **to** which you want to append glyphs – double-click the font name in the Fonts panel.
4. In the Fonts panel select the font **from** which you want to append glyphs.
5. Click the **Append** button in the Fonts panel toolbar.

If copied glyphs have names that already exist in the destination font, FontLab Studio will **replace existing glyphs**.

To merge fonts with the menu command:

1. Open the two fonts you want to merge.
2. Activate the font **to** which you want to append glyphs.
3. Select the **Merge Fonts** command from the **Tools** menu. The Merge Fonts dialog box appears:



Merge Fonts

Select the source font in the list below:

BellMT-SemiBoldItalic
BellMT-SemiBoldSC

You have selected font BellMT-SemiBoldSC as a source font.

If a glyph already exists in the target font:

Rename the existing glyph

☑ Mark appended and renamed glyphs

4. In the font list select the font **from** which you want to append glyphs.
5. Set the desired action for the cases when glyphs have names that already exist in the destination font. You may choose to overwrite existing glyphs, or rename source or destination glyphs, or to not copy duplicate glyphs at all.
6. Click on the **OK** button to merge fonts.

Saving and Opening a Project

To keep your font project intact FontLab Studio offers some project management functions.

A Project is a set of fonts opened in FontLab Studio and information about the position and size of their font windows.

To save a project, use the 💾 button in the Fonts panel toolbar. FontLab Studio will open a standard **File Save** dialog box where you can select a name and path for the project file. FontLab Studio project files have the extension ".flw".

FontLab Studio project files are automatically generated macro programs in the Python scripting language. They are text files that you can edit with any text editor if you wish. (Recommended only for the knowledgeable and brave.)

To open a project file, use the 📂 button in the Fonts panel toolbar or simply drag-drop the .flw file onto the FontLab Studio window.

✐ Note that FontLab Studio project files won't open if Python is not installed on the System.

Saving and Opening a Workspace

A Workspace is the information about visual interface items customizable in FontLab Studio: panels, menus, toolbars and keyboard shortcuts.

To save a workspace, use the **Export Workspace** command in the **Window > Workspace** menu. FontLab Studio will open a standard **File Save** dialog box where you can select a name for the workspace file. The default destination for the workspace files is the [Application user data folder]\Workspaces folder (typically C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5\Workspace). FontLab Studio workspace files have the extension ".xml".

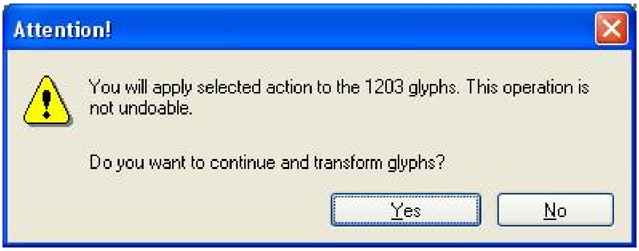
To open a workspace file, use the same **Window > Workspace** menu where all workspaces that were stored in the above mentioned folder are listed.

Before opening the saved workspace FontLab Studio will ask you whether you want to save the current user interface configuration.

Applying Modifications

You can find many modification commands in the **Contour**, **Glyph** and **Tools** menus that can be applied to the open glyph in the Glyph window (see the "Glyph Window" chapter), but most of them are applicable to the glyph(s) selected in the Font window.

To apply a modification command, select the glyphs in the Font window and choose the appropriate command in the **Contour**, **Tools** or **Glyph** menu. For example, to convert glyphs from TrueType outlines to Type 1 outlines, select the glyphs that you want to convert and choose the **Contour > Convert > Curves To PostScript** command. If more than 128 glyphs were selected for transformation, you will see the warning message:



You will apply selected action to the 1203 glyphs. This operation is not undoable.

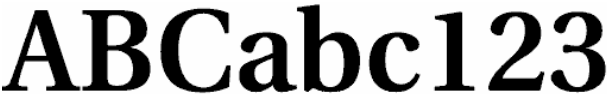
Do you want to continue and transform glyphs?

Click **Yes** and FontLab Studio will apply the command to all selected glyphs.

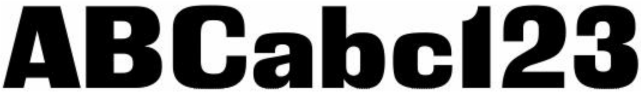
You can find descriptions of all modification commands in the chapter "Glyph Window". Please also refer to the "Actions" chapter for related information.

Blending Fonts

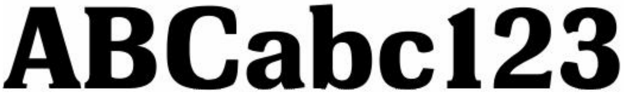
With FontLab Studio you can automatically blend two fonts and generate an intermediate version of them:



First font



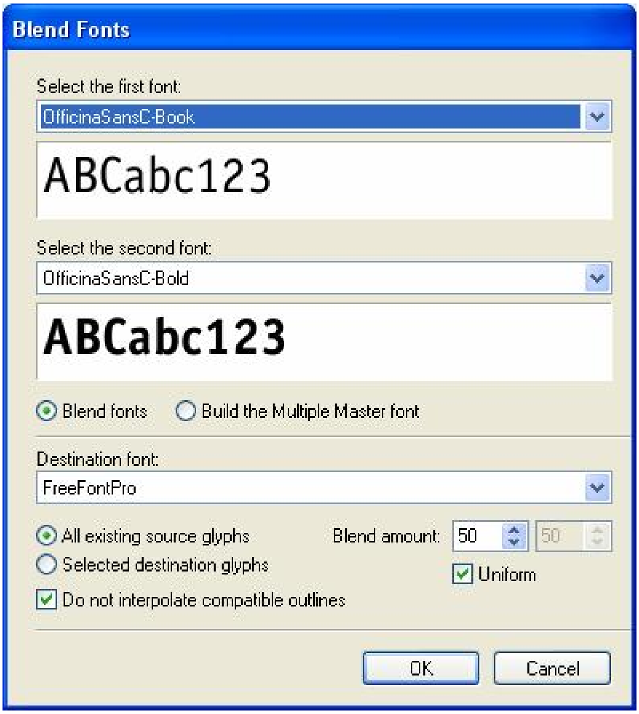
Second Font



Resulting font (50% blend)

The font blending process is completely automatic, it analyses the shapes of glyphs and tries to find the best way to morph one to another. Best example of blend feature is to make a font that has weight intermediate to two existing weights.

You must have at least two fonts open to use the Blend fonts operation. To activate the Blend feature, select the **Blend fonts** command from the **Tools** menu. A dialog box appears:



Blend Fonts

Select the first font: OfficinaSansC-Book

ABCabc123

Select the second font: OfficinaSansC-Bold

ABCabc123

● Blend fonts ○ Build the Multiple Master font

Destination font: FreeFontPro

● All existing source glyphs
○ Selected destination glyphs
☑ Do not interpolate compatible outlines

Blend amount: 50 50
☑ Uniform

The dialog box is divided into three sections. The first two sections let you specify the fonts to blend. To select the first or second font choose the font name in the list. The Preview panel will show a sample of the font. You cannot select the same font in both sections; FontLab Studio will take care of that.

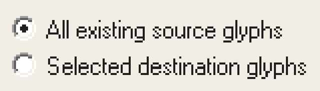
The bottom section lets you specify blend options.

● Blend fonts ○ Build the Multiple Master font

You have two main choices: to make a single master font that will contain the result of the source fonts blend or to make a Multiple Master font that will have the two source fonts as the masters. Here we will describe only single-master mode. Please refer to the “Multiple Master Fonts” chapter for information about using the Blend feature to make Multiple Master fonts.

In the **Destination font** combo box you can select the font in which to store the blended glyphs. Choose “New font” to put the generated glyphs into a new font.

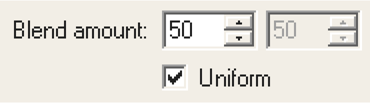
Further down there are two options:



● All existing source glyphs
○ Selected destination glyphs

Select the second option if you want to blend only glyphs that are selected in the **destination** font.

To the right there are controls to specify the blend amount:



Blend amount: 50 50
☑ Uniform

Enter the blend percentage in the editing field. If you want to blend fonts nonproportionally along the X and Y axes, uncheck the **Uniform** check box and enter the blend amount for the two directions.

To not let FontLab Studio add nodes to compatible contours leave the **Do not interpolate compatible outlines** option switched on.

Switch on the **Remember source and destination fonts** option if you have more than one font open and are going to repeat the operation later.

Click **OK** and wait while FontLab Studio blends the fonts. After the process is finished you will find the new glyphs in the new font or in the destination font. The outlines of the two source glyphs will be stored in the Mask layer of each glyph and the blending result in the outline layer.

Those glyphs that had compatible outlines and do not get additional nodes during the blend operation will be marked with green color in the font window. Those glyphs that had no their own outlines (composite glyphs) will be marked with blue color.

In some cases it is not possible to blend two outlines. This happens when two source glyphs have different numbers of contours, like O and 8. If some glyphs were not blended, FontLab Studio will show a warning message and those glyphs will have an empty outline layer and will be marked with red color.

The Font Header

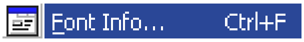
Perhaps the most important information you need to define for a font is its header or font info data. This information is mainly used to properly register the font in the operating system and in any program that uses it.

It is very important to carefully define all font parameters. Even the best-designed font is useless if it cannot be installed.

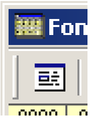
3

Font Info Dialog Box

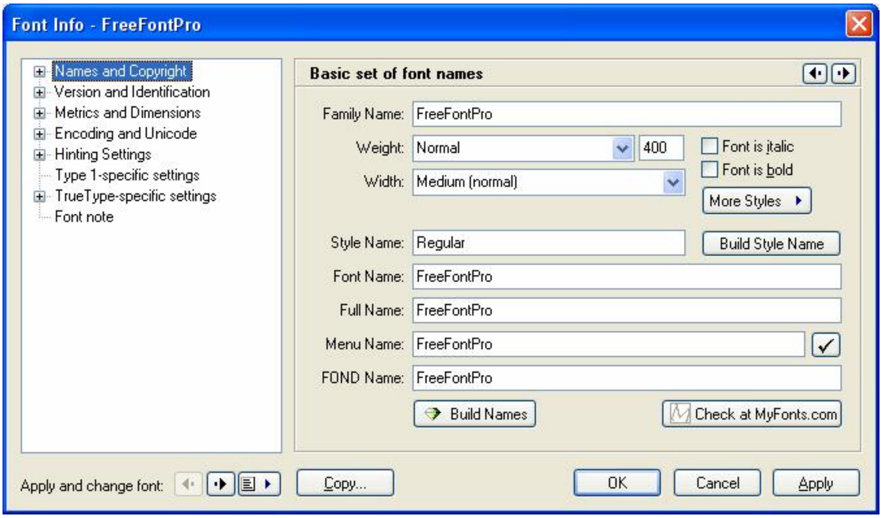
The control center where you define font parameters is called the Font Info Dialog box and is accessible from the **File** menu:



or with the button on any Font window:



The Font Info dialog box consists of three parts:



Family Name: FreeFontPro

Weight: Normal 400

□ Font is italic

□ Font is bold

Width: Medium (normal)

Style Name: Regular

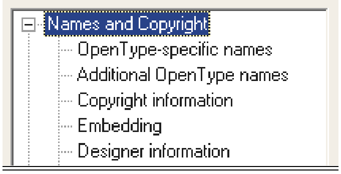
Font Name: FreeFontPro

Full Name: FreeFontPro

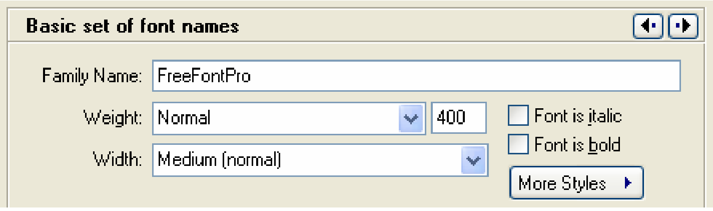
Menu Name: FreeFontPro ✓

FOND Name: FreeFontPro

At the left there is a page selection control where you can choose one of the sections in order to edit part of the Font Info information:



When you select one of the pages, it immediately appears to the right of the list:



Family Name: FreeFontPro

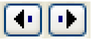
Weight: Normal 400

Width: Medium (normal)

□ Font is italic

□ Font is bold

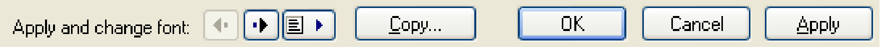
Use the arrow buttons in the top-right area of the page to browse all available pages:



Alternately you may use the **CTRL+TAB** and **CTRL+SHIFT+TAB** key combinations to browse pages.

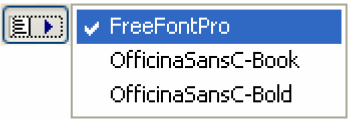
Command Bar

In the bottom area of the dialog box you find the command bar:



The Left part of the bar allows you to select a font for header information editing without closing the Font Info dialog box. Use the arrow buttons to browse fonts:

or click this button ☰ ▶ to select a font from the list:



To the right you find four buttons:

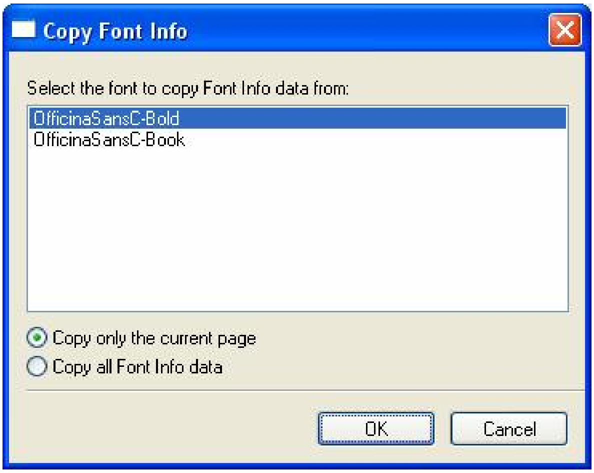
Copy...	Allows you to copy font header information between fonts
OK	Accepts changes you made to font info and closes the dialog box
Cancel	Cancels any changes and closes the dialog box
Apply	Accepts changes but lets you continue, so you can see the results of your changes in the Font, Glyph or Metrics windows.

Copying Font Info

If you want to copy font info from one font to another, you can do it with the Font Info dialog box.

1. Open both fonts.
2. Activate the font **to** which you want to copy information.
3. Open the Font Info dialog box.
4. Click on the **Copy** button:

5. In the dialog box select the font from which you want to copy information:



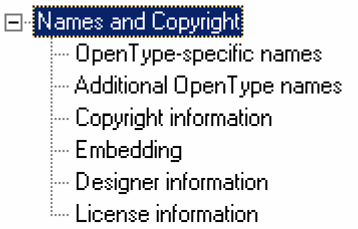
Select the font to copy Font Info data from:

OfficinaSansC-Bold
OfficinaSansC-Book

● Copy only the current page
○ Copy all Font Info data

Using the options below the list you can copy only the information from the current page or the whole font info. Make a selection and click OK to complete.

Font Names

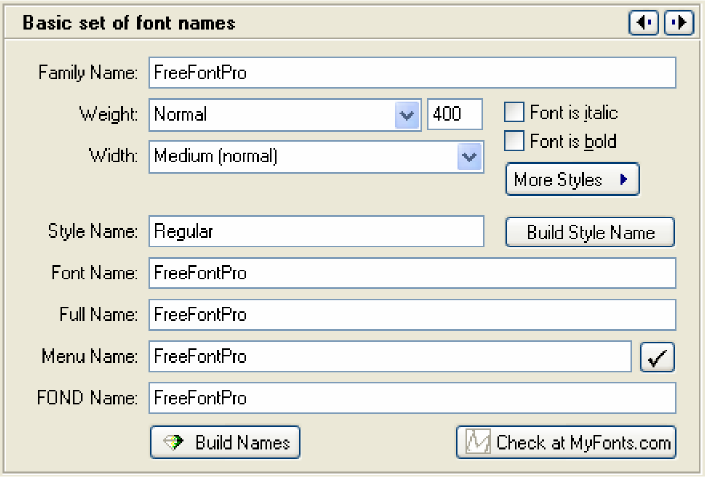


Names and Copyright
- OpenType-specific names
- Additional OpenType names
- Copyright information
- Embedding
- Designer information
- License information

The names section includes the most important font-registration information.

All programs use the information on this page to refer to a font. Be sure to enter all the values very carefully and use the automatic features where available.

Basic Identification and Names



Basic set of font names

Family Name: FreeFontPro

Weight: Normal 400

Width: Medium (normal)

□ Font is italic

□ Font is bold

Style Name: Regular

Font Name: FreeFontPro

Full Name: FreeFontPro

Menu Name: FreeFontPro ✓

FOND Name: FreeFontPro

Family Name [name: 1] (this mark is the ID of the name in the TrueType and OpenType specification: http://microsoft.com/typography/otspec/name.htm)

The name of the typeface to which the font belongs. All fonts that are from the same typeface must have the same **Family Name** field. The Family Name is used as the root of the Font Name so we recommend that you fill in this field first

Weight Weight of the font. You may enter a custom value in this field or select one of the predefined weight names in the box. Values in this list are sorted by increased weight value. Choose **Normal** or leave this field empty if you do not care about the font's weight

Weight Value Numeric weight value of the font. This number defines the font weight and is used by the operating systems to organize fonts to font families. FontLab Studio will fill it automatically when you select some Weight in the combo box, but if you want you can customize it

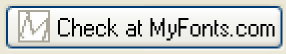
Width The average width of the font's characters. Enter a custom value or select one of the predefined width values from the drop-down list. Leave this field empty or select **Normal** width if you do not care about the font's width

Font is Italic [OS/2: fsSelection] Switch on this check box if you are creating an italic font

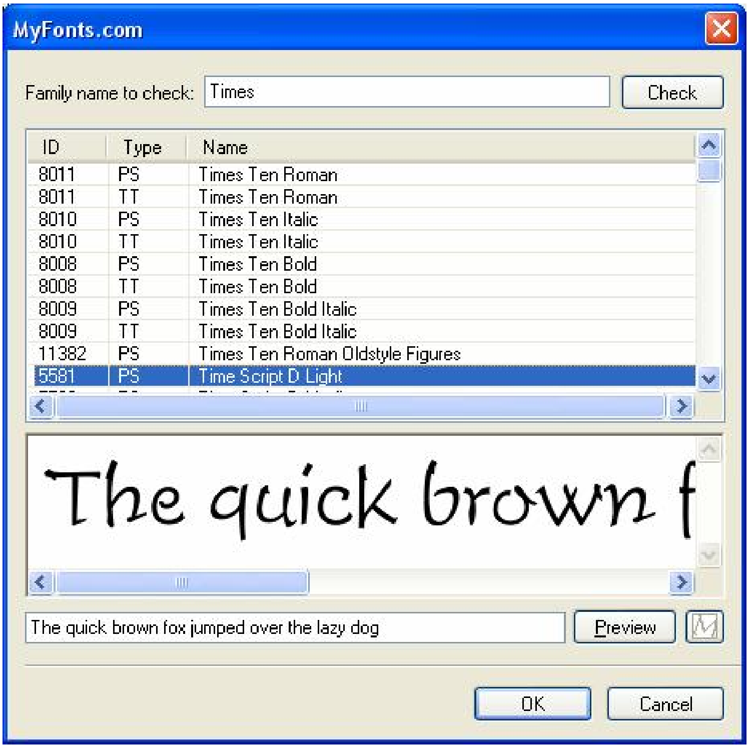
Font is bold	[OS/2: fsSelection] The Font is defined as bold. Usually this checkbox is related to the Weight setting, but it is not required. For example, if you are making a family containing Light and Normal styles, you may need to mark the Normal style as Bold so you will not need to split these styles into two separate families
More styles	Press this button to open a popup menu where you can select one of the additional font styles. Only TrueType fonts use this information, but we recommend you always set it properly to simplify future font identification
Style Name	[name: 2] Contains complete style information about the font. We recommend that you fill in the Weight, Width and Italic data, to automatically generate this field using the **Build Style Name** button and edit this field if necessary
Build Style Name	Press this button to automatically generate the **Style Name** field. Style names are based on the Width, Weight and Italic information
Font Name	[name: 6] PostScript name. This name will be used by a PostScript print driver to reference the font. Do not include spaces in this name
Full Name	[name: 4] More detailed font name. It may include spaces as well as any other characters – this is the name that is exposed to users when the font is installed in Windows
Menu Name	The name used to access the font in applications. This name must not include style information (bold, italic or similar). The length of this field is limited to 31 characters for TrueType or single-master Type 1 fonts and to 7 characters for Multiple Master fonts. To ensure that the current Menu name is made properly, press the **Check** button
FOND Name	This name is used by the Mac OS to organize fonts into font families. Windows does not use it. We recommend you fill in this name if you plan to port your font to Mac by FontLab Studio for Mac or TransType
Build Names	Press this button to automatically generate the **Font Name** and **Full Name** fields. If you are creating a new font we recommend that you fill in the **Family Name** field, generate or manually fill in the **Style Name** field and press this button to create the Font and Full names. If necessary you can edit the names later.

Accessing MyFonts.com Database

The last button on the Basic names page is **Check at MyFonts.com**:



Click on this button to browse the huge database of fonts that is located on the MyFonts.com servers to see if your font name has already been used:



Family name to check: Times

ID	Type	Name
8011	PS	Times Ten Roman
8011	TT	Times Ten Roman
8010	PS	Times Ten Italic
8010	TT	Times Ten Italic
8008	PS	Times Ten Bold
8008	TT	Times Ten Bold
8009	PS	Times Ten Bold Italic
8009	TT	Times Ten Bold Italic
11382	PS	Times Ten Roman Oldstyle Figures
5581	PS	Time Script D Light

The quick brown f

The quick brown fox jumped over the lazy dog

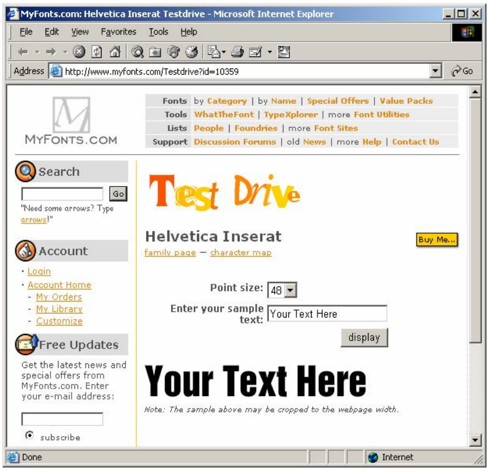
In the topmost editing field you may enter the font name that you want to check for similarities. Click the **Check** button to send a request to the myfonts.com database.

If you have an Internet connection, MyFonts.com replies with a list of font names (if any) that include the name you entered. Select one of the fonts and click on the **Preview** button (or just double-click the font name) to see a sample of the font in the sample box below the list.

The sample picture is downloaded from MyFonts.com, so it may take some time (depending on the speed of your Internet connection).

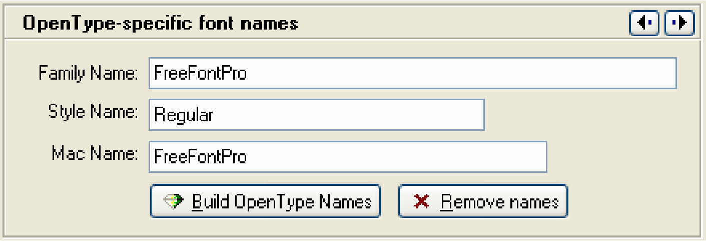
You can modify the contents of the sample string in the editing field below the sample window. By default it has the standard “Quick brown fox” sentence but you can enter anything there.

The Button will open a browser window with the currently selected font presented in full detail:


MyFonts.com: Helvetica Inserat Testdrive - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://www.myfonts.com/Testdrive?id=10359
Go
MYFONTS.COM
Fonts by Category | by Name | Special Offers | Value Packs
Tools WhatTheFont | TypeXplorer | more Font Utilities
Lists People | Foundries | more Font Sites
Support Discussion Forums | old News | more Help | Contact Us
Search
Go
"Need some arrows? Type arrows!"
Account
· Login
· Account Home
- My Orders
- My Library
- Customize
Free Updates
Get the latest news and special offers from MyFonts.com. Enter your e-mail address:
subscribe
Test Drive
Helvetica Inserat
family page – character map
Buy Me...
Point size: 48
Enter your sample text: Your Text Here
display
Your Text Here
Note: The sample above may be cropped to the webpage width.
Done
Internet

There is also a **Buy Me** button – click it if you want to buy the font.

OpenType-Specific Names



OpenType-specific font names

Family Name: FreeFontPro

Style Name: Regular

Mac Name: FreeFontPro

The OpenType format adds several new name records that are needed to use OpenType fonts on PC and Mac:

Family Name

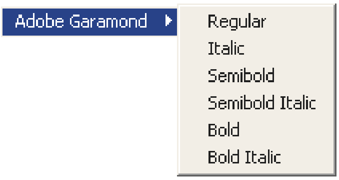
"Preferred Family Name" [name: 16] –This name is used to create a family containing more than 4 styles. You need to use the same Preferred Family Name in all fonts that you want to put into a "big" family and make the Preferred Style Name different for each of these fonts.

The Preferred Family name appears in the font menu as the "font name".

Please note that this information is used only by new applications that can handle OpenType fonts. Adobe InDesign or other new Adobe programs are good examples

Style Name

"Preferred Style Name" [name: 17]– Used to complement Preferred Family Name and defines a font style in a big font family. This is the name that appears in the submenu of the fonts list:



You need to include the Preferred Family Name and Preferred Style Name on this page only if they are different from the Family and Style names you defined on the Basic Names page

Mac Name

Macintosh compatible full name [name: 16] – If you want the name of the font to appear differently than the Full Name (defined on the Basic Names page), you can insert the Compatible Full Name.

Note: You don't need to fill in the **Preferred Family name** and **Preferred Style Name** fields if they are the same as the Family Name and Style Name on the main naming page of Font Info. Enter names there only if the names are different.

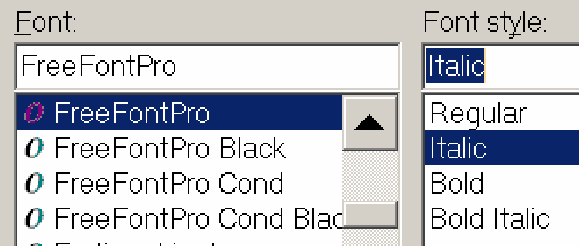
How to Make a Font Family

Fonts on Windows may only include only 4 styles in a family. These styles are: Regular, Bold, Italic and Bold Italic.

If you have more than four styles in your Type 1 or TrueType typeface for Windows you must create several families. You may put all condensed styles into a Condensed or Narrow *sub-family* (like Arial Narrow, Arial Narrow Bold, Arial Narrow Italic), all black styles into a Black sub-family (Arial Black, Arial Black Italic) and all "normal" styles in the "Normal" sub-family (Arial, Arial Italic, Arial Bold and Arial Bold Italic).

Mac Type 1 fonts and OpenType fonts (TT or PS) on Mac OS and within OpenType-savvy applications can contain an arbitrary number of styles within one family. To make OpenType fonts (TT or PS) cross-platform compatible, you have two choices. Either create only families with up to 4 styles (as described above) or maintain two sets of naming within the font family: a set of "brief" families for Windows, with no more than 4 styles per family, and one "long" family for Mac OS and OpenType applications.

Brief families on Windows with no more than 4 styles per family:

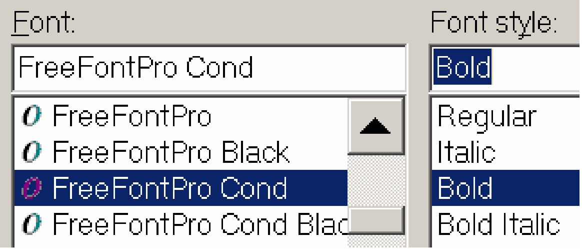


Font: FreeFontPro

Font style: Italic

FreeFontPro
FreeFontPro Black
FreeFontPro Cond
FreeFontPro Cond Blac

Regular
Italic
Bold
Bold Italic



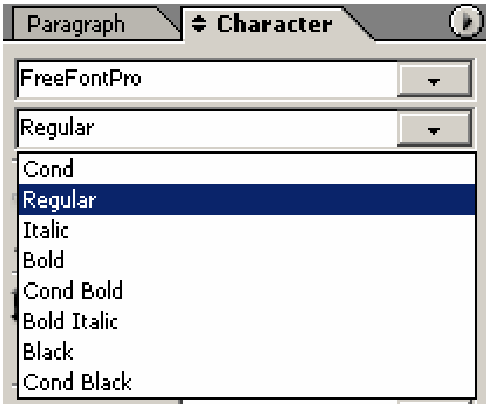
Font: FreeFontPro Cond

Font style: Bold

FreeFontPro
FreeFontPro Black
FreeFontPro Cond
FreeFontPro Cond Blac

Regular
Italic
Bold
Bold Italic

The same family viewed as a long family on Mac OS and in OpenType-savvy applications:



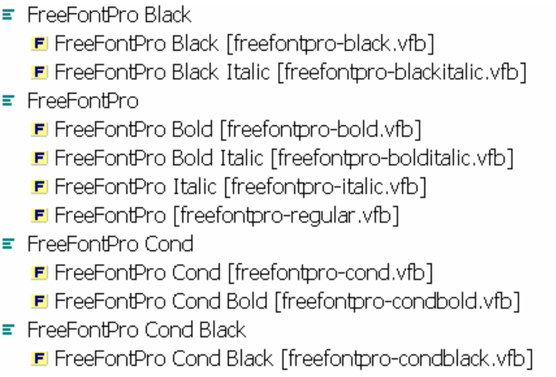
FreeFontPro

Regular

Cond
Regular
Italic
Bold
Cond Bold
Bold Italic
Black
Cond Black

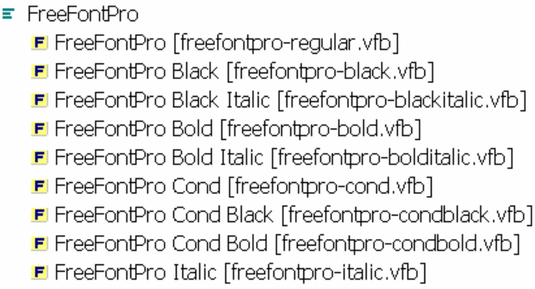
In FontLab Studio, the Fonts panel (**Window > Panels > Fonts**) can be used to preview both sorts of naming.

Brief family naming:



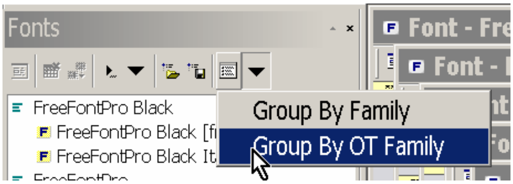
```
FreeFontPro Black
    FreeFontPro Black [freefontpro-black.vfb]
    FreeFontPro Black Italic [freefontpro-blackitalic.vfb]
FreeFontPro
    FreeFontPro Bold [freefontpro-bold.vfb]
    FreeFontPro Bold Italic [freefontpro-bolditalic.vfb]
    FreeFontPro Italic [freefontpro-italic.vfb]
    FreeFontPro [freefontpro-regular.vfb]
FreeFontPro Cond
    FreeFontPro Cond [freefontpro-cond.vfb]
    FreeFontPro Cond Bold [freefontpro-condbold.vfb]
FreeFontPro Cond Black
    FreeFontPro Cond Black [freefontpro-condblack.vfb]
```

Long (OpenType) family naming:



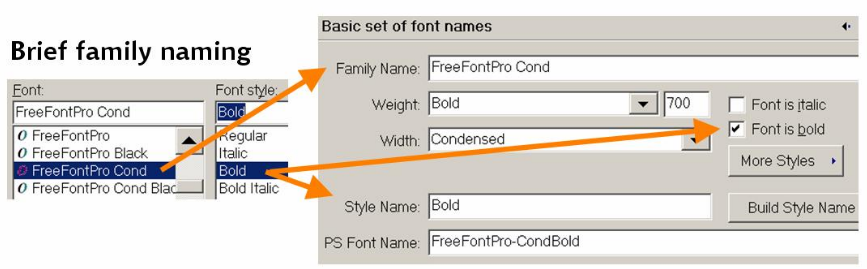
```
FreeFontPro
    FreeFontPro [freefontpro-regular.vfb]
    FreeFontPro Black [freefontpro-black.vfb]
    FreeFontPro Black Italic [freefontpro-blackitalic.vfb]
    FreeFontPro Bold [freefontpro-bold.vfb]
    FreeFontPro Bold Italic [freefontpro-bolditalic.vfb]
    FreeFontPro Cond [freefontpro-cond.vfb]
    FreeFontPro Cond Black [freefontpro-condblack.vfb]
    FreeFontPro Cond Bold [freefontpro-condbold.vfb]
    FreeFontPro Italic [freefontpro-italic.vfb]
```

You can use the flyout menu of the Fonts panel to switch the views between these two sets of naming:



In FontLab Studio's **Font Info** dialog (from the **File** menu), there are two pages that are relevant for font family naming: **Basic set of font names** (the first page of the Names and Copyright section) and **OpenType-specific font names**.

In an OpenType font, the "brief" (Windows) family naming should be devised on the **Basic set of font names** page:


Brief family naming

Font: FreeFontPro Cond

Font style: Bold

Basic set of font names

Family Name: FreeFontPro Cond

Weight: Bold 700

□ Font is italic

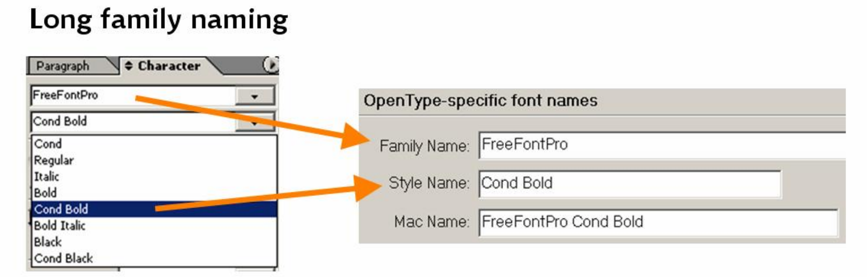
☑ Font is bold

Width: Condensed

Style Name: Bold

PS Font Name: FreeFontPro-CondBold

while the "long" (OpenType/Mac) family naming should be devised on the **OpenType-specific names** page:


Long family naming

FreeFontPro

Cond Bold

OpenType-specific font names

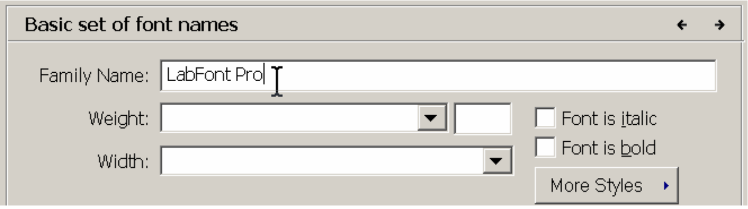
Family Name: FreeFontPro

Style Name: Cond Bold

Mac Name: FreeFontPro Cond Bold

Below is an example of how family names should be devised using FontLab Studio's Font Info dialog.

1. Start by giving an identical Family Name (here: FreeFont Pro) to all styles in your family.



Basic set of font names

Family Name: LabFont Pro

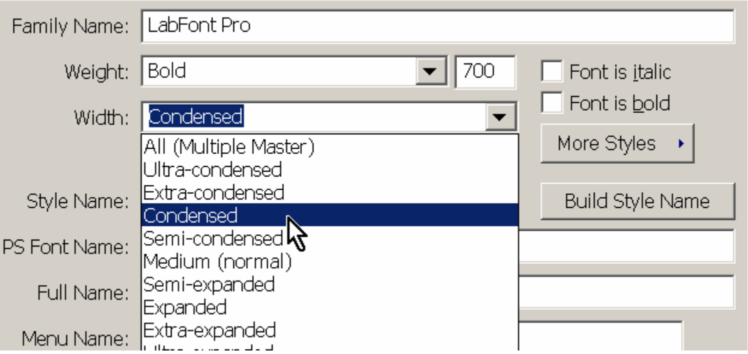
Weight:

Width:

☐ Font is italic

☐ Font is bold

2. Select a Weight and a Width that best matches the true design of each style. For light fonts, avoid the "Thin", "UltraLight" and "ExtraLight" settings and choose "Light" instead.



Family Name: LabFont Pro

Weight: Bold 700

Width: Condensed

☐ Font is italic

☐ Font is bold

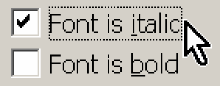
Style Name:

PS Font Name:

Full Name:

Menu Name:

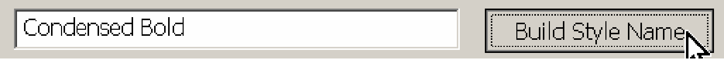
3. If your style is italic or oblique, check the "Font is italic" mark, but leave "Font is bold" unchecked at this stage.



☑ Font is italic

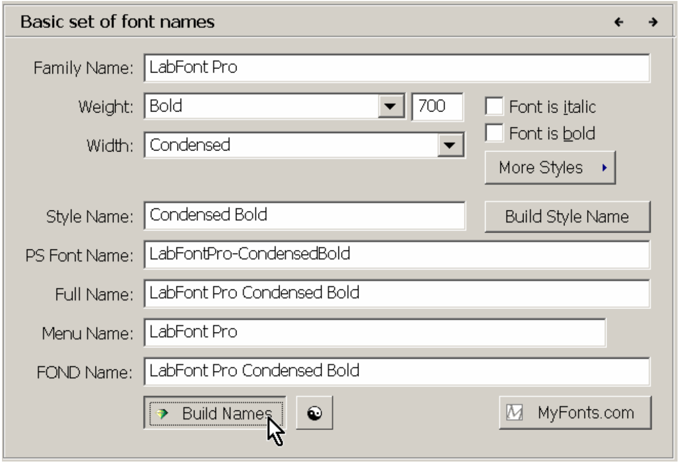
☐ Font is bold

4. Click on the "Build Style Name" button to automatically build a style name.



Condensed Bold

5. Abbreviate excessively long style names (e.g. replace “Condensed” with “Cond”). The style name must be unique within the family, so if FontLab builds the same style name for two different fonts, revise one of them.



Basic set of font names

Family Name: LabFont Pro

Weight: Bold 700

Width: Condensed

□ Font is italic

□ Font is bold

Style Name: Condensed Bold

PS Font Name: LabFontPro-CondensedBold

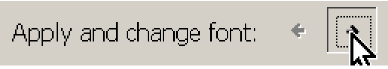
Full Name: LabFont Pro Condensed Bold

Menu Name: LabFont Pro

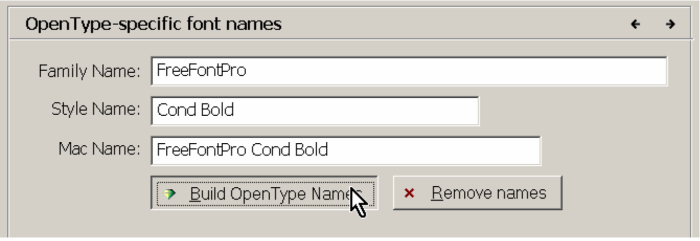
FOND Name: LabFont Pro Condensed Bold

6. Click on the “Verify names” button to check the technical correctness of your names.

7. Switch between styles and repeat the previous steps analogically for all styles in your family.



8. Go to the “OpenType-specific font names” page and click on “Build OpenType Names”. Repeat for all styles in the family.



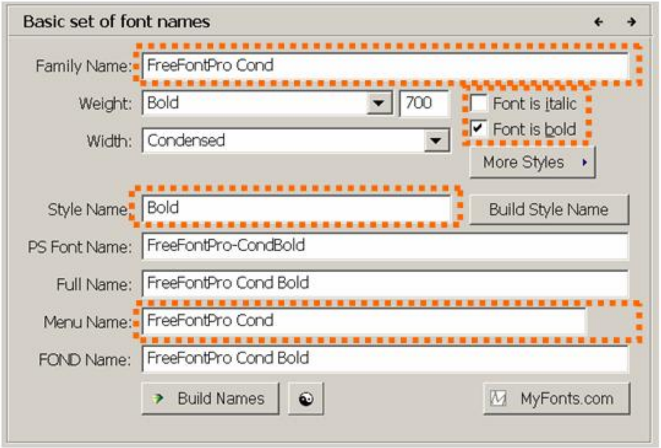
OpenType-specific font names

Family Name: FreeFontPro

Style Name: Cond Bold

Mac Name: FreeFontPro Cond Bold

9. Go back to the “Basic set of font names” page and apply the brief family naming: Enter the brief family name into the Family Name field and into the Menu Name field. Enable “Font is bold” whenever a font is supposed to be “bold style” within the brief family. Revise the “Style Name” field so it only contains one of the following: “Regular”, “Italic”, “Bold” or “Bold Italic”. Leave other settings unchanged.



Basic set of font names

Family Name: FreeFontPro Cond

Weight: Bold 700

Width: Condensed

□ Font is italic

☑ Font is bold

Style Name: Bold

PS Font Name: FreeFontPro-CondBold

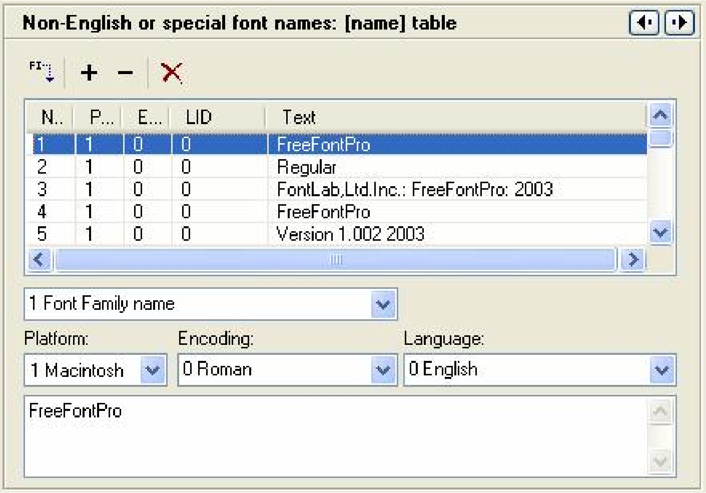
Full Name: FreeFontPro Cond Bold

Menu Name: FreeFontPro Cond

FOND Name: FreeFontPro Cond Bold

10. Repeat this for all styles in your family and you should be done.

Non-English and Special Names



N..	P...	E...	LID	Text
1	1	0	0	FreeFontPro
2	1	0	0	Regular
3	1	0	0	FontLab,Ltd.Inc.: FreeFontPro: 2003
4	1	0	0	FreeFontPro
5	1	0	0	Version 1.002 2003

1 Font Family name

Platform: 1 Macintosh

Encoding: 0 Roman

Language: 0 English

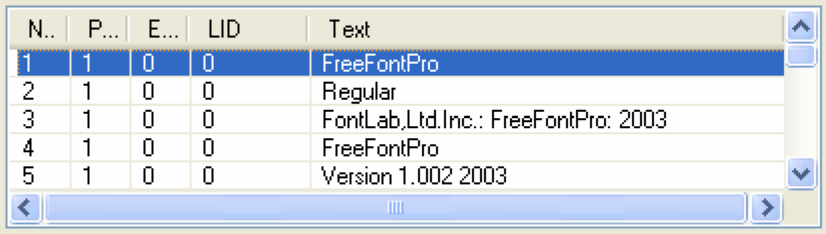
FreeFontPro

The TrueType and OpenType specifications let you put many names into the font. Most of them can be defined on specialised pages of the Font Info dialog box (Basic Names, OpenType names, Copyright, etc.) but these names are in English. If you need to have non-English names or names that are not covered by the FontLab Studio FontInfo pages you may use this Non-English or special font names page.

Please refer to the OpenType specification to get full information about TrueType and OpenType names:

http://www.microsoft.com/typography/otspec/name.htm

Most of the page is covered by the names list:



N..	P...	E...	LID	Text
1	1	0	0	FreeFontPro
2	1	0	0	Regular
3	1	0	0	FontLab,Ltd.Inc.: FreeFontPro: 2003
4	1	0	0	FreeFontPro
5	1	0	0	Version 1.002 2003

The Columns of the list are:

NID Name ID – code of the name (this is what we put in the [name: x] comment on ‘x’ place).

PID Platform ID – platform identified. Could be 0, 1, 2 or 3.

EID, LID Encoding and Language IDs – see the OpenType name table specification

Text Content of the name table record. May include Unicode characters after the ‘\’.

Click on the caption of the column to sort name records by one of the values.

Below the list is a set of controls that let you define records.

Above the list there is a toolbar that you can use to modify the names table; add or remove name records; or import custom name records from the “English” data:

FI Import names from the basic set of names defined in other pages of the Names section

+ Add a name record

− Remove the currently selected name record

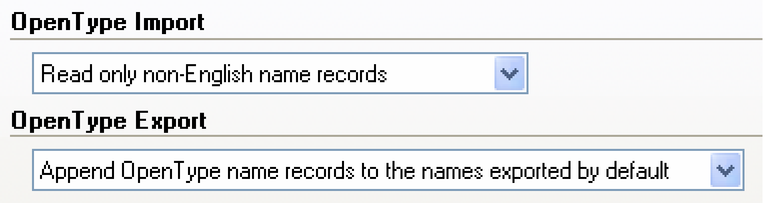
✕ Remove all custom name records.

To add a new name record, click on the − button on a toolbar, select name record options using the controls below the list and type in the name record content. To enter non-ANSI characters use "\[unicode index]" or "\[code]" notation where [unicode index] is the Unicode index of the character if the name record is for the Unicode (0 or 1) platform and [code] is the character code in the Mac Roman codepage if the name record is for the Macintosh platform. For example you may enter "\0411" for the Cyrillic "beh".

Note that you can use the same notation in FontLab Studio's Metrics window or Preview panel, so if you open a Unicode font you may test the name records there.

To remove a record, select it in the list and click on the − button. Click on the ✕ button **to remove all name records**.

You can use the OpenType page of the Options dialog box to control the import and export of the additional name records:



OpenType Import

Read only non-English name records

OpenType Export

Append OpenType name records to the names exported by default

Import options:

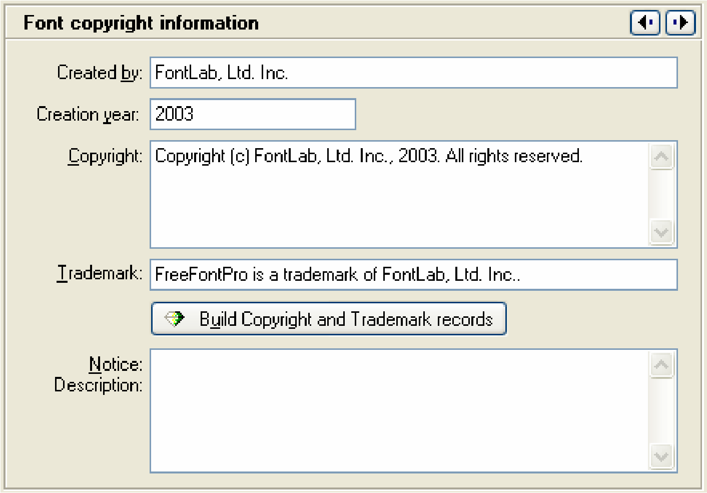
Read only non-English name records	This is the default choice – FontLab Studio will read only those additional records that cannot be interpreted to "standard" name records, which have dedicated pages in the Font Info dialog box
Do not read OpenType name records	With this selection any record that cannot be interpreted by the default algorithm is ignored
Read all OpenType name records	All name records are imported as additional OpenType records and are placed in the page.

Export options:

Append OpenType name records to the names exported by default	This is the default choice: FontLab Studio will export English names and then add only those additional OpenType names that aren't already covered
Do not export OpenType name records	With this option FontLab Studio will not export any additional name records
Export only OpenType name records - ignore default names	When this option is selected, only additional name records are exported, all other names (from other pages in the Names section) are ignored.

✐ **Final note:** please, use this page carefully – FontLab Studio doesn't verify information that you put into additional name records. Be sure that you read and understand the name table specification.

Copyright Information



Font copyright information

Created by: FontLab, Ltd. Inc.

Creation year: 2003

Copyright: Copyright (c) FontLab, Ltd. Inc., 2003. All rights reserved.

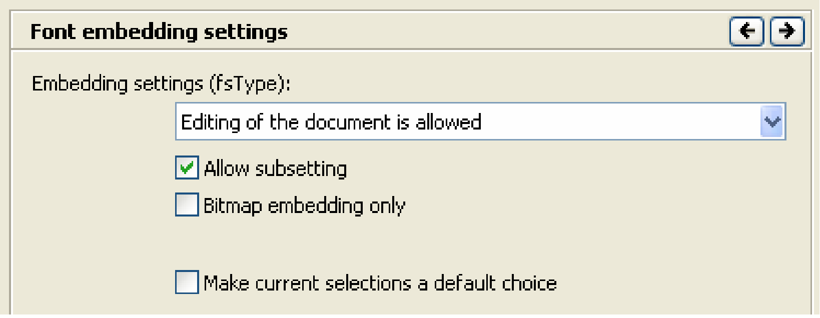
Trademark: FreeFontPro is a trademark of FontLab, Ltd. Inc..

Notice:
Description:

On the copyright page you can enter information about the creators of the font. If you have created a new font you should enter your copyright notice here. If you have edited an existing font that was not your creation you must not remove the information contained on this page, or you may violate copyright laws.

Created by	Name of the company or person that created the font. If you are creating a new font enter your name or the name of your company here
Creation year	Year when the font was created. This is used by FontLab Studio to automatically fill in the **Copyright** field and is exported in TrueType fonts as the Creation year entry
Copyright	[name: 0] Copyright message. Must include the © sign or the word “Copyright”, the name of the company or person that owns the copyright and the copyright year. In Type 1 fonts this information is stored in the Notice entry and in TrueType fonts in the Copyright entry
Trademark	[name: 7] Font trademark – used to save font’s trademark notice
Build Copyright and Trademark Records	Press this button to create the standard Copyright record based on the **Created By** and **Creation Year** fields
Notice	[name: 10] Additional information that you want to include in Font Info. Exported in Type 1 fonts as the Copyright entry and in TrueType fonts as the Description entry.

Font Embedding



Font embedding settings

Embedding settings (fsType):

Editing of the document is allowed

☑ Allow subsetting

□ Bitmap embedding only

□ Make current selections a default choice

These settings control how the font may be embedded into documents. Embedding is a feature of the Windows operating system and some applications that allow programs to include fonts into documents to guarantee that they will be reproduced correctly. However, this feature may cause problems with font piracy. It is not very hard to extract embedded fonts from a document, so the TrueType font format includes a special setting that can control font embedding.

There are four types of font embedding:

Everything is allowed	After the document is opened the font works as if it was installed in the system
Embedding is not allowed	Embedding is not allowed for this font
Only printing and previewing is allowed	The font may be embedded, but editing of the document it contains is not allowed
Editing of the document is allowed	The font may be embedded and the document that contains the font may be viewed, printed and edited.

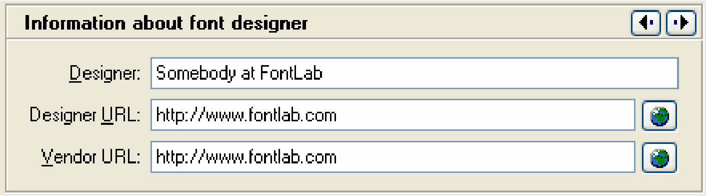
Additional options **Allow subsetting** and **Bitmap embedding only** are available.

Copyright Note

We decided to allow modification of the embedding setting only because we are sure that the users of FontLab Studio are professionals who respect others' rights to intellectual property. We assume that you will change the embedding setting **only in your own fonts**.

You are not allowed to change this setting in fonts that were created by somebody else. Even if according to the font license you can modify the font for your own use, you must not “increase” the embedding rights for a font. So if embedding is not allowed leave it as it is.

Designer Information



Designer: Somebody at FontLab

Designer URL: http://www.fontlab.com

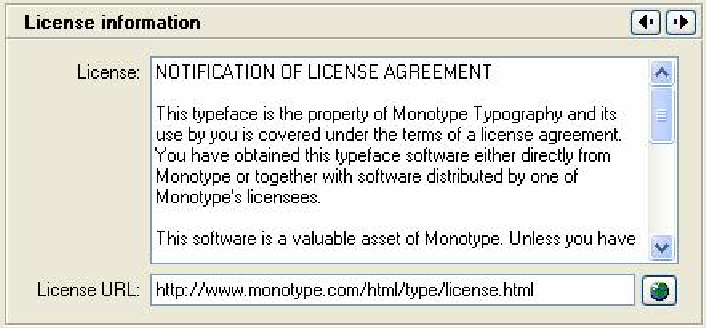
Vendor URL: http://www.fontlab.com

This page stores information about the font's designer. Do not modify this data if you open an existing font to modify for personal use.

Designer	[name: 9] Name of font designer
Designer URL	[name: 12] A new entry implemented only in TrueType format. It is the WWW link to the designer of the font
Vendor URL	[name: 11] This TrueType-only entry shows the WWW link to the site of the font vendor.

Use the buttons 🌐 to the right of the Designer URL and Vendor URL controls to open pages in a Web browser window. This requires an Internet connection.

License Information



License: NOTIFICATION OF LICENSE AGREEMENT

This typeface is the property of Monotype Typography and its use by you is covered under the terms of a license agreement. You have obtained this typeface software either directly from Monotype or together with software distributed by one of Monotype's licensees.

This software is a valuable asset of Monotype. Unless you have

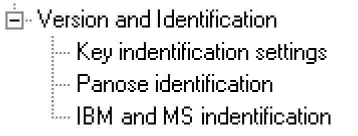
License URL: http://www.monotype.com/html/type/license.html

License and License URL records are relatively new and have appeared only in OpenType specification version 1.3.

License	[name: 13] License description – contains information about how the font can be used
License URL	[name: 14] URL where additional license information can be found.

Use the button to the right of the License URL control 🌐 to open the page in a Web browser window. This requires an Internet connection.

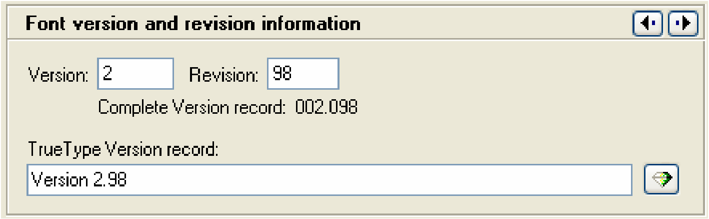
Font Identification


Version and Identification
Key indentification settings
Panose identification
IBM and MS indentification

Sometimes the operating system or a DTP application needs to know what the font looks like. It may be necessary, for example, to properly substitute for a missing font with the closest look-alike.

FontLab Studio supports all the font-identification settings that are used in Type 1 or TrueType fonts.

Version Information



Version: 2 Revision: 98

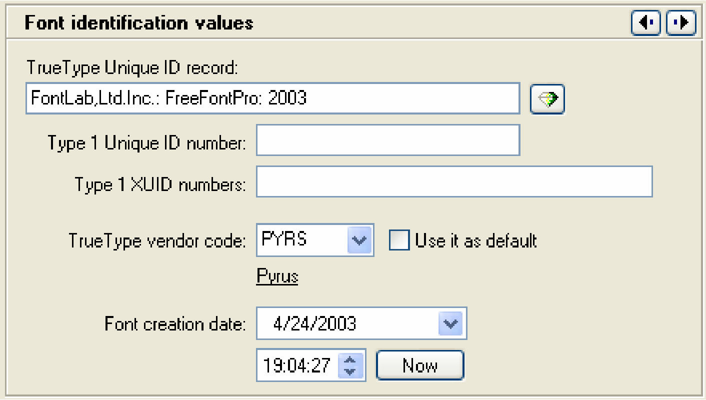
Complete Version record: 002.098

TrueType Version record:

Version 2.98

Version	Version of the font.
Revision	Revision of the font. Version and revision numbers are combined and build a complete version record that appears in Type 1 font headers
TrueType Version Record	[name: 5] TrueType font version records have a different format. You may enter the TrueType version record here or just press the **Recalc** button at the right of the field to fill this record automatically. You must have the **Names** and **Copyright** pages filled in to use the automatic features on this page. Press the **Apply** button at the bottom of the dialog box to enter the new Font Info values into the font's header.

Basic Font Identification



Font identification values

TrueType Unique ID record: FontLab,Ltd.Inc.: FreeFontPro: 2003

Type 1 Unique ID number:

Type 1 XUID numbers:

TrueType vendor code: PYRS □ Use it as default

Pyrus

Font creation date: 4/24/2003

19:04:27 Now

TrueType Unique ID Record This field is necessary to identify TrueType fonts. Usually it includes the creator's name, font family name and creation year. The format of this field is freeform, but we recommend that you use the ◆ button to fill this field automatically

Type 1 Unique ID Record An integer number identifying the font. Unique ID numbers must be registered with Adobe Systems. However, you may leave 0 in this field or enter a value from the users Unique ID zone (4000000 to 4999999). If you enter this value and plan to export Type 1 fonts, be sure not to have more than one font with the same Unique ID value because that may cause a problem with PostScript printers or Adobe Type Manager software

Type 1 XUID Numbers More advanced identification codes for Type 1 fonts. This number is used only in PostScript Level 2 printers. Please, refer to Adobe documentation for more information concerning the **XUID** field

TrueType Vendor Code An up-to-four letter length code that is assigned to most TrueType producers to identify their fonts. An *uppercase* vendor code must be registered with Microsoft or Apple. All registered Vendor codes known at the time of FontLab Studio's release are placed in the drop-down list box. If you want to identify yourself without registering you may enter a *lowercase* four-letter vendor code.

Below the vendor selection list you can see the full name of the registered vendor. Click the name to open the vendor's page in a Web browser

Use it as default Check this option to use the current vendor code as the default in all new fonts. You may make your own code the default so you will not have to enter it every time.

Vendor.dat File

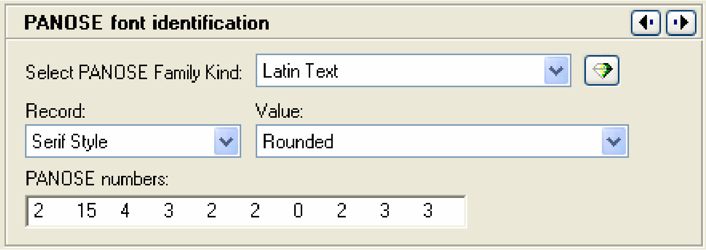
FontLab Studio stores information about registered vendors in the vendor.dat file located in the FontLab Studio/Data folder. This is a text file with a simple structure:

```
2REB 2Rebels
39BC Finley's Barcode Fonts
3ip Three Islands Press
918 RavenType
```

As you can see, it is just a vendor code followed by vendor name. A single space is used as a separator.

If you want to change the file or add a new entry, just open it in any text editor (such as Notepad or WordPad) and make changes.

PANOSE™ Identification


PANOSE font identification

Select PANOSE Family Kind: Latin Text

Record: Serif Style

Value: Rounded

PANOSE numbers:

2 15 4 3 2 2 0 2 3 3

In the PANOSE identification system 10 numbers describe a font. Each number represents one identification category. The most important category (represented by the first number) defines the “kind” of font — is it a normal Roman font, a hand-written font, a decorative or symbol font. The meaning of all the other categories depends on this setting.

In all categories the first two values (0 and 1) mean Any and No Fit. Any means that the value of this category is not important. No Fit means that the category value for this font is not among the available values.

To set the PANOSE identification numbers, first select the font family kind.

After that, select the category in the **Record** combo box and the value in the **Value** combo box.

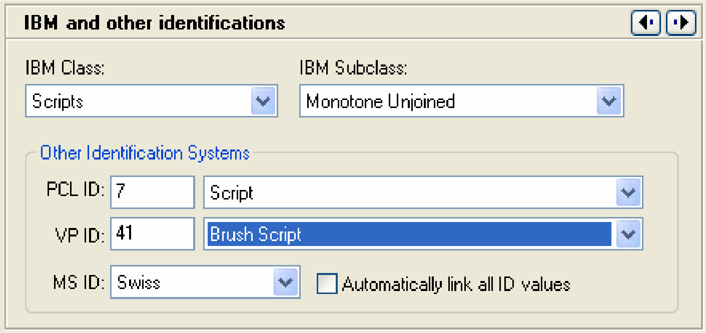
Here is a table of the categories and possible values for the Latin Text family:

Serif Style	Cove, Obtuse Cove, Square Cove, Obtuse Square Cove, Square, Thin, Oval, Exaggerated, Triangle, Normal Sans, Obtuse Sans, Perpendicular Sans, Flared, Rounded
Weight	Very Light, Light, Thin, Book, Medium, Demi, Bold, Heavy, Black, Extra Black
Proportion	Old Style, Modern, Even Width, Extended, Condensed, Very Extended, Very Condensed, Monospaced
Contrast	None, Very Low, Low, Medium Low, Medium, Medium High, High, Very High
Stroke Variation	No Variation, Gradual/Diagonal, Gradual/Transitional, Gradual/Vertical, Gradual/Horizontal, Rapid/Vertical, Rapid/Horizontal, Instant/Vertical, Instant/Horizontal
Arm Style	Straight Arms/Horizontal, Straight Arms/Wedge, Straight Arms/Vertical, Straight Arms/Single Serif, Straight Arms/Double Serif, Non-Straight Arms/Horizontal, Non-Straight Arms/Wedge, Non-Straight Arms/Vertical, Non-Straight Arms/Single Serif, Non-Straight Arms/Double Serif
Letterform	Normal/Contact, Normal/Weighted, Normal/Boxed, Normal/Flattened, Normal/Rounded, Normal/Off Center, Normal/Square, Oblique/Contact, Oblique/Weighted, Oblique/Boxed, Oblique/Flattened, Oblique/Rounded, Oblique/Off Center, Oblique/Square
Midline	Standard/Trimmed, Standard/Pointed, Standard/Serifed, High/Trimmed, High/Pointed, High/Serifed, Constant/Trimmed, Constant/Pointed, Constant/Serifed, Low/Trimmed, Low/Pointed, Low/Serifed
X-height	Constant/Small, Constant/Standard, Constant/Large, Ducking/Small, Ducking/Standard, Ducking/Large

A detailed description of the PANOSE categories and values (the so-called Gray Book) may be found at:

`http://www.w3.org/Printing/stevahn.html`

Other Identification Systems



IBM and other identifications

IBM Class: Scripts

IBM Subclass: Monotone Unjoined

Other Identification Systems

PCL ID: 7 Script

VP ID: 41 Brush Script

MS ID: Swiss

□ Automatically link all ID values

IBM Identification

The IBM Identification system uses a different approach from the one used in the PANOSE system. This system is based on the font's appearance. In the IBM system two numbers that designate the font category and sub-category identify each font. A font's design is compared to one of the "standard" and well-known designs.

To set IBM Identification information select a Category that matches your font from the IBM Class list. Then select a sub-category in the IBM Subclass list.

A detailed description of the IBM Font Identification system may be found in the TrueType font format specification on the Microsoft Typography Web site at:

http://www.microsoft.com/typography/tt/tt.htm

PCL and Ventura Publisher Identification

These identification systems are relatively old ones and are rarely used in modern DTP applications. However, to keep compatibility with all possible usage of your font we recommend setting these options. They are used only with Type 1 fonts and are exported only in the INF file.

Both systems are based on font appearance so they are close to the IBM identification system. And both systems are one-level, so you just have to select a well-known font that is close in appearance to your font. To simplify this when the **Automatically link all ID values** check box is active and you select one of the values FontLab Studio will select the a similar value in the other combo box. For example, if you select Helvetica in the **PCL ID** combo box, Swiss will be selected in the **VP ID** combo box.

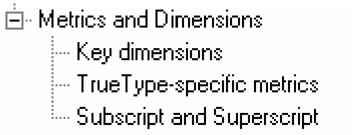
If you want you may enter PCL ID and VP ID indexes manually using the edit fields at the left of the combo boxes. Please refer to the technical specifications for detailed descriptions of these identification systems.

Microsoft Identification

This is the simplest identification system. Just select one of the common font categories (Roman, Swiss, Modern, Script and Decorative) and you are done. This is the only identification system that is implemented in the PFM files that are used by Windows to work with Type 1 fonts, so we strongly recommend selecting the proper value in this list box.

✐ **Note:** If you are building a Type 1 font for Windows, take this field very seriously. Do not leave “Decorative” in this option if the font is not decorative – this will affect the font spacing.

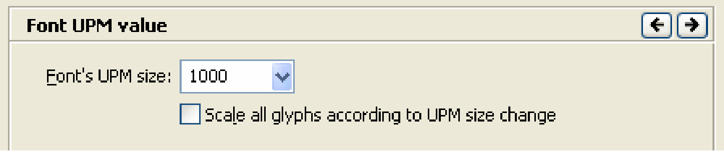
Metrics and Dimensions



- Metrics and Dimensions
  - Key dimensions
  - TrueType-specific metrics
  - Subscript and Superscript

This page is used to set font dimensions that are used mostly to properly align text lines.

Font UPM Value



Font UPM value

Font's UPM size: 1000

□ Scale all glyphs according to UPM size change

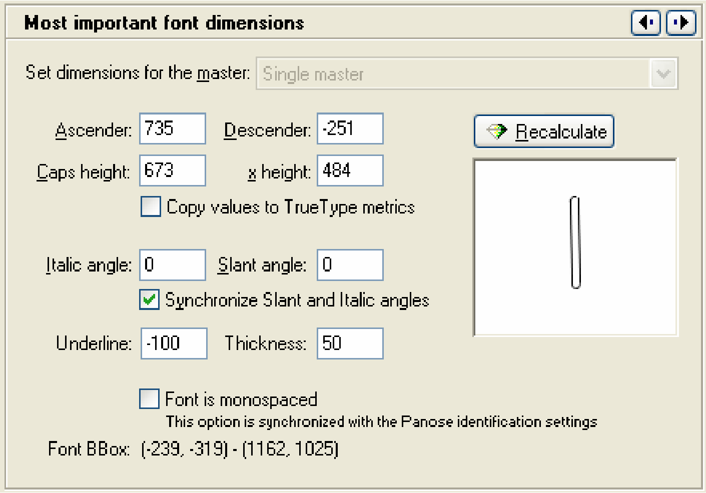
The most important field on this page is the **Font UPM**. Let's explain what UPM is and why it is so important.

The UPM (Units Per eM) is the basis of all font dimensions. The UPM is the number of font units that defines the font height and the coordinate grid on which the glyphs are drawn.

The bigger the UPM is the more coordinate space you have, so you can set more precise positions of points. For technical reasons in FontLab Studio the UPM is limited to 10000 units, but we strongly recommend you work with one of the standard UPMs. In Type 1 fonts the standard UPM is 1000 units and in TrueType fonts the UPM may be set to any value, but the recommended value is 2048 units.

If you change the UPM value in the Dimensions page of the Font Info dialog box this doesn't necessarily mean that the size of the characters will change. For example, if you change the UPM from 1000 to 2000 all the glyphs will now be half as big as they were before – because they are still dimensioned at 1000 UPM. You have to scale all the characters to fit them in the new UPM setting manually or you can switch on the **Scale all characters according to UPM change** check box and all the font data will be scaled automatically.

Basic Font Dimensions



Set dimensions for the master: Single master

Ascender: 735 Descender: -251

Caps height: 673 x height: 484

□ Copy values to TrueType metrics

Italic angle: 0 Slant angle: 0

☑ Synchronize Slant and Italic angles

Underline: -100 Thickness: 50

□ Font is monospaced

This option is synchronized with the Panose identification settings

Font BBox: (-239, -319) - (1162, 1025)

The page has several editing fields with numbers and a sample window where an appropriate character is displayed to help set correct values.

Other fields on this page mean:

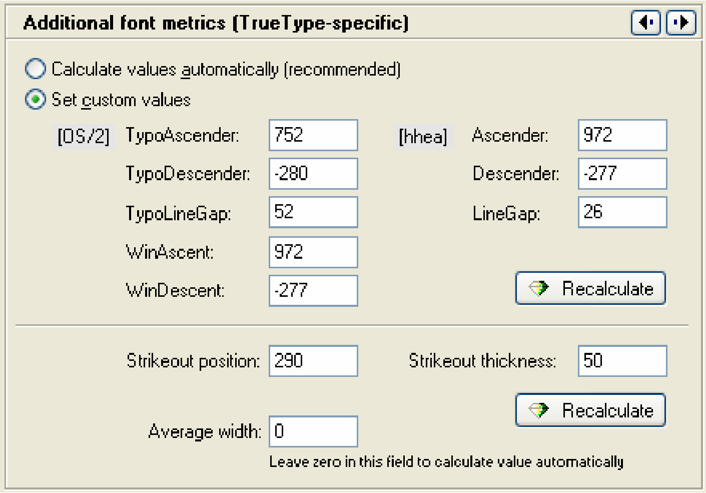
Ascender	Position of the font's ascender line. Usually this is the height of the lowercase 'b' character
Descender	Position of the font's descender line. Usually this is the position of the bottom line of the 'p' character
Caps height	Height of the font's uppercase characters. Usually the height of the 'H' character
x height	Height of the lowercase characters. Usually the height of the 'x' character
Italic angle	Actual italic or oblique angle for the font. The italic angle is measured in the counterclockwise direction, so the default value is -12º
Slant angle	Type 1 fonts can be artificially slanted to get an "oblique" appearance while keeping the actual outlines upright. Enter a slant angle value (in degrees) here and check the result in the Preview panel
Underline	This is the position of the middle of the underline line in your font
Thickness	This is the thickness of the underline line.

If you press the **Recalculate dimensions** button, FontLab Studio will automatically recalculate all the dimension values.

Ascender, Descender and Type 1 fonts

If you are making a Type 1 font you should set the Ascender and Descender values verycarefully. In Type 1 fonts these values are used very directly to calculate interline spacing. It is usually necessary to set the Ascender value higher than actual height of the "ascender" 'b' character, to have some additional space between lines.

Advanced Vertical Metrics



Additional font metrics (TrueType-specific)

○ Calculate values automatically (recommended)
● Set custom values

[OS/2]	TypoAscender:	752	[hhea]	Ascender:	972
	TypoDescender:	-280		Descender:	-277
	TypoLineGap:	52		LineGap:	26
	WinAscent:	972			
	WinDescent:	-277			

Strikeout position: 290 Strikeout thickness: 50

Average width: 0

Leave zero in this field to calculate value automatically

In TrueType font files vertical metrics can be stored in the OS/2 and hhea tables. Different programs and operating systems use vertical metrics from these tables. Windows usually uses data stored in the OS/2 table while the Mac OS uses only data located in the hhea table.

It is important to correctly define all vertical metrics if you want your font to align properly. In most cases FontLab Studio can calculate vertical metrics according to the system recommendations, but in some cases you may want to customize these values.

We recommend you generally leave these values untouched in an existing OpenType font. Of course, if you perform heavy modification of the font you will need to update the advanced vertical metrics.

If you want FontLab Studio to automatically calculate all vertical metrics, select the option **Calculate values automatically**.

If you want to customize values, select the **Set Custom values** option and edit data in the fields below. Note that if you choose Set Custom values but leave all data unchanged, FontLab Studio will restore the original vertical metrics data from the imported font and the new updated font will align exactly as the original one.

Here is a description of each value:

Typo Ascender	This is the typographically-correct ascender value. It is the topmost line of lowercase characters, usually, the topmost line of the ‘b’ character
Typo Descender	The same as Typo Ascender, but for the lowest line. Usually it is equal to the bottom line of the character ‘p’
Typo Line Gap	“Typographically” correct line gap value (distance between bottom line of the upper line of text and top line of the lower line of text)
WinAscent	[OS/2] This value defines the topmost line of all important characters in the font. “Important” characters are all non-exceptional characters. For example, if most of the characters have the topmost position at 900 font units and one, not often used character, has it at 1300 font units, it’s a good idea to set WinAscent at 900 units. Note that in most cases portions of the characters that are above the WinAscent value will not appear on the screen or print on some printers. Please note that WinAscent is NOT a typography ascender, usually measured as the topmost line of lowercase characters. It is mostly a technical parameter used by the rasterizer to allocate vertical space to render characters
WinDescent	[OS/2] The same as WinAscent, but for the lowest line of all “normal” characters
Ascender	[hhea] This value is used by the Mac OS in about the same situation as Windows uses the WinAscent value from the OS/2 table – to define the topmost position of all important glyphs
Descender	[hhea] In short: the Macintosh version of the Windows WinDescent parameter. If there are any pixels below this line the glyph will be squashed in the vertical direction to match metrics defined by the Ascender and Descender parameters
Line Gap	[hhea] This value is used by the Mac OS to compensate Ascender and Descender values and calculate the correct distance between baselines of the text. Refer to the formulas below to see how baseline-to-baseline distance is calculated.

Baseline-to-baseline distance calculation

Windows:

Windows Metric	OpenType Metric
ascent	WinAscent
descent	WinDescent
internal leading	WinAscent + WinDescent – UPM
external leading	MAX(0, LineGap - ((WinAscent + WinDescent) - (Ascender - Descender)))

BTBD = ascent + descent + external leading

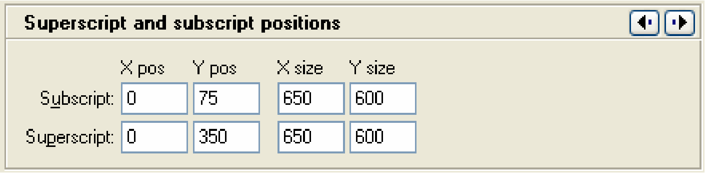
It should be clear that the "external leading" can never be less than zero. Pixels above the ascent or below the descent will be clipped from the character; this is true for all output devices.

Macintosh:

Macintosh Metric	OpenType Metric
ascender	Ascender
descender	Descender
leading	LineGap

BTBD = ascender + descender + leading

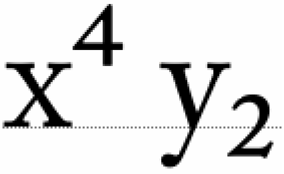
Superscript and Subscript



Superscript and subscript positions

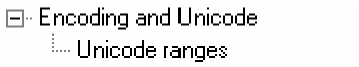
	X pos	Y pos	X size	Y size
Subscript:	0	75	650	600
Superscript:	0	350	650	600

TrueType and OpenType font format allows you to specify position and size of the superscript and subscript characters:



Subscript	Position and size of the subscript characters in font units
Superscript	Position and size of the superscript characters in font units.

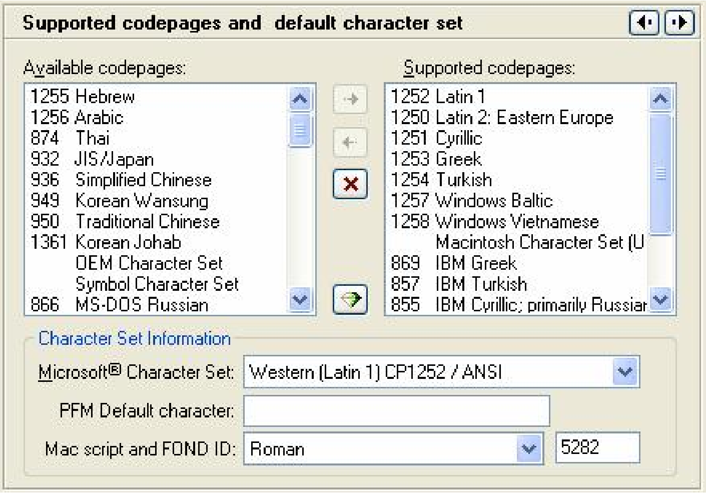
Encoding and Unicode



As we mentioned earlier, fonts may have very many characters and support a lot of different languages. To tell the operating system what codepages the current font can support, you set the codepages information.

TrueType and Type 1 fonts use different methods to identify what codepages a font supports. In TrueType fonts you can identify all the supported codepages by setting bits in a special field of the font header. In Type 1 fonts you select only one codepage (actually, encoding vector) and it must be compatible with the actual font encoding.

Supported Codepages



Supported codepages and default character set

Available codepages:

1255 Hebrew
1256 Arabic
874 Thai
932 JIS/Japan
936 Simplified Chinese
949 Korean Wansung
950 Traditional Chinese
1361 Korean Johab
OEM Character Set
Symbol Character Set
866 MS-DOS Russian

Supported codepages:

1252 Latin 1
1250 Latin 2: Eastern Europe
1251 Cyrillic
1253 Greek
1254 Turkish
1257 Windows Baltic
1258 Windows Vietnamese
Macintosh Character Set (U
869 IBM Greek
857 IBM Turkish
855 IBM Cyrillic; primarily Russiar

Character Set Information

Microsoft® Character Set: Western (Latin 1) CP1252 / ANSI

PFM Default character:

Mac script and FOND ID: Roman 5282

The operating system needs to know which codepages a TrueType font can support. To set this information you select all the codepages that this font can “cover” from the list of standard codepages that are available to the operating system.

To select the supported codepages automatically press the ◆ **Auto** button. FontLab Studio will analyse the Unicode information available in the font and will automatically detect which codepages this font can support.

To add a codepage to the list of supported codepages select a codepage in the left list and press the → **Add** button.

To remove a codepage from the list of supported codepages select a codepage in the right list and press the ← **Del** button.

To reset the list of supported codepages, press the ✕ **Reset** button.

The Meaning of Supported Codepages in Windows

In Windows 3.1x this information is not used.

In Windows 95 and Windows NT a font that has more than one standard (1252 Latin 1) codepage supported will appear as a font available for different scripts. So, if, for example, you setaLatin 1 and Cyrillic codepages for a font with the name MyFont, in Windows 95 (and NT) it will appear as MyFont (Western) and MyFont (Cyrillic).

Type 1 Character Set

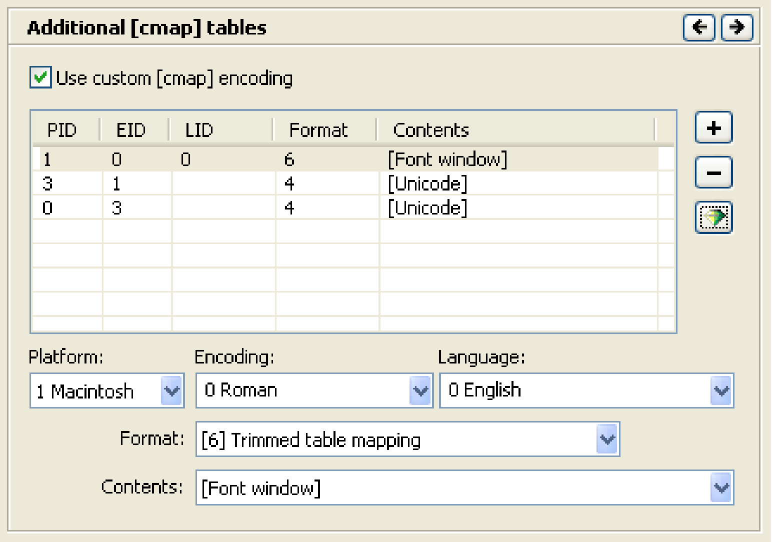
Type 1 fonts do not have such extensive support for multiple codepages. The character names they use to identify characters are mapped to codes through the encoding vector. There is one parameter that is used to tell Adobe Type Manager (used to support Type 1 fonts in Windows) how to interpret the encoding vector. This is the Microsoft Character set.

Some of the values for Microsoft Character set:

ANSI	The Font has all the characters necessary to represent the standard Windows Latin 1 character set. No reencoding is necessary
Symbol	The font is symbolic with a custom encoding vector. It should appear as Symbol in Windows applications and the font's own encoding vector should be used to access characters
ShiftJIS	This is a Japanese font that includes Kanji characters
OEM	The font has MS DOS characters. This setting is rarely used in Type 1 fonts
Bitstream	This is a normal text font, but it has its own encoding that should be used to access characters. This setting is highly recommended for all text fonts with a non-standard encoding vector
Arabic	The font has Arabic encoding.

Other values cover more codepages that may be supported by the font. Choose the codepage that is the default for your font.

Custom [cmap] encodings



Additional [cmap] tables

☑ Use custom [cmap] encoding

PID	EID	LID	Format	Contents
1	0	0	6	[Font window]
3	1		4	[Unicode]
0	3		4	[Unicode]

Platform: 1 Macintosh

Encoding: 0 Roman

Language: 0 English

Format: [6] Trimmed table mapping

Contents: [Font window]

When you are generating a TrueType / OpenType TT or a OpenType PS font, it is override FontLab Studio's default encoding options and use a custom "cmap" table editor instead. On this page, if the option **Use custom [cmap] encoding is enabled**, the user can specify how each subtable of the "cmap" table should be built.

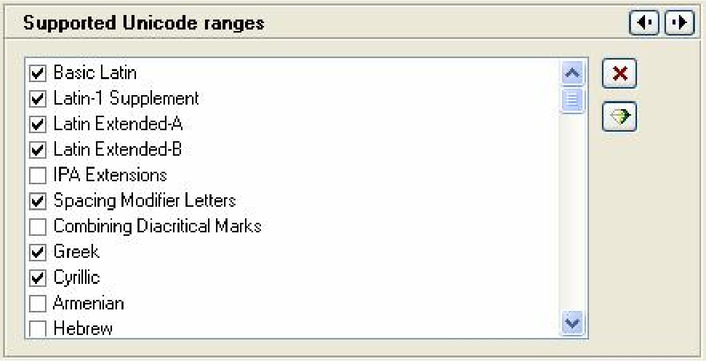
Please refer to the OpenType specification for the cmap table for detailed explanation of the platform and format settings:

http://www.microsoft.com/OpenType/OTSpec/cmap.htm

Use the ⊞ button to add a custom cmap subtable, and the ⊟ button to remove one. The ◆ adds a set of three cmap subtables: (1,0) for Mac OS Classic, (3,1) for Windows Unicode and (0,3) for Mac Unicode. This is a typical configuration of the cmap table for an OpenType font.

In the **Contents** combo box, you can select **[Unicode]** to write the mapping according to Unicode indexes specified in FontLab Studio, or choose a custom codepage mapping. Selecting **[Font window]** chooses the Codepage that is currently shown in the Font Window codepage mode.

Supported Unicode Ranges



Supported Unicode ranges

- ☑ Basic Latin
- ☑ Latin-1 Supplement
- ☑ Latin Extended-A
- ☑ Latin Extended-B
- ☐ IPA Extensions
- ☑ Spacing Modifier Letters
- ☐ Combining Diacritical Marks
- ☑ Greek
- ☑ Cyrillic
- ☐ Armenian
- ☐ Hebrew

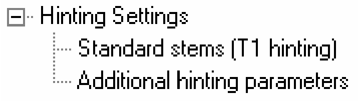
TrueType and OpenType fonts must declare Unicode ranges that the font can Support so that the operating system can decide which characters the font can be used to represent. In TrueType format this information is stored as the ulCodePageRange1 and ulUnicodeRange fields in the OS/2 table.

The Supported Unicode ranges dialog is relatively simple: you can see a list of all Unicode ranges with a check box to the left of each name. If the check box is checked it means that range is supported.

Buttons to the right of the list mean:

✕	Uncheck all ranges
◆	Automatically check ranges using information about Unicode indexes assigned to fonts characters.

Hinting Settings

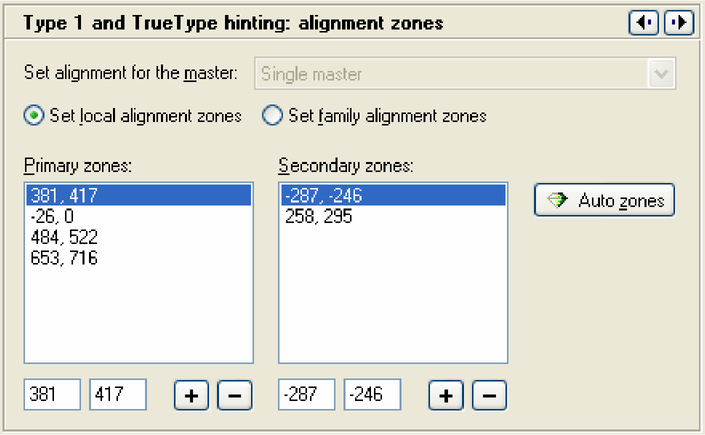


- Hinting Settings
  - Standard stems (T1 hinting)
  - Additional hinting parameters

Information in this section is related to hinting, which is described in full detail in the “Hinting” chapter. The information below is copied there also, so if you’re not interested in hinting right now, you can skip this section.

Alignment Zones

There are two list boxes where alignment zones can be set: the **Primary zones** list and the **Secondary zones** list:



Set alignment for the master: Single master

● Set local alignment zones ○ Set family alignment zones

Primary zones:

- 381, 417
- -26, 0
- 484, 522
- 653, 716

Secondary zones:

- -287, -246
- 258, 295

381 417 | -287 -246

In Type 1 terminology primary zones are called *BlueValues* and secondary zones *OtherBlues*.

BlueValues include one bottom alignment zone, the so-called *baseline zone,* and up to 6 top alignment zones. The baseline zone is used to control bottom overshoots that have to be aligned to the baseline.

OtherBlues includes up to 5 bottom alignment zones.

To add a new alignment zone, press the **Add** button below the list.

To edit the position of the zone, select the zone you want to edit in the list and edit it in the edit fields below the list.

To remove an alignment zone, select the zone you want to remove from the list and press the **Del** button below that list.

You can **see a preview of the zones** by switching on the Alignment Zones layer ▤ in the Glyph Window and pressing the **Apply** button in the FontInfo dialog box. You will see the alignment zones in the Glyph Window in light blue.

Press the **Auto zones** button to automatically calculate alignment zones in the **Primary zones** list box.

How FontLab Studio Calculates Alignment Zones

To calculate alignment zones in the BlueValues list, FontLab Studio fin ds characters with overshoots and characters that are flat in the position of the overshoot. Then it measures the top and bottom vertical positions of these characters and detects a zone. Examples of such characters are: ‘o’ and ‘x’, ‘O’ and ‘H’, ‘p’ and ‘g’, and so on. FontLab Studio tries to find many different characters from different languages, so it is usually able to locate some examples.

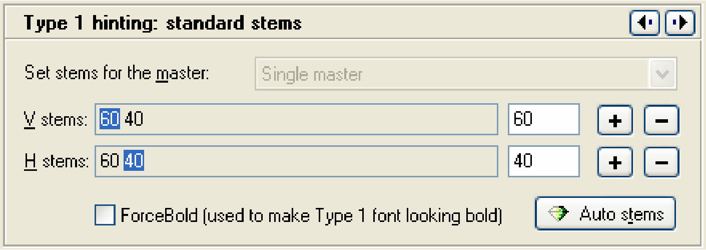
Alignment zones are also used in TrueType manual and automatic hinting.

Family Alignment Zones

To support the common appearance of fonts that belong to the same font family the Type 1 hinting system allows so-called FamilyBlues, alignment zones that are used in the whole font family.

To set family alignment zones switch on the **Set family alignment zones** check box. Then edit the alignment zones as usual. To return to editing “local” alignment zones switch on the **Set local alignment zones** check box.

Type 1 Standard Stems



Type 1 hinting: standard stems

Set stems for the master: Single master

V stems: 60 40 | 60

H stems: 60 40 | 40

□ ForceBold (used to make Type 1 font looking bold)

Standard stem widths are also controlled through the **Alignment** page of the **Font Info** dialog box. To edit standard stems open the Font Info dialog box and select the **Alignment** page.

There are controls for both vertical and horizontal standard stem widths. All available horizontal stems appear in the horizontal lists. You can select any stem just as you would in normal, vertical list controls.

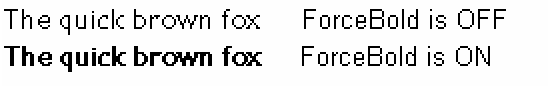
To add a stem to the list of the standard stems press + at the right side of the stems' list.

To edit a standard stem width, select it using the left mouse button and edit its value in the edit field to the right of the list.

To remove a stem from the list, select it and press the − button.

Note that FontLab Studio will sort stem widths starting from the second in ascending order when you close the **Font Info** dialog box.

ForceBold – when this option is switched on, Type 1 rendering algorithm makes the font looking "bold"



The quick brown fox   ForceBold is OFF

The quick brown fox   ForceBold is ON

StdHW, StdVW, StemSnapH and StemSnapV Parameters

From the Type 1 font specification you may know that in Type 1 fonts two types of standard stem widths are used: Standard Width and Stem Snap Width. There is one standard width for each direction and up to 10 stem snap values. In FontLab Studio these values are united in the stem list. StdHW and StdVW are taken from the first records in the stem lists. StemSnapH and StemSnapV records are the remaining records in the stems' list.

FontLab Studio also has a faster way to append stems to the list of standard stem widths. Any vertical or horizontal hint may be used as a source of stem width information. Just point the Edit tool at the hint, press the right mouse button and select the **Define a Stem** command in the popup menu. If this command is not accessible, it means that this stem is already in the list.

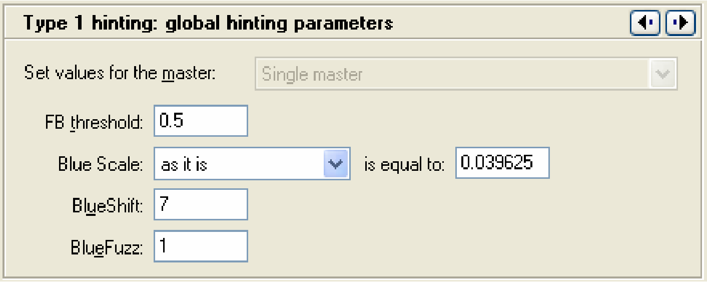
To automatically calculate standard stem widths press the **Auto stems** button.

How FontLab Studio Calculates Standard Stems

FontLab Studio can calculate standard stem widths only if some characters in the font have Type 1 hints.

1. It builds a table of all hints that are used in the font, sorts this table by frequency of usage and selects the most frequently used hints.
2. All selected hints are then compared with these most frequently occurring stem widths and hints with widths that are close together are combined into a single record.
3. The list is then sorted again.
4. The most frequently used elements are then selected and used as standard stems.

Global Hinting Parameters



Type 1 hinting: global hinting parameters

Set values for the master: Single master

FB threshold: 0.5

Blue Scale: as it is — is equal to: 0.039625

BlueShift: 7

BlueFuzz: 1

Some additional data may be set to control the hinting process:

FB threshold	ForceBold threshold – this parameter is used only in Multiple Master font and controls when the Force Bold parameter is ON in an intermediate design
BlueScale	Controls PPM when overshoot depression is switched off
BlueShift	Gives more precise control over overshoot description (see below)
BlueFuzz	Expands alignment zones in both directions

You can set all these values in the right part of the **Alignment** page of the **Font Info** dialog box.

BlueScale is the PPM size at which overshoot suppression is switched off. If PPM is less than BlueScale, then overshoot suppression is applied. If it is equal to or exceeds BlueScale, overshoot suppression works only if the distance from the aligned point to the base line of the alignment zone is less than the **BlueShift** value and the scaled distance is less then half of a pixel.

The BlueScale value is stored in Type 1 fonts in a very strange format, but in the Alignment page you can set it using one of three different ways: directly, in the form that the Type 1 specification describes (i.e. it looks like a floating point number), as a PPM size, or as a point size on a device with 300 DPI resolution. Use the **BlueScale:** combo box to select the BlueScale editing method and edit it in the **is equal to** edit field.

BlueScale Formulas

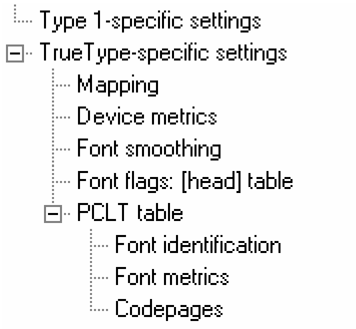
The "actual" value of the BlueScale value is calculated as:

$$BlueScale = \frac{(PPM - 1.63333)}{800.0}$$

The **BlueFuzz** value allows you to expand the action range of the alignment zones in both directions. Thus if you have defined a zone like (700-715), and BlueFuzz is equal to 2, then the actual zone used will be (698-717). This is usually used when you are not sure that you correctly set all the alignment zones or when the characters are not all precisely aligned. The normal value of this parameter is 0 but by default it is set to 1.

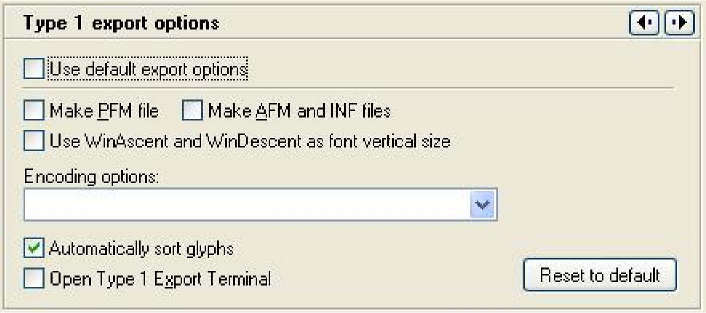
TrueType hinting algorithms do not use BlueScale, BlueFuzz and BlueShift values.

Format-Specific Options



This section covers options that are specific to Type 1 and TrueType/OpenType fonts. For both destination formats you may choose font-specific export options that will be used instead of globally set FontLab Studio options. In addition, for TrueType fonts you can customize some settings that are necessary for high-quality rendering.

Type 1 Export Options



☐ Use default export options

☐ Make PFM file ☐ Make AFM and INF files

☐ Use WinAscent and WinDescent as font vertical size

Encoding options:

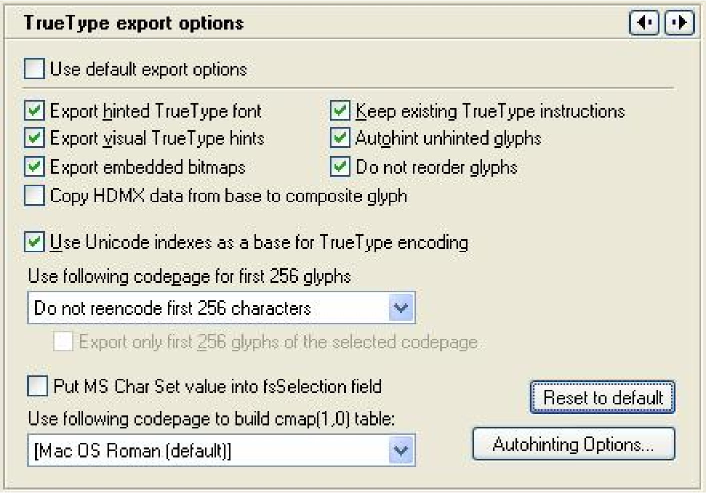
☑ Automatically sort glyphs

☐ Open Type 1 Export Terminal

Use this page to customize font export options for the current font. This page copies Options/Type 1 export settings, so you may refer there for the detailed description.

Switch on the **Use default export options** parameter to use default export options that are not font-specific.

TrueType Export Options



TrueType export options

□ Use default export options

☑ Export hinted TrueType font
☑ Export visual TrueType hints
☑ Export embedded bitmaps
□ Copy HDMX data from base to composite glyph

☑ Keep existing TrueType instructions
☑ Autohint unhinted glyphs
☑ Do not reorder glyphs

☑ Use Unicode indexes as a base for TrueType encoding

Use following codepage for first 256 glyphs: Do not reencode first 256 characters

□ Export only first 256 glyphs of the selected codepage

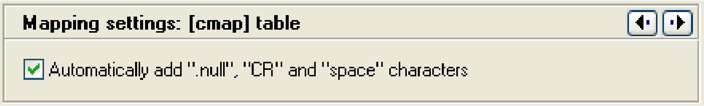
□ Put MS Char Set value into fsSelection field

Use following codepage to build cmap(1,0) table: [Mac OS Roman (default)]

Use this page to customize font export options for the current font. This page copies Options/TrueType export settings, so you may refer there for the detailed description.

Switch on the **Use default export options** parameter to use default export options that are not font-specific.

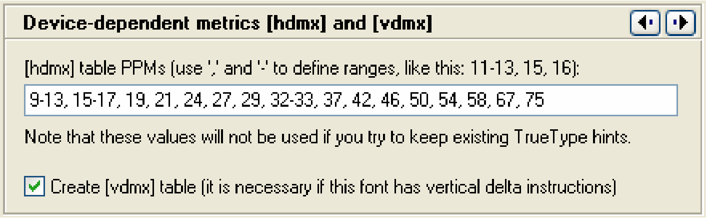
TrueType Mapping Settings


Mapping settings: [cmap] table

☑ Automatically add ".null", "CR" and "space" characters

If the **Automatically Add…** option is on, then FontLab Studio will analyse the font and add characters that are necessary for complete font compatibility. In Windows only two characters are really necessary: the “.notdef” and “space” characters. On the Mac a couple additional characters are required: “CR” and “NULL”. Note that FontLab Studio will generate these characters only if they do not exist in the font, so you can create them manually and control their appearance. We recommend leaving this option on, especially if you are developing Macintosh fonts.

Device-Dependent Metrics



Device-dependent metrics [hdmx] and [vdmx]

[hdmx] table PPMs (use ',' and '-' to define ranges, like this: 11-13, 15, 16):

9-13, 15-17, 19, 21, 24, 27, 29, 32-33, 37, 42, 46, 50, 54, 58, 67, 75

Note that these values will not be used if you try to keep existing TrueType hints.

☑ Create [vdmx] table (it is necessary if this font has vertical delta instructions)

The **[hdmx]** control lets you customize the sizes for which FontLab Studio will generate records in the hdmx TrueType table. This table is used to pre-calculate pixel metrics of font glyphs so it will not be necessary to run a hinting program to get the correct width.

If you don’t want FontLab Studio to generate a hdmx table for your font, empty this editing field.

Use a colon to separate entries and ‘-’ to define ranges of PPM.

Use the **Create VDMX Table** control to ask FontLab Studio to automatically calculate a VDMX (Vertical Device Metrics) table. This is necessary if some characters in the font are hinted in the vertical direction, so that at some resolutions they can extend above or below the scaled Win/Mac Ascender or Win/Mac Descender values and unwanted dropouts do not appear. We strongly recommend you always have this option switched on.

Using CacheTT to Build Device Metrics Tables

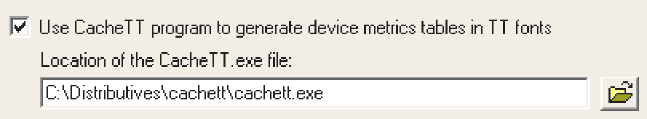
There are two ways to make a device metrics tables. You can use FontLab Studio to calculate these values or you can use the CacheTT program made by Microsoft. FontLab Studio’s own algorithm is very fast but is not as precise as CacheTT. We recommend you use FontLab Studio’s calculation while you are working on the font and use CacheTT when you prepare your font for release.

To calculate the device metrics tables using the CacheTT:

1. Download and install the CacheTT program. You can download it from this location:

   http://www.microsoft.com/typography/tools/cachett.zip

2. Open the Options dialog box (**Tools > Options...** command). Select the General page:

   ☑ Use CacheTT program to generate device metrics tables in TT fonts

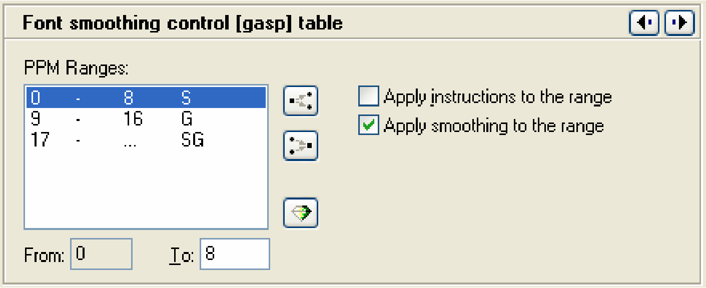
   Location of the CacheTT.exe file:

   C:\Distributives\cachett\cachett.exe

   Enter the full path to the CacheTT.exe file in the **Location of the Cache TT.exe file** field or click on the 📂 button to find the CacheTT.exe file using the file open dialog box.

3. Check the **Use CacheTT program to generate device metrics tables in TT fonts** checkbox if you want FontLab Studio to use CacheTT to generate device metrics tables in exported TrueType fonts.

Font Smoothing Control



Font smoothing control [gasp] table

PPM Ranges:

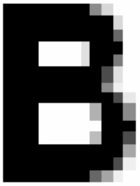
0	-	8	S
9	-	16	G
17	-	...	SG

□ Apply instructions to the range

☑ Apply smoothing to the range

From: 0 To: 8

To improve the appearance of TrueType fonts on the screen the latest versions of the Windows operating system use a special technique called font smoothing. With this technique edges of the characters are rendered using shades of gray:



Visually this decreases the dither of the characters' edges so that text is easier to read. This technique may be combined with gridfitting methods that optimize the character's appearance by adjusting its outline.

The font smoothing options let you control when to use one or both of these techniques.

In the list box you see PPM (Pixels Per eM — font size measured in screen pixels) ranges with one or two letters describing the applied technique.

S means that smoothing will be applied; **G** means that gridfitting will be applied; **SG** means that both techniques will be combined to achieve the best results.

To set options for a range, select the range and change its settings using the controls in the dialog box. Use the check boxes to select the rendering technique and the edit controls below the list to change the PPM range.

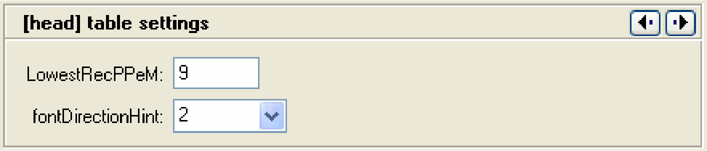
To define a new range, select one of the existing ranges and press the **Split** button. The range will be split into two ranges and you will be able to set different options for them.

To merge two ranges select a range and press the **Merge** button. The selected range will be merged with the range that is above it.

To reset the font smoothing settings press the **Auto** button and they will be calculated as advised by the TrueType specification.

You can see the results of these settings in the TrueType hinting Preview window when the TrueType hinting tool is active. Refer to the “Hinting” chapter for more information.

[head] Table Settings



[head] table settings

LowestRecPPeM: 9

fontDirectionHint: 2

These entries are specific for TrueType rendering. We do not recommend you modify them if you are not sure of what you are doing.

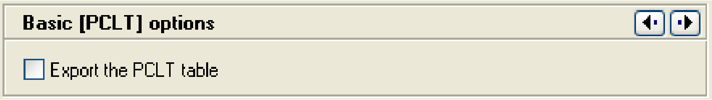
LowestRecPPem This parameter controls the lowest PPM at which the TrueType rasterizer is allowed to apply instructions

FontDirectionHint This [head] table parameter defines font direction, which may have the following values:

0: Fully mixed directional glyphs
1: Only strongly left to right
2: Like 1 but also contains neutrals
-1: Only strongly right to left
-2: Like -1 but also contains neutrals.

A neutral character has no inherent directionality. Spaces and punctuation are examples of neutral characters.

Basic PCLT options



Basic [PCLT] options

□ Export the PCLT table

The PCLT table is used when a TrueType font is printing on a PCL printer. PCL (Printer Control Language) is a page-definition and printer-control language developed by Hewlett Packard and is used in their printers.

This table is recommended for TrueType fonts, but only if you understand all the options and parameters.

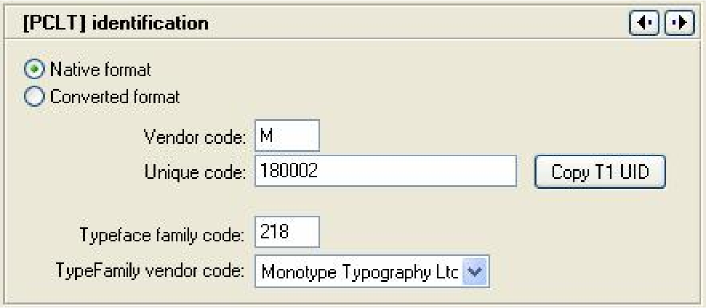
The first page includes only one option: **Export the PCLT table,** which controls table export. Note that you can define table parameters but not export the table – all values will be saved to your FontLab Studio font file (VFB).

Extra information on many of PCLT fields can be found in the *HP PCL 5 Printer Language Technical Reference Manual* available from Hewlett-Packard Boise Printer Division.

Our description of various PCLT fields is partially copied from the PCLT table specification available online at:

http://www.microsoft.com/typography/otspec/pclt.htm

PCLT Identification

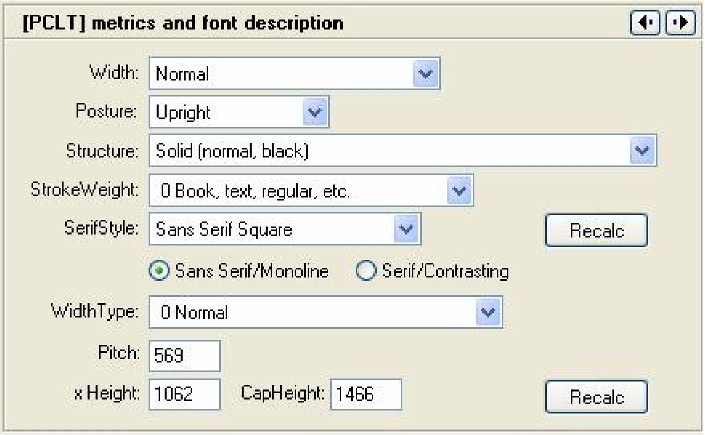


● Native format
○ Converted format

Vendor code: M
Unique code: 180002
Typeface family code: 218
TypeFamily vendor code: Monotype Typography Ltc

Native/Converted format	Only original font vendors can select Native format. If you are modifying an imported font, select **Converted format**
Vendor code	Single-character code of the font vendor - assigned by Hewlett-Packard Boise Printer Division to major font vendors. Below is a list of registered font vendors: A Adobe Systems B Bitstream Inc. C Agfa Corporation H Bigelow & Holmes L Linotype Company M Monotype Typography Ltd.
Unique code	Font's unique code – 24-bit integer. Using the Copy T1 UID button you can copy the Type 1 Unique ID value into this field
Typeface family code	This is a family code assigned by HP Boise Division. Refer to HP manuals for more information
TypeFamily vendor code	This is another vendor code assigned by the HP Boise Division. Choose one of values in the list.

PCLT Metrics and Font Description



[PCLT] metrics and font description

Width: Normal

Posture: Upright

Structure: Solid (normal, black)

StrokeWeight: 0 Book, text, regular, etc.

SerifStyle: Sans Serif Square

● Sans Serif/Monoline ○ Serif/Contrasting

WidthType: 0 Normal

Pitch: 569

x Height: 1062 CapHeight: 1466

Width The appearance width. Select one of the options in the list

Posture The slant of the glyphs. Could be upright, italic/oblique or reversed italic

Structure The structure of the glyph’s interior. Select one of the options in the list

StrokeWeight Weight of the font. This value is related to the **Weight** parameter on the **basic names** page

SerifStyle Style of the glyph’s serifs. This is related to the PANOSE settings.

Use the **Recalc** button to calculate values automatically using information from other pages

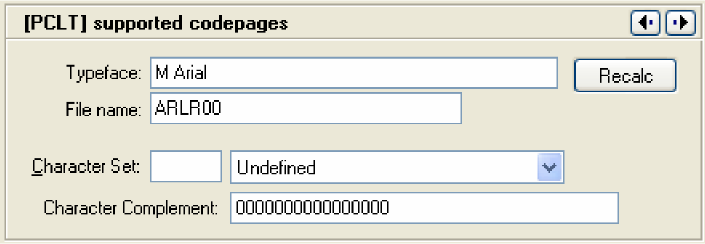
WidthType PCL appearance width value. Select one of the options in the list

Pitch The width of the space in font units

xHeight The height of the optical line describing the height of the lowercase x in font units. This might not be the same as the measured height of the lowercase x

CapHeight The height of the optical line describing the top of the uppercase H in font units. This might not be the same as the measured height of the uppercase H.

PCLT Codepages


[PCLT] supported codepages

Typeface: M Arial

File name: ARLR00

Character Set: Undefined

Character Complement: 0000000000000000

Typeface

This 16-byte ASCII string appears in the "font print" of PCL printers. Care should be taken to insure that the base string for all typefaces of a family are consistent, and that the designators for bold, italic, etc. are standardized.

Times New
Times New Bd
Times New It
Times New BdIt

File name

This 6-byte field is composed of 3 parts. The first 3 bytes are an industry standard typeface family string. The fourth byte is a treatment character, such as R, B, I. The last two characters are either zeroes for an unbound font or a two-character mnemonic for a symbol set if a symbol set is found.

Examples:

TNRR00 Times New (text weight, upright)
TNRI00 Times New Italic

Character Set

Symbol set values are assigned by HP Boise Division. Unbound fonts, or "typefaces" should have a symbol set value of 0. See the *PCL 5 Printer Language Technical Reference Manual* or the *PCL 5 Comparison Guide* for the most recent published list of codes.

In most cases all you need to do is to select one of pre-defined values in the list to the right of the manual field. See below for more information

Character Complement

This 8-byte field identifies the symbol collections provided by the font, each bit identifies a symbol collection and is independently interpreted. Symbol set bound fonts should have this field set to all F's (except bit 0).

File Name Treatment Flags:

R	Text, normal, book, etc.
I	Italic, oblique, slanted, etc.
B	Bold
J	Bold Italic, Bold Oblique
D	Demibold
E	Demibold Italic, Demibold Oblique
K	Black
G	Black Italic, Black Oblique
L	Light
P	Light Italic, Light Oblique
C	Condensed
A	Condensed Italic, Condensed Oblique
F	Bold Condensed
H	Bold Condensed Italic, Bold Condensed Oblique
S	Semibold (lighter than demibold)
T	Semibold Italic, Semibold Oblique

Character Set Table

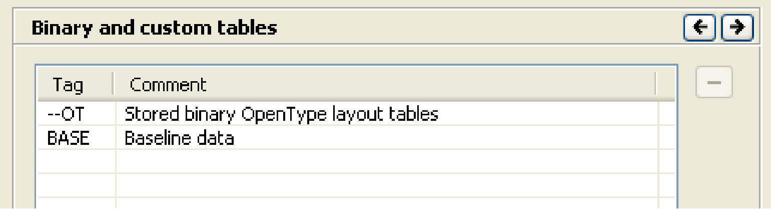
FontLab Studio stores the list of predefined character set codes with descriptions in a special text file named pclset.dat located in the FontLab Studio/Data folder.

This file has a simple structure:

```
-- Undefined
19M Adobe Symbol
0V Arabic (McKay's)
```

Every line contains a Character set code followed, after a single space, by a description of the character set. You can open this file in any text editor, like Windows Notepad, and make any changes you want.

Binary and custom tables



Tag	Comment
--OT	Stored binary OpenType layout tables
BASE	Baseline data

OpenType and TrueType fonts may contain tables that are unknown to FontLab Studio. These can be registered OpenType tables that FontLab cannot interpret (e.g. BASE or JSTF), AAT tables (e.g. morx or gvar), binary "native" copies of some tables that the user may want to retain (e.g. the OpenType Layout tables or native TrueType hinting) or tables generated by some private tools.

If the option **Store custom TrueType/OpenType tables** is enabled in **Options > Opening OpenType & TrueType**, FontLab Studio will store in the .vfb file the tables that it cannot interpret. If the option **Store binary OpenType layout tables** is enabled, FontLab Studio will also store the OpenType layout tables GPOS, GDEF and GSUB in their binary form – although it can interpret these tables at least to a large extent. Finally, if the option **Store TrueType native hinting** is enabled, FontLab Studio will store the original TrueType instructions.

The **Binary and custom tables** page shows all stored OpenType and TrueType tables. If stored OpenType Layout tables are present in the .vfb file, the tag "—OT" is shown in the Tag column. If stored TrueType native hinting is present, the tag "—TT" is shown. For all other tables, the actual table tag will be displayed. In the Comment field, FontLab Studio shows a description of the table if possible (known).

You can use the ⊟ button to remove any stored tables from the .vfb file. Note that if you generate the font in the TrueType / OpenType TT or OpenType PS format, the stored tables will only be written if appropriate options are set.

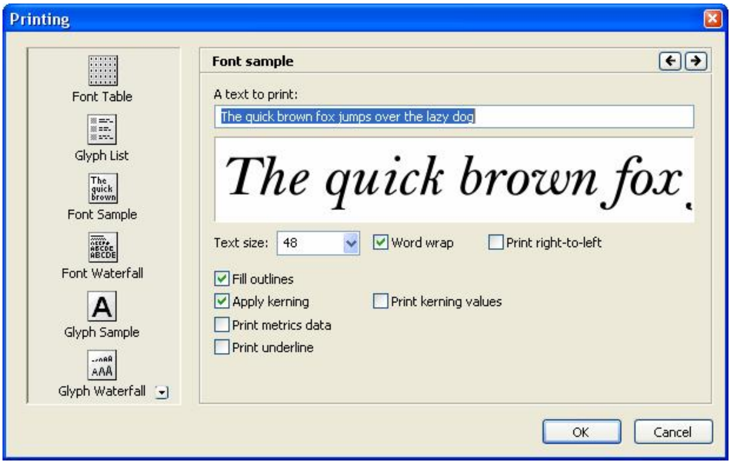
Printing and Proofing Fonts

FontLab Studio 5 has several new tools for visual proofing and printing of your fonts. Several new printing modes allow you to print font content in different ways with various options. You can print all or selected glyphs with all character information, sample strings, detailed glyph printouts as well as a kerning table. A new Quick Test feature that proofs the font using the system renderer has also been added. At the end of this section, a summary of additional methods of visual proofing is presented.

4

Printing

To see the printing modes available, choose File **> Print**. You will see the following dialog box:



A text to print: The quick brown fox jumps over the lazy dog

Text size: 48

☑ Word wrap

□ Print right-to-left

☑ Fill outlines

☑ Apply kerning

□ Print kerning values

□ Print metrics data

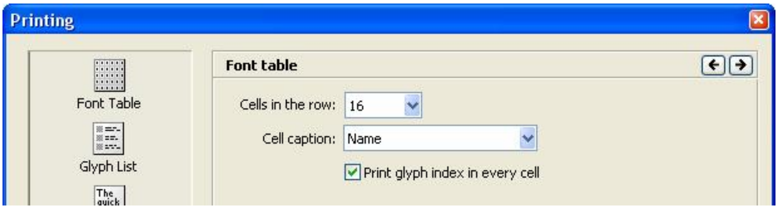
□ Print underline

On the left side of the dialog box, you can choose one of the available printing modes: Font Table, Glyph List, Font Sample, Font Waterfall, Glyph Sample, Glyph Waterfall and Kerning Table.

Printing Font Table

To print the font table of the current font

1. Select the **Print** command in the **File** menu or click on the 🖨 button in the Standard toolbar. You will see a dialog box that asks you to select one of the printing modes:



Font table

Cells in the row: 16

Cell caption: Name

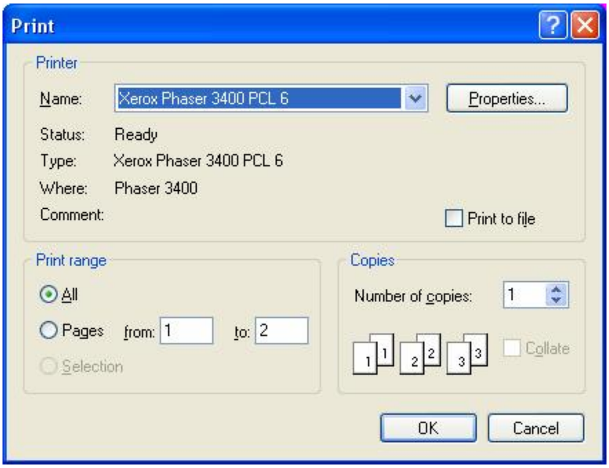
☑ Print glyph index in every cell

2. Select the “Font Table” item in the list at the left to print a font chart containing samples of all font glyphs.

3. Choose how many cells you want to be printed in one row. The fewer cells will be printed in a row the larger will be each cell and the more pages you will get printed.

4. Choose information for the cells caption. This option is similar to the caption popup menu in the Font window.

5. Select whether to print glyph index in every cell or not and click **OK**. You will see the standard Windows **Print** dialog box that will ask you to choose a printer and modify the printer settings:



Print

Printer

Name: Xerox Phaser 3400 PCL 6

Status: Ready

Type: Xerox Phaser 3400 PCL 6

Where: Phaser 3400

Comment:

□ Print to file

Print range

● All

○ Pages from: 1 to: 2

○ Selection

Copies

Number of copies: 1

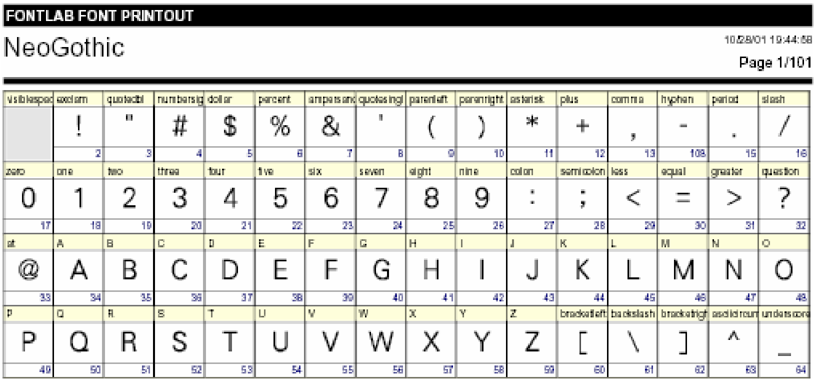
□ Collate

In this dialog you can choose the range of pages you want to print.

When you press the **OK** button, FontLab Studio will print a font table containing samples for all font glyphs.

If you print a Multiple Master font the glyphs will appear according to the current font's WeightVector.

Printout of the font chart:



FONTLAB FONT PRINTOUT

NeoGothic

10/28/01 19:44:58

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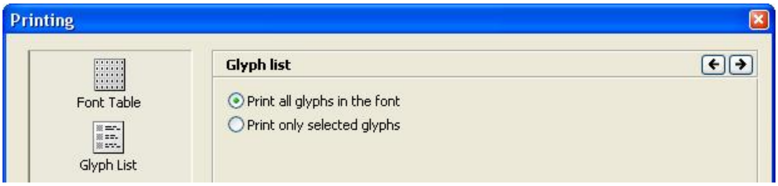
visiblespac	exclam	quotedbl	numbersig	dollar	percent	ampersanc	quotesingl	parenleft	parenright	asterisk	plus	comma	hyphen	period	slash
	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
	2	3	4	5	6	7	8	9	10	11	12	13	108	15	16
zero	one	two	three	four	five	six	seven	eight	nine	colon	semicolon	less	equal	greater	question
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
at	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
P	Q	R	S	T	U	V	W	X	Y	Z	bracketleft	backslash	bracketrigh	asciicircum	underscore
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64

Printing Glyph List

To print the glyph list of the current font

1. Select the **Print** command in the **File** menu or click on the button in the Standard toolbar and select the “Glyph List” item at the left of the Printing dialog box:



Printing

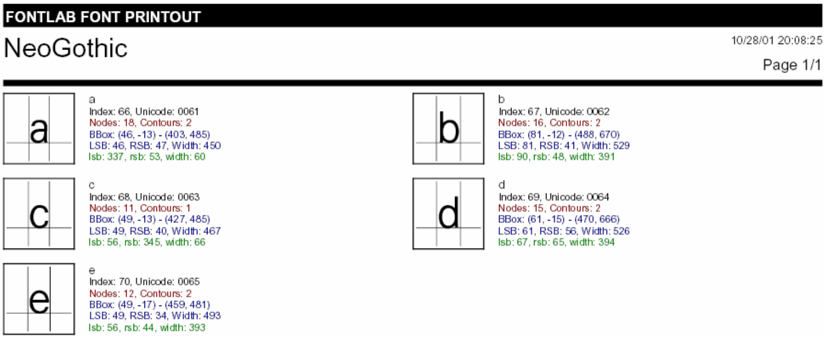
Glyph list

● Print all glyphs in the font
○ Print only selected glyphs

2. At the right choose whether to print all font glyphs or only the selected glyphs and click **OK**. You will see the standard Windows **Print** dialog box.

Note that some information is colored; so printing on a color printer will have some benefits.

Printout of the glyph list:



FONTLAB FONT PRINTOUT

NeoGothic

10/28/01 20:08:25

Page 1/1

a
Index: 66, Unicode: 0061
Nodes: 18, Contours: 2
BBox: (46, -13) - (403, 485)
LSB: 46, RSB: 47, Width: 450
lsb: 337, rsb: 53, width: 60

b
Index: 67, Unicode: 0062
Nodes: 16, Contours: 2
BBox: (81, -12) - (488, 670)
LSB: 81, RSB: 41, Width: 529
lsb: 90, rsb: 48, width: 391

c
Index: 68, Unicode: 0063
Nodes: 11, Contours: 1
BBox: (49, -13) - (427, 485)
LSB: 49, RSB: 40, Width: 467
lsb: 56, rsb: 345, width: 66

d
Index: 69, Unicode: 0064
Nodes: 15, Contours: 2
BBox: (61, -15) - (470, 666)
LSB: 61, RSB: 56, Width: 526
lsb: 67, rsb: 65, width: 394

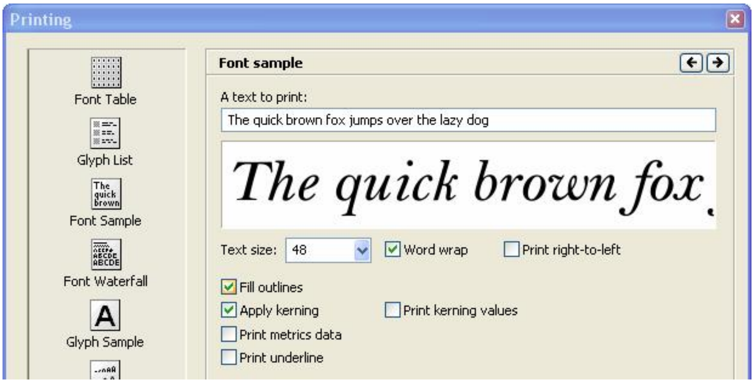
e
Index: 70, Unicode: 0065
Nodes: 12, Contours: 2
BBox: (49, -17) - (459, 481)
LSB: 49, RSB: 34, Width: 493
lsb: 56, rsb: 44, width: 393

As you can see, this is the same information that is displayed in the Glyph properties panel.

Printing Font Sample

To print the current font sample

1. Select the **Print** command in the **File** menu or click on the button in the Standard toolbar and select the “Font Sample” item at the left of the Printing dialog box:



Font sample

A text to print: The quick brown fox jumps over the lazy dog

Text size: 48 ☑ Word wrap □ Print right-to-left

☑ Fill outlines

☑ Apply kerning □ Print kerning values

□ Print metrics data

□ Print underline

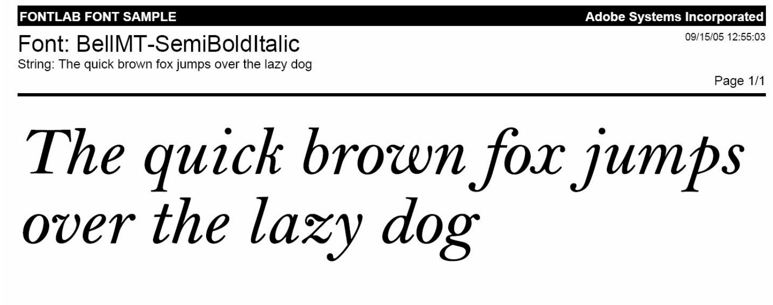
2. At the right type the text you want to be printed and set the size of text. Note that metrics information is printed only when larger sizes are selected.

3. Set other printing options:

Word wrap	If this option is on FontLab Studio will wrap words when printing
Fill outlines	If this option is on characters will be printed filled
Apply kerning	If this option is on and the kerning is defined for the font the text will be printed kerned
Print kerning values	If this option is on and the kerning is defined FontLab Studio will print kerning values
Print metrics data	If this option is on and the text size is large enough the values of the glyph width and sidebearings will be printed
Print underline	If this option is on the text will be printed underlined.

4. Click **OK**. You will see the standard Windows Print dialog box.

Printout of the font sample with default printing options:



FONTLAB FONT SAMPLE Adobe Systems Incorporated

Font: BellMT-SemiBoldItalic

09/15/05 12:55:03

String: The quick brown fox jumps over the lazy dog

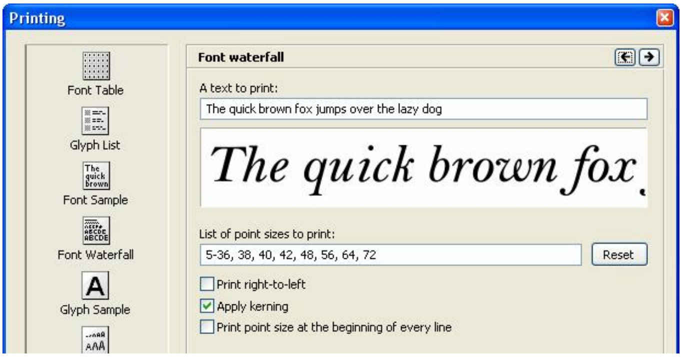
Page 1/1

The quick brown fox jumps over the lazy dog

Printing Font Waterfall

To print the current font waterfall sample

1. Select the **Print** command in the **File** menu or click on the 🖨 button in the Standard toolbar and select the “Font Waterfall” item at the left of the Printing dialog box:



Printing

Font waterfall

A text to print:

The quick brown fox jumps over the lazy dog

List of point sizes to print:

5-36, 38, 40, 42, 48, 56, 64, 72

Reset

□ Print right-to-left

☑ Apply kerning

□ Print point size at the beginning of every line

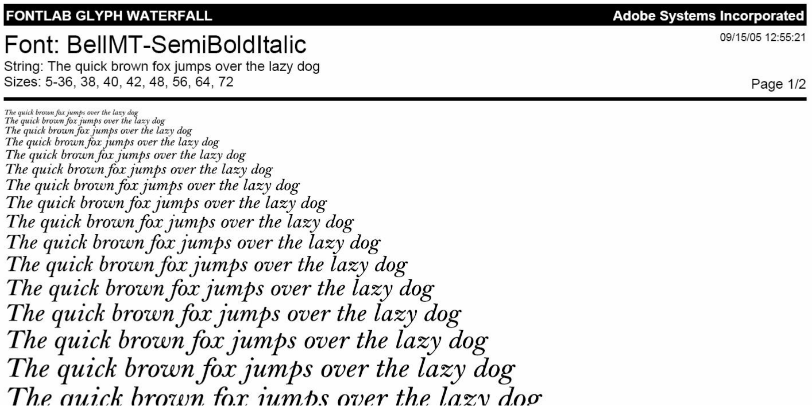
2. At the right type the text you want to be printed and edit the list of point sizes if needed. Click on the **Reset** button to restore the default list of sizes.

3. Set other printing options:

Apply kerning	If this option is on and the kerning is defined for the font the text will be printed kerned
Print point sizes at the beginning of every line	If this option is on FontLab Studio will print size values

4. Click **OK**. You will see the standard Windows Print dialog box.

Printout of the font waterfall with default printing options:



FONTLAB GLYPH WATERFALL | Adobe Systems Incorporated

Font: BellMT-SemiBoldItalic

09/15/05 12:55:21

String: The quick brown fox jumps over the lazy dog

Sizes: 5-36, 38, 40, 42, 48, 56, 64, 72

Page 1/2

The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
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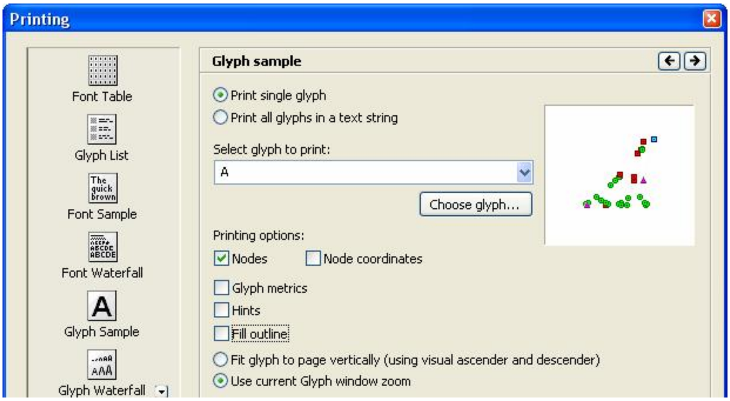
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog

Printing Glyph Sample

To print the glyph sample

1. Select the **Print** command in the **File** menu or click on the button in the Standard toolbar and select the “Glyph Sample” item at the left of the Printing dialog box:



Printing

Glyph sample

● Print single glyph
○ Print all glyphs in a text string

Select glyph to print: A

Printing options:

☑ Nodes ☐ Node coordinates
☐ Glyph metrics
☐ Hints
☐ Fill outline

○ Fit glyph to page vertically (using visual ascender and descender)
● Use current Glyph window zoom

2. At the right select the single glyph that you want to be printed or type the names of glyphs proceeded by slash. You also may use glyph Unicode codepoints proceeded by backslash. You can use the **Choose Glyph** button to open the Find Glyphs dialog box.

3. Set other printing options:

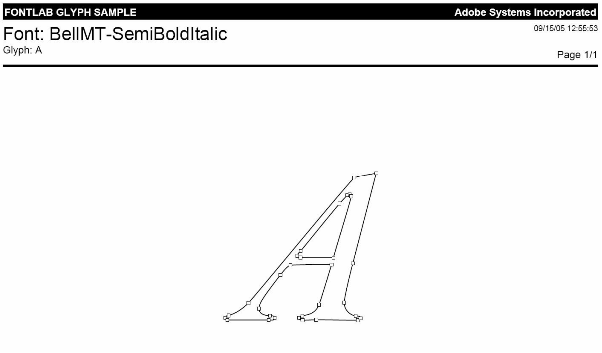
Nodes	If this option is on FontLab Studio will print squares visually representing nodes
Node coordinates	If this option is on FontLab Studio will also print coordinates for each node in font units. Node coordinates cannot be printed without printing nodes
Glyph metrics	If this option is on FontLab Studio will print lines representing glyph metrics
Hints	If this option is on and hints are present they will be printed
Fill outline	If this option is on glyph outlines will be printed filled

Fit glyph to page vertically	If this option is selected each glyph will be printed scaled to fit the page vertically and centered horizontally
Use current Glyph window zoom	If this option is on each glyph will be printed at the size of the currently opened Glyph window. This option cannot be selected if there are no opened Glyph windows.

4. Click **OK**. You will see the standard Windows Print dialog box.

Use combinations of different options to see the printing result which better meets your needs.

Printout of the glyph sample with default printing options:



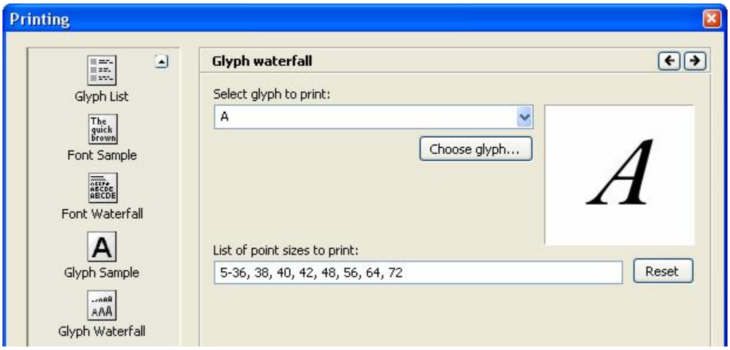
FONTLAB GLYPH SAMPLE
Adobe Systems Incorporated

Font: BellMT-SemiBoldItalic
09/15/05 12:55:53
Glyph: A
Page 1/1

Printing Glyph Waterfall

To print the glyph waterfall sample

1. Select the **Print** command in the **File** menu or click on the button in the Standard toolbar and select the “Glyph Waterfall” item at the left of the Printing dialog box:

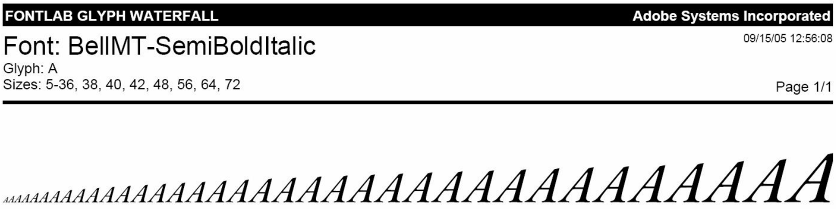


Select glyph to print: A

List of point sizes to print: 5-36, 38, 40, 42, 48, 56, 64, 72

2. At the right select the single glyph that you want to be printed. Use the **Choose Glyph** button to open the Find Glyphs dialog box and find a particular glyph for print.
3. Edit the list of point sizes if needed. Click on the **Reset** button to restore the default list of point sizes.
4. Click **OK**. You will see the standard Windows Print dialog box.

Printout of the glyph waterfall:



FONTLAB GLYPH WATERFALL　Adobe Systems Incorporated

Font: BellMT-SemiBoldItalic　09/15/05 12:56:08

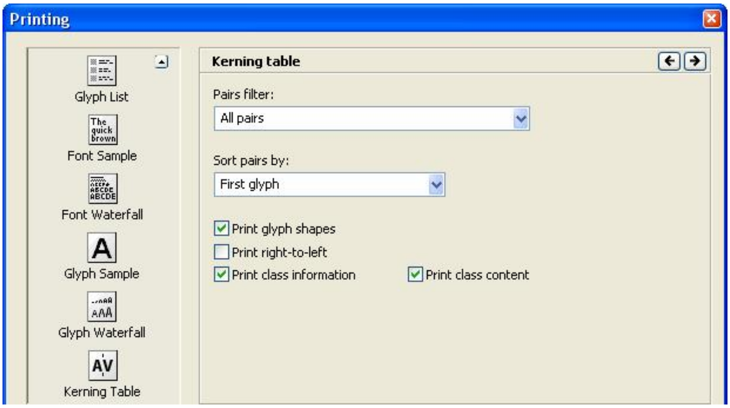
Glyph: A

Sizes: 5-36, 38, 40, 42, 48, 56, 64, 72　Page 1/1

Printing Kerning Table

To print the kerning table

1. Select the **Print** command in the **File** menu or click on the 🖨 button in the Standard toolbar, click on the ▾ button in the left pane of the dialog box and select the “Kerning Table” item at the left of the Printing dialog box:



Kerning table

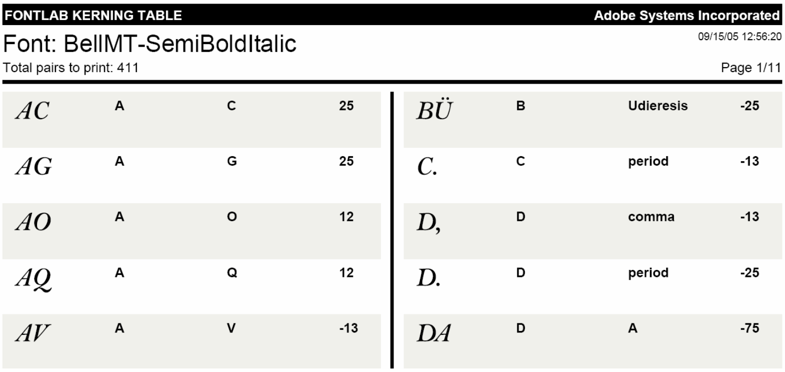
Pairs filter: All pairs

Sort pairs by: First glyph

☑ Print glyph shapes
□ Print right-to-left
☑ Print class information
☑ Print class content

2. At the right choose the options of the printout. The **Pairs filter** selector is similar to the one in the Kerning Table in Metrics Window. You can choose to print all pairs or only those where one or both glyphs are either selected or in encoding, i.e. “in the yellow zone”.
3. Choose how to **Sort pairs by** in the printout (by the glyph name of the first or second glyph in the pair, or by the kerning value).
4. Enable **Print glyph shapes** to print the actual glyphs. If disabled, only glyph names and values will be printed.
5. **Print right-to-left** allows you to print the pairs so that the first glyph in the pair is always on the left of the second glyph.
6. If your font uses class kerning, **Print class information** and **Print class content** allow to include basic or full information about the classes.
7. Click **OK**. You will see the standard Windows Print dialog box.

Printout of the kerning table with default printing options:



FONTLAB KERNING TABLE Adobe Systems Incorporated

Font: BellMT-SemiBoldItalic 09/15/05 12:56:20

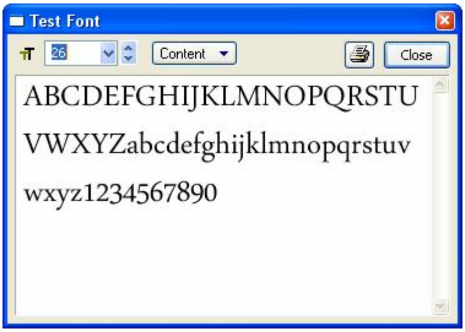
Total pairs to print: 411 Page 1/11

AC	A	C	25	*BÜ*	B	Udieresis	-25
AG	A	G	25	*C.*	C	period	-13
AO	A	O	12	*D,*	D	comma	-13
AQ	A	Q	12	*D.*	D	period	-25
AV	A	V	-13	*DA*	D	A	-75

Quick Test

FontLab Studio has a new feature allowing you to test your fonts quickly. You can generate and temporarily install your font with one command and then see how it works in real text-editing environment.

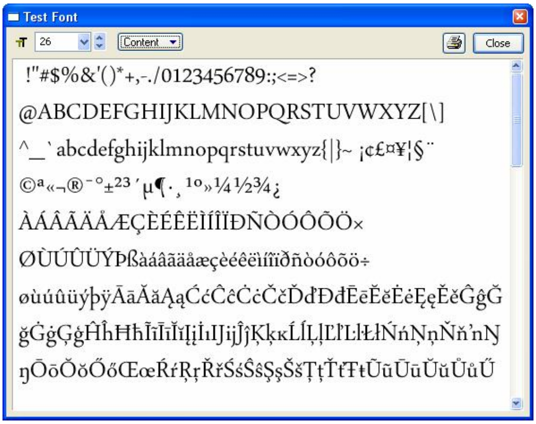
To test the open font, just select the **OpenType TT** or **OpenType PS** command in the **Tools > Quick Test As** menu. FontLab Studio will generate the font in the selected font format (using the current generation Options), temporarily install it in your system, and present the following window:



ABCDEFGHIJKLMNOPQRSTU
VWXYZabcdefghijklmnopqrstuv
wxyz1234567890

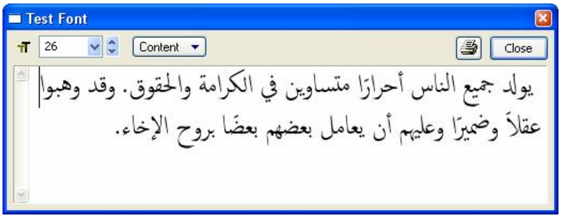
This is a simple text editor allowing you to type with your font, change the text size and print the content.

Type or paste the sample text in the editing field. Use the **Content** popup menu to see the characters of the particular codepage or entire character set of the font, i.e. all glyphs that have a Unicode codepoint assigned.



 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
^_`abcdefghijklmnopqrstuvwxyz{|}~ ¡¢£¤¥¦§¨
©ª«¬®¯°±²³´µ¶·¸¹º»¼½¾¿
ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖ×
ØÙÚÛÜÝÞßàáâãäåæçèéêëìíîïðñòóôõö÷
øùúûüýþÿĀāĂăĄąĆćĈĉĊċČčĎďĐđĒēĔĕĖėĘęĚěĜĝĞ
ğĠġĢģĤĥĦħĨĩĪīĬĭĮįİıĲĳĴĵĶķĸĹĺĻļĽľĿŀŁłŃńŅņŇňŉŊ
ŋŌōŎŏŐőŒœŔŕŖŗŘřŚśŜŝŞşŠšŢţŤťŦŧŨũŪūŬŭŮůŰ

You can also type in your custom text. Note that since this dialog uses the system font rendering, you will see the OpenType layout features that are applied by the operating system by default. If you use Windows XP SP-2 or higher and enable **Control Panel > Regional and Language Options > Language > Supplemental language support > Install files for complex script…** , you will be even able to test complex script OpenType Layout features if your font has binary OpenType tables included (for more information on dealing with binary OpenType tables see the "OpenType Fonts" chapter).



يولد جميع الناس أحرارًا متساوين في الكرامة والحقوق. وقد وهبوا
عقلاً وضميرًا وعليهم أن يعامل بعضهم بعضًا بروح الإخاء.

You can print the display text from this dialog.

You can launch other applications (e.g. MS Word or InDesign) and see how the font works there. The font name is generated automatically and starts with 'FLSFNT'.

To finish testing the font and close the window, click on the **Close** button.

Other Proofing Methods

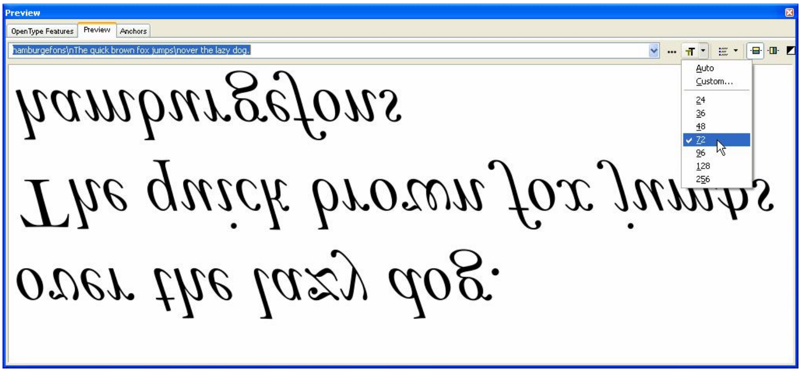
In addition to the proofing features described above that allow you to produce printouts, FontLab Studio offers additional methods for visual proofing of your fonts on screen. They are discussed more extensively in other sections of this manual but here follows a quick summary.

Preview panel

The **Preview** panel (Windows > Panels > Preview) allows you to preview sample strings with a variety of options. It can be docked at the top or bottom of the screen, or positioned on a second monitor. With the panel, you can type arbitrary strings that will be previewed using your current font, or choose the strings from a combo box. Extended characters can be inserted by typing /glyphname or \XXXX or \uXXXX for Unicode codepoints.

✐ **Tip**: **SC Unipad** (http://www.unipad.org/) is an excellent Unicode text editor that can quickly convert between true Unicode characters and the \uXXXX notation. To produce multilingual previews, type your text in SC Unipad, convert to \uXXXX and paste the result into FontLab Studio.

A new feature in FontLab Studio 5 is the ability to preview multiline text: insert \n anywhere within the preview string to enforce line wrap.

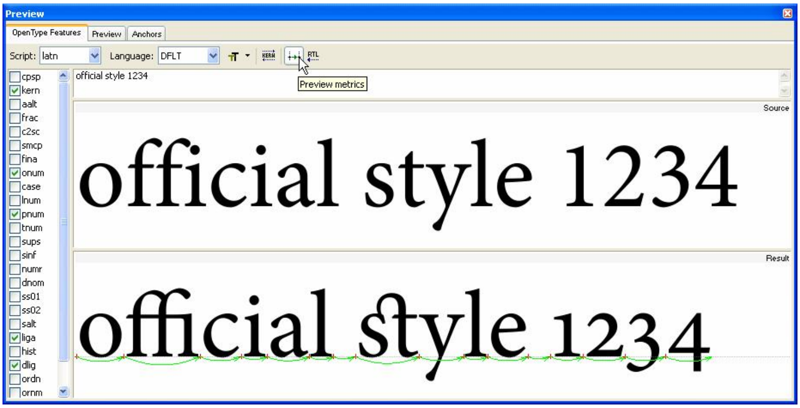


hamburgefons\nThe quick brown fox jumps\nover the lazy dog.

The text in the preview panel can be shown in reversed colors (white on black), flipped vertically, flipped horizontally, previewed right-to-left or in vertical orientation.

OpenType Features panel

The **OpenType Features** panel is available as a second page of the Preview panel and provides visual proofing capabilities for OpenType Layout features included in the font. It is a great tool for quick previewing of your OpenType feature definition code, especially for Western typographic features. You can check whether your features are in a correct order (to avoid unwanted effects with interaction of different features), customize the preview size, optionally display the glyph metrics and present the glyphs in right-to-left order.



Script: latn
Language: DFLT

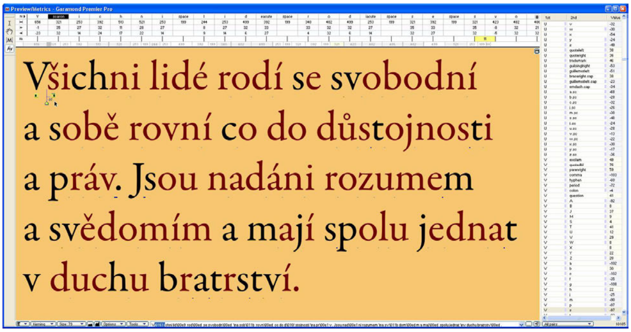
- □ cpsp
- ☑ kern
- □ aalt
- □ frac
- □ c2sc
- □ smcp
- □ fina
- ☑ onum
- □ case
- □ lnum
- ☑ pnum
- □ tnum
- □ sups
- □ sinf
- □ numr
- □ dnom
- □ ss01
- □ ss02
- □ salt
- ☑ liga
- □ hist
- ☑ dlig
- □ ordn
- □ ornm

official style 1234

Currently, the OpenType Features panel does not support all lookup types and does not allow you to apply features selectively to single characters or words. It also does not support special shaping rules for complex scripts. To preview OpenType Layout features for complex scripts, use the Quick Test feature discussed earlier.

Metrics Window

The vastly enhanced **Metrics Window** (**Window > New Metrics Window**) in FontLab Studio 5 offers attractive visual proofing capabilities. With improved multilingual support, direct multiline text editing in the text mode, fully customizable colors and a screen-space saving layout with optional controls, it offers an excellent tool for letter spacing, kerning and visual proofing.

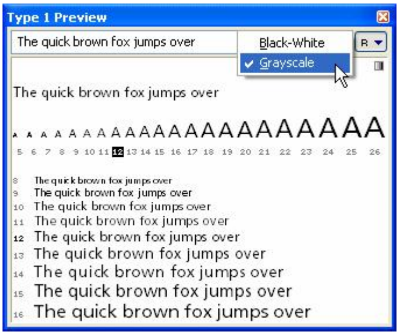


Preview/Metrics - Garamond Premier Pro

Všichni lidé rodí se svobodní
a sobě rovní co do důstojnosti
a práv. Jsou nadáni rozumem
a svědomím a mají spolu jednat
v duchu bratrství.

Hinting Tools

The **Type 1 Hinting** and **TrueType Hinting** tools (**Tools > Hints & Guides**) provide accurate bitmap previews of your Type 1, OpenType and TrueType fonts as they will appear on screen. The tools call the font rasterizers present in the system to produce the previews so the accuracy is guaranteed. The hinting preview panels allow you to toggle between different screen sizes, zoom in individual glyphs and select various rendering modes.



Type 1 Preview

The quick brown fox jumps over

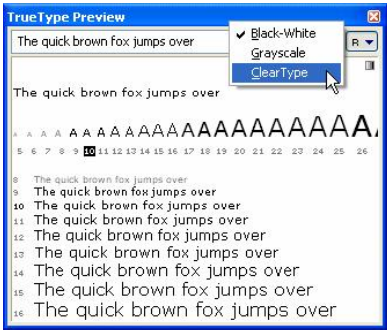
Black-White
✓ Grayscale

The quick brown fox jumps over

A A A A A A A A A A A A A A A A A A A A A A

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

8 The quick brown fox jumps over
9 The quick brown fox jumps over
10 The quick brown fox jumps over
11 The quick brown fox jumps over
12 The quick brown fox jumps over
13 The quick brown fox jumps over
14 The quick brown fox jumps over
15 The quick brown fox jumps over
16 The quick brown fox jumps over



TrueType Preview

The quick brown fox jumps over

✓ Black-White
Grayscale
ClearType

The quick brown fox jumps over

A A A A A A A A A A A A A A A A A A A A A A

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

8 The quick brown fox jumps over
9 The quick brown fox jumps over
10 The quick brown fox jumps over
11 The quick brown fox jumps over
12 The quick brown fox jumps over
13 The quick brown fox jumps over
14 The quick brown fox jumps over
15 The quick brown fox jumps over
16 The quick brown fox jumps over

Generating Fonts

In this chapter, we will discuss the most important aspects of generating workable fonts in the most popular formats. Please note that all recommendations and guidelines in this chapter only address typical and common cases. There can be exceptions and special situations. For those, you need to refer to the specific sections of the manual, and to the appropriate font format specifications.

This chapter also assumes that you have read the rest of the manual.

5

Relevant Font Formats

The following lists the most relevant font formats and lists some of their advantages and disadvantages.

OpenType PS

Also known as: OpenType-CFF, PostScript-flavored OpenType, OTF

Filename extension: .otf

Pros: Works on Windows, Linux, Mac OS 8.6, 9, and OS X. Uses the Bezier curves that are preferred by designers and used in drawing apps such as Illustrator and Freehand so letterforms can be drawn precisely and outlines need not be converted. May contain up to 65,535 glyphs, supports Unicode and can contain OpenType Layout features.

Suitable for Western Roman fonts, non-Latin fonts, multilingual fonts and advanced typography. May include class kerning allowing for moderately-sized kerning tables. Uses Type 1 hinting that is relatively easy to create. Can include embedding rights information defining whether or not the font may be attached to electronic documents.

Cons: Type 1 hinting does not allow precise control in small screen sizes. Can theoretically contain bitmaps, but they are not displayed. Since this is a relatively new format, there are problems with old some applications (some styles are not displayed in menus, kerning for non-Western characters does not work.) The multilingual and advanced typography features only work with new OpenType-savvy applications, otherwise just the basic character set is available. Two alternative family namings within each font must be devised: one where a family contains an arbitrary number of styles, and second “brief family” where one family does not contain more than four styles. Does not work on Mac OS 8.

Windows TrueType / OpenType TT

Also known as: Data-fork TrueType, Windows TrueType, TrueType-flavored OpenType, TTF

File extension: .ttf, also possible: .otf

Pros: Works on Windows, Linux and Mac OS X. May contain up to 65,535 glyphs, supports Unicode and can contain OpenType Layout features.

Suitable for Western Roman fonts, non-Latin fonts, multilingual fonts and advanced typography. May include class kerning allowing for moderately-sized kerning tables. TrueType hinting allows precise control in small screen sizes, can also contain bitmaps. Can include embedding rights information defining whether or not the font may be attached to electronic documents.

Cons: Does not work on Mac OS 8/9. May cause output problems on ten-year-old PostScript output and printing devices. The designer usually needs to convert the outlines from Bezier curves which may introduce very slight changes in the shape. When converted back to Bezier curves (e.g. in Illustrator), the resulting curves have superfluous points. Manual TrueType hinting is laborious to create. The multilingual and advanced typography features only work with new OpenType-savvy applications, otherwise just the basic character set is available. For font families, requires two versions of the family name within each font: the first may contain any number of styles; the second “brief family” may contain only four styles.

Windows Type 1

Also known as: Windows PostScript, PC PostScript, PC Type 1

File extension: .pfb, with supplementary files .afm, .inf, .pfm

Pros: Works on Windows and Linux. Works in all PostScript commercial output and printing devices. Uses the same curve system (Bezier) as drawing applications such as Illustrator and Freehand, so letterforms are easy to edit when converted to curves. Type 1 hinting is comparatively easy to create.

Cons: Does not work on Mac OS 9 or X, not cross-platform. Contains two parts, the outline file (.pfb) and the metrics font (.pfm), both of which must be in the same folder. Does not contain class kerning so kerning tables are large. Type 1 hinting does not allow precise control for very small screen sizes. Cannot include more than 256 encoded characters and lacks advanced layout features such as ligatures, making the format unsuitable for multilingual or non-Latin fonts. Cannot contain bitmaps for small screen sizes. Does not contain embedding rights information. One family cannot contain more than four styles.

Recommendation: Draw fonts with Beziers as Type 1. When complete, make a duplicate FontLab master .vfb file and make TT conversions to it. Generate either a TrueType / OpenType TT or an OpenType PS font for the newest systems (Windows and Mac OS X).

Mac Type 1 is not included in this overview since FontLab Studio 5 for Windows cannot generate Mac Type 1 fonts. You can use FontLab for Mac or TransType for Mac or Windows to produce a Mac Type 1 font. However, we recommend producing fonts in the OpenType format unless you have Mac customers running a pre-8.6 Mac OS.

Before You Generate

Before you generate your font, make sure the most relevant aspects of the font are complete. Open all fonts that belong to your family in FontLab Studio.

Font Info

Open **Window > Panels > Fonts** and look at the family naming. Unless you are creating Mac Type 1 fonts, each brief family listed in the Fonts panel should contain no more than 4 styles. If you plan to create OpenType fonts (PS or TT), use the **Group fonts by** button to switch from the **Group By Family** view to the **Group By OT Family** view. In this view, all fonts should be grouped under one family.

Open **File > Font Info** and walk through all fonts of your family using the **Apply and Change** buttons. On the **Names and Copyright** page, make sure that all text boxes and combo boxes are filled in and that the **Font is bold** and **Font is italic** checkboxes are checked accordingly. Use the **Validate Names** button for each font to check against potentially wrong names.

If you are making an OpenType font, check the **OpenType-specific names** page as well.

Check the pages **Copyright information**, **Embedding, Designer information** and **License information**. All information should be filled in there (although for Type 1 fonts, actually only a subset of the entries will be included in the generated fonts).

In **Version and Identification**, put a reasonable version number into the top fields and click on the green Auto button. Increase your minor version number if you revised your font. On the Basic identification settings, click on the green **Auto** button and on the **Now** button. Leave the Type 1 number fields empty, select your vendor ID from the **TrueType vendor code** combo box. If you don’t have one, register one at Microsoft Typography.

On the **Panose identification** page, click on the Auto button and customize the entries as good as you can. The more precise the info the better, but it’s not crucial.

On the Metrics and Dimensions page, font UPM size can be 1000 for all formats. Don't worry about things like 2048 for TrueType.

On the **TrueType-specific metrics** page, click on both **Recalculate** buttons. Then go to **Key dimensions** and check **Copy values to TrueType metrics**. Make sure your **Ascender** and **Descender** values are uniform for all fonts in your family; use average values if your styles de facto have different ascenders or descenders. The Ascender value should be positive, the Descender value should be negative (preceded with a minus sign) in the fields. Make sure the sum of the absolute values of Ascender and Descender are equal to the font UPM size, e.g. if your Ascender is 720 and your UPM size is 1000, your Descender should be -280.

Go again to the TrueType-specific metrics page and make sure the values of **OS/2 WinAscent** and **OS/2 WinDescent** are uniform across your family, average if necessary. The value of all **OS/2 Typo*** values should be uniform as well. **TypoLineGap** should be between 5% and 20% of your UPM size and uniform across all styles.

The **hhea Ascender** and **hhea Descender** should have the values equal to **WinAscent** and **WinDescent**, and the **hhea LineGap** should be 0. Alternatively, the **hhea Ascender**, **hhea Descender** and **hhea LineGap** should be equal to the corresponding Typo* fields.

You can usually leave the other Font Info settings that were not mentioned above at their factory settings.

Character Set

Switch to **Names mode** in Font Window and select some encodings to see whether all glyphs in a desired encoding that you wish to cover by your font are included in the font. If you are making a text font, it should at least cover all glyphs from the MacOS Roman and the MS Windows 1252 Western (ANSI) encodings.

You may want to create a custom .enc Encoding file that will work as your font family "map" and will include all glyphs that you want to include in the font.

Switch to Codepages mode and check several codepages. If you are making a text font, it should at least cover all glyphs from the MacOS Roman and the MS Windows 1252 Western (ANSI) encodings.

Remember that the Names mode uses glyph names and the Codepages mode uses Unicode codepoints to reference the glyphs. Your font should have both the glyph names and the Unicode codepoints conform to published recommendations.

If any glyphs are present "in the yellow zone" in the Codepages mode but are missing from the "yellow zone" of the corresponding Encoding, your glyph names may be incorrect. Choose **Glyph > Glyph Names > Generate Names** to fix this problem.

If any glyphs are present "in the yellow zone" in the Encoding mode but are missing from the "yellow zone" of the corresponding Codepage, your Unicode codepoints may be incorrect. Choose **Glyph > Glyph Names > Generate Unicode** to fix this problem.

Any glyph cells with white background and red captions indicate that either the glyphname or the Unicode codepoint is incorrect. Fix them manually or automatically using the commands mentioned above.

It is recommended that all fonts in your family have the same character set.

In **Font Info**, on the **Encoding and Unicode** page, press on the green **Auto** button. If you're making non-Western single-codepage Type 1 fonts or a Symbol-encoded TrueType font, select the appropriate character sets from **Microsoft Character Set** and **Mac script and FOND ID** combo boxes.

On the **Unicode ranges** page, click on the green **Auto** button.

Glyphs

Select all glyphs in the Font Window (**Edit > Select All**). Choose Contour > Correct Connections.

If you're making an **OpenType PS** or **Type 1** font, choose **Contour > Convert > Curves to PostScript** (if it is enabled). Choose **Contour > Paths > Set PS Direction**.

If you're making an **OpenType TT**, choose **Contour > Convert > Curves to TrueType** (if it is enabled). Choose **Contour > Paths > Set TT Direction**.

✐ ***Note***: you can automate most of the above operations through **Tools > Action Set**.

Open the first glyph of your font in a Glyph Window, enable **View > Show Layers > FontAudit** and walk through all your glyphs. Review and fix potential problems reported by FontAudit.

Hints

If you have manually hinted your glyphs, skip this.

If you're making an **OpenType PS** or **Type 1** font, choose **Tools > Hints & Guides > Autohinting**, then **Tools > Hints & Guides > Autoreplacing**.

Go to **File > Font Info > Hinting Settings** and click on **Auto zones**. In **Standard stems (T1 hinting)** click on **Auto stems**.

You can now review your hinting manually or just leave it as is – FontLab Studio will take care of the rest as good as it can.

Kerning

Open **Window > Panels > Classes** and choose **Clean Up Classes** from the flyout menu.

Open the **Metrics Window** and review your kerning.

Open **Tools > Kerning Assistance** and click on the **Check for overlap** button and then on **Update [kern] feature**.

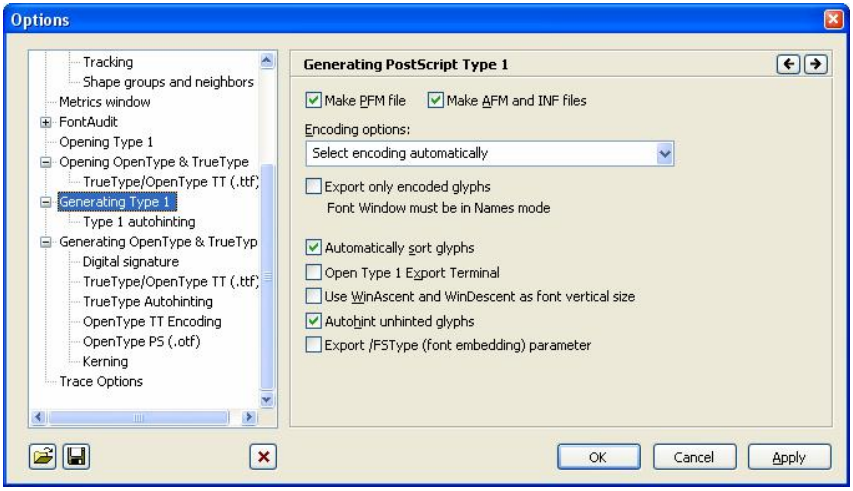
OpenType Layout Features

Open **Window > Panels > OpenType** and click on the **Compile** button. Observe the Output panel for possible error messages and debug your feature definitions if necessary.

Relevant Generation Options

In **Tools > Options** dialog box use the following settings.

Generating Type 1



Generating PostScript Type 1

☑ Make PFM file ☑ Make AFM and INF files

Encoding options:

Select encoding automatically

□ Export only encoded glyphs

Font Window must be in Names mode

☑ Automatically sort glyphs

□ Open Type 1 Export Terminal

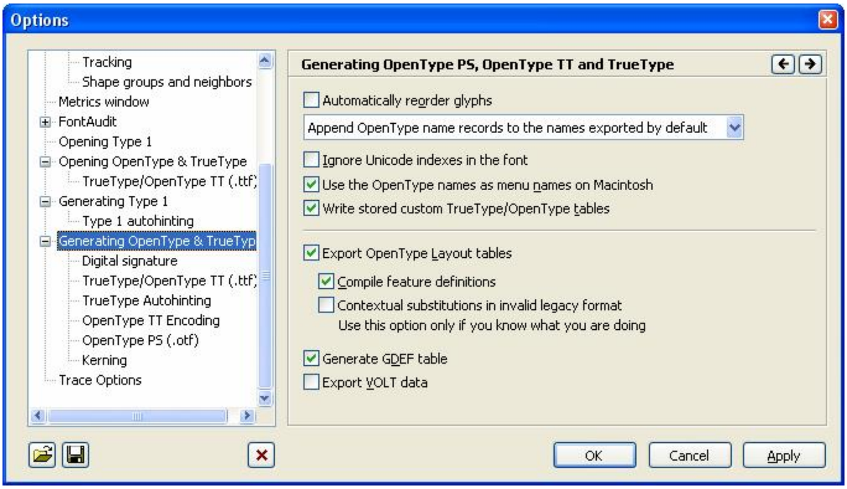
□ Use WinAscent and WinDescent as font vertical size

☑ Autohint unhinted glyphs

□ Export /FSType (font embedding) parameter

If you plan to create a Type 1 and an OpenType TT font from the same source, you may enable **Use WinAscent and WinDescent as font vertical size**.

OpenType PS



Generating OpenType PS, OpenType TT and TrueType

☐ Automatically reorder glyphs

Append OpenType name records to the names exported by default

☐ Ignore Unicode indexes in the font

☑ Use the OpenType names as menu names on Macintosh

☑ Write stored custom TrueType/OpenType tables

☑ Export OpenType Layout tables

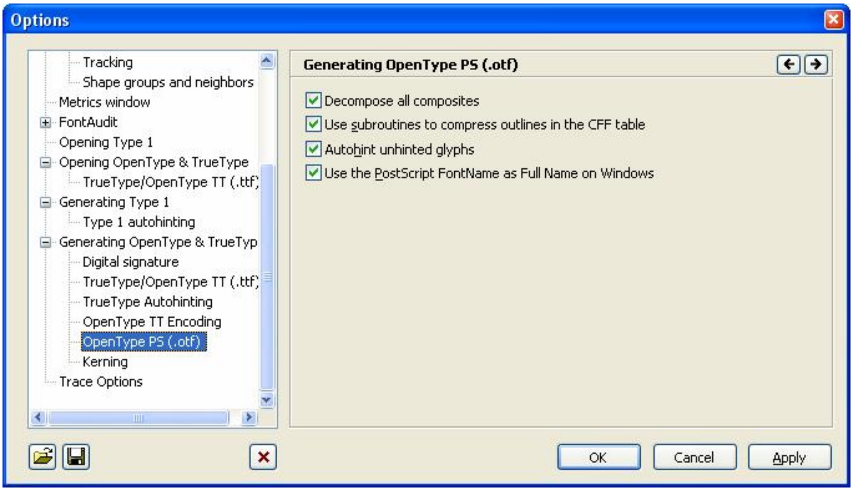
☑ Compile feature definitions

☐ Contextual substitutions in invalid legacy format
Use this option only if you know what you are doing

☑ Generate GDEF table

☐ Export VOLT data

If you plan to do additional work in Microsoft VOLT, enable **Export VOLT data**. If you opened an existing OpenType font that has stored binary OpenType tables and prefer to use these, disable **Compile feature definitions**.



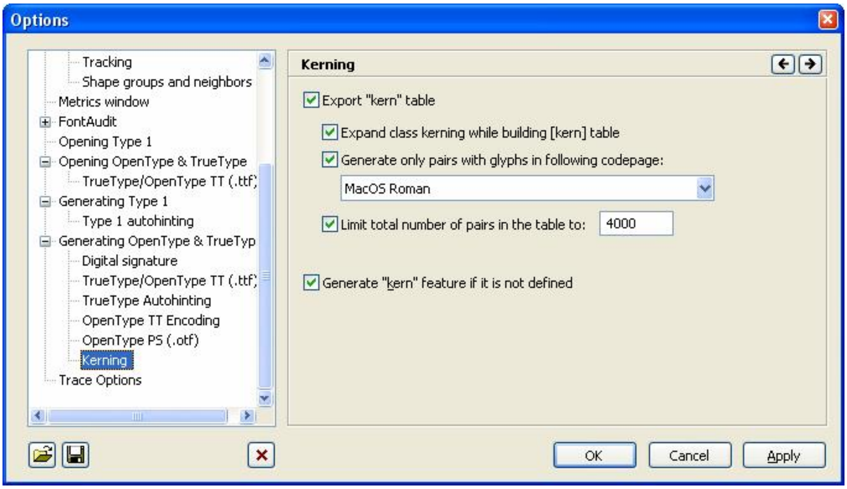
Generating OpenType PS (.otf)

☑ Decompose all composites

☑ Use subroutines to compress outlines in the CFF table

☑ Autohint unhinted glyphs

☑ Use the PostScript FontName as Full Name on Windows



Kerning

☑ Export "kern" table

☑ Expand class kerning while building [kern] table

☑ Generate only pairs with glyphs in following codepage:

MacOS Roman

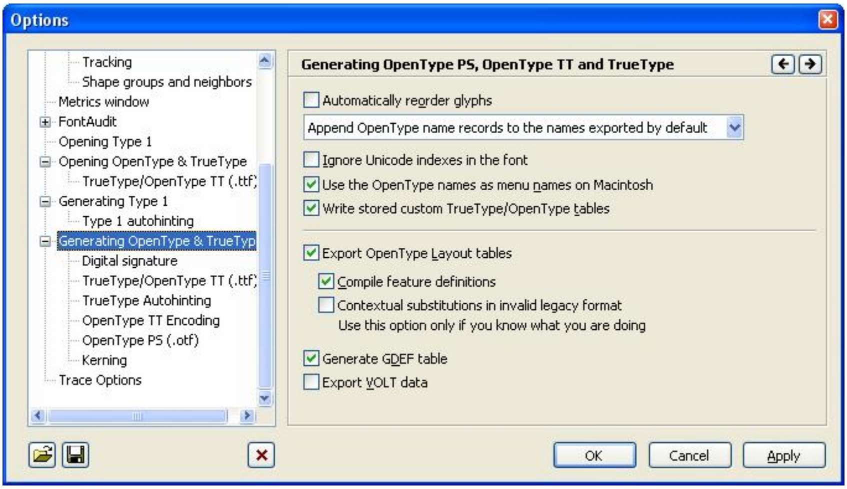
☑ Limit total number of pairs in the table to: 4000

☑ Generate "kern" feature if it is not defined

You may consider disabling **Export "kern" table** if you are creating OpenType PS fonts. This will be more conformant to the OpenType specification but will result in the lack of kerning for accented characters in Mac OS X. You can also use **Tools > Kerning Assistance** before generating your font to manually expand the kerning table into plain kerning.

Also make sure that **Tools > Options > General Options > Unicode and OpenType > Add all glyph classes to OpenType…** is enabled.

OpenType TT



Generating OpenType PS, OpenType TT and TrueType

☐ Automatically reorder glyphs

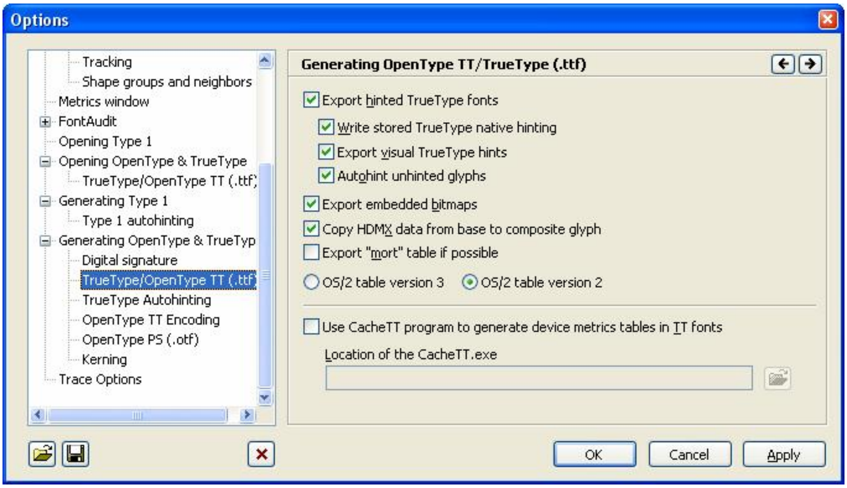
Append OpenType name records to the names exported by default

☐ Ignore Unicode indexes in the font
☑ Use the OpenType names as menu names on Macintosh
☑ Write stored custom TrueType/OpenType tables

☑ Export OpenType Layout tables
☑ Compile feature definitions
☐ Contextual substitutions in invalid legacy format
Use this option only if you know what you are doing

☑ Generate GDEF table
☐ Export VOLT data

If you plan to do additional work in Microsoft VOLT, enable **Export VOLT data**. If you opened an existing OpenType font that has stored binary OpenType tables and prefer to use these, disable **Compile feature definitions**.

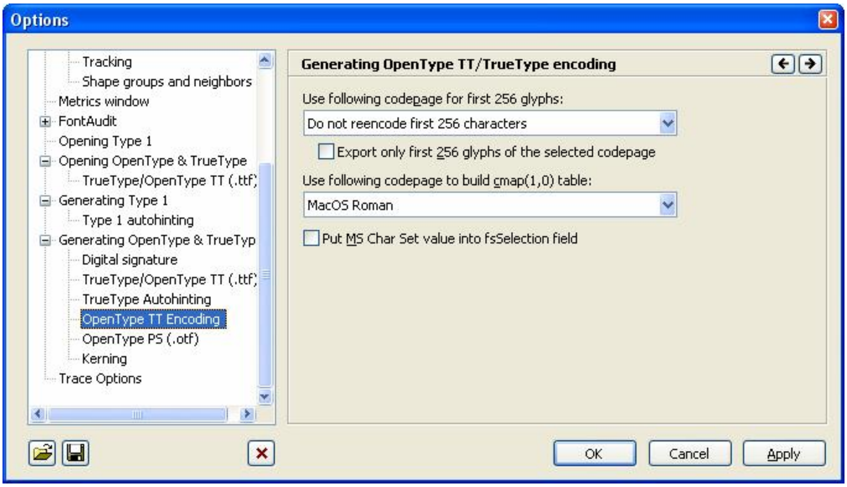


Generating OpenType TT/TrueType (.ttf)

☑ Export hinted TrueType fonts
☑ Write stored TrueType native hinting
☑ Export visual TrueType hints
☑ Autohint unhinted glyphs
☑ Export embedded bitmaps
☑ Copy HDMX data from base to composite glyph
☐ Export "mort" table if possible
○ OS/2 table version 3 ● OS/2 table version 2

☐ Use CacheTT program to generate device metrics tables in TT fonts
Location of the CacheTT.exe

You may use the CacheTT program to generate your shipping fonts.



Generating OpenType TT/TrueType encoding

Use following codepage for first 256 glyphs:

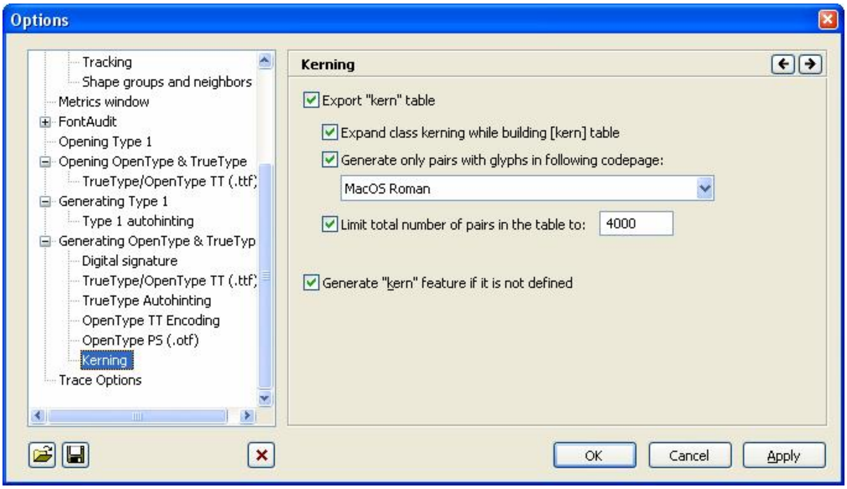
Do not reencode first 256 characters

□ Export only first 256 glyphs of the selected codepage

Use following codepage to build cmap(1,0) table:

MacOS Roman

□ Put MS Char Set value into fsSelection field



Kerning

☑ Export "kern" table

☑ Expand class kerning while building [kern] table

☑ Generate only pairs with glyphs in following codepage:

MacOS Roman

☑ Limit total number of pairs in the table to: 4000

☑ Generate "kern" feature if it is not defined

You may want to tweak the kerning settings or use **Tools > Kerning Assistance** before generating your font to manually expand the kerning table into plain kerning.

Also make sure that **Tools > Options > General Options > Unicode and OpenType > Add all glyph classes to OpenType...** is enabled.

Options for Converting Fonts

We recommend selecting different options for converting fonts between different formats. In addition to the font generating options, we also suggest particular opening options that will produce the best results in specific situations:

Source	Destination	Opening options	Generating options
TrueType / OT TT	TrueType / OT TT	Keep instructions, do not convert curves, do not scale to 1000, do not decompose, do not autohint, read all records, read OT, store binary OT, store custom, do not interpret OT, import bitmaps	All hinting options — on, do not reencode, export bitmaps
TrueType / OT TT	Type 1	Keep instructions, convert curves, scale to 1000, do autohint, do not decompose, do not read records, read OT, interpret OT	Write PFM, AFM and INF files, Select encoding automatically. Before export, switch the Font window to the Names mode and select the desired encoding vector
TrueType / OT TT	OT PS	Keep instructions, convert curves, scale to 1000, do autohint, do not decompose, store custom tables, read all records, read OT, store binary OT, do not interpret OT	Autohinting on, Decompose on
OT PS	Type 1	Do not decompose, Generate Unicode	Write PFM, AFM and INF files, Select encoding automatically, Autohinting off
OT PS	OT PS	Do not decompose, read all records, read OT, store binary OT, store custom, do not interpret	Autohinting off, Decompose off
OT PS	TrueType / OT TT	Do not decompose, read all records, read OT, store binary OT, store custom, do not interpret	All hinting options — on, do not reencode first 256 glyphs

Type 1	Type 1	Do not decompose, Generate Unicode	Write PFM, AFM and INF files, Select encoding automatically
Type 1	OT PS	Do not decompose, Generate Unicode, Generate basic OT	Autohinting off, do not reencode, Decompose on
Type 1	TrueType / OT TT	Do not decompose, Generate Unicode, Generate basic OT	All hinting options — on

Of course you can choose other options, but when you just want to convert a font from one format to another these recommended combinations of opening and generating options will usually give you fonts that will work fine in most environments.

Testing Fonts

We recommend using available **font validation software**. Many good font validation software packages are available for free or included in the system.

FontQA

A quality assurance application framework written in Python that runs within FontLab Studio for Mac OS or Windows. It includes various tests to be run before you generate your font.

http://www.fontqa.com/

Microsoft Font Validator

A free testing application for OpenType (PS or TT) fonts, published by Microsoft. Runs on Microsoft Windows.

http://www.microsoft.com/typography/FontValidator.mspx

Apple ftxvalidator

A free command line validator for OpenType (PS or TT) fonts, published by Apple. Runs on Mac OS X. Font Book in Mac OS X 10.4 also validates fonts when installing them.

http://developer.apple.com/fonts/OSXTools.html

Adobe FDK for OpenType

A free set of tools that includes several validation applications for OpenType (PS or TT) fonts, published by Adobe. Runs on Mac OS X or Windows.

http://partners.adobe.com/public/developer/opentype/afdko/topic.html

We also recommend extensive application testing of your fonts. Many text editing or layout applications are available in demo or trial versions and can be used for testing. We recommend testing the fonts on screen and in print for at least following applications:

- Microsoft Word XP or newer for Windows XP
- Microsoft WordPad and Microsoft Notepad on Windows XP
- Microsoft Word 2004 for Mac OS X
- Microsoft PowerPoint XP or newer for Windows XP
- Adobe InDesign CS or newer for Windows and Mac OS X
- Adobe Illustrator or Adobe Photoshop (any version)
- QuarkXPress 4.1/5.0 and 6.5 for Mac OS
- Apple TextEdit and Apple Keynote on Mac OS X

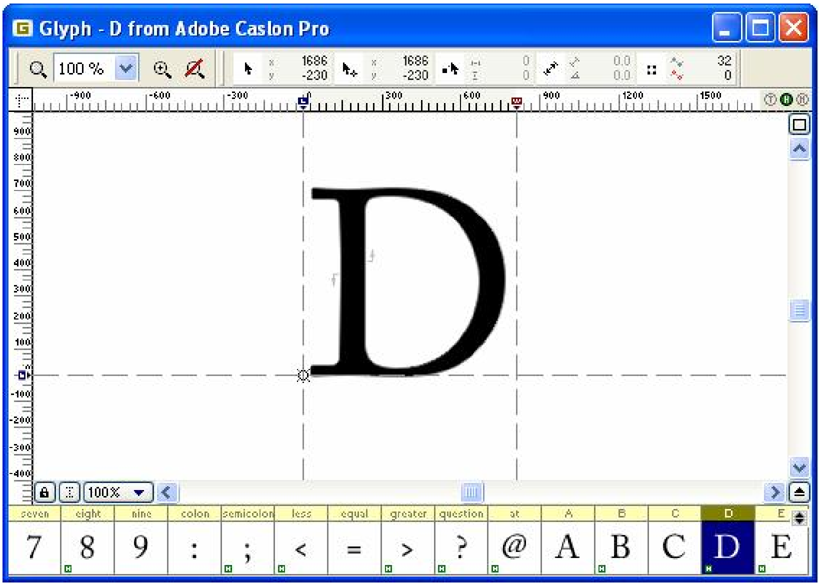
The Glyph Window

“The Glyph Window is a standard tool in all FontLab Studio based applications. It is a universal and very powerful contour-editing module that also allows you to perform many font-specific operations.

6

Glyph Window Contents

Open the Glyph Window by double-clicking any character sample in the Font Window or Metrics Window.

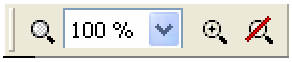


The Glyph Window

The Glyph Window has the following parts:

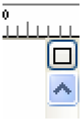
- Toolbar area
- Control marks area
- Editing Field
- Top and left rulers
- Left-Top box
- Scroll Bars
- Glyphs Bar
- Glyphs Bar expand button
- Note icon
- Lock button
- Meter panel button
- Glyph mark area

The *Local Toolbar* is the command center of the Glyph Window. There is a combo box with zoom selection and two groups of buttons:

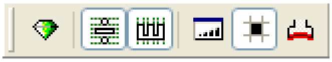


The first group of buttons includes two buttons that are used to select the zoom level.

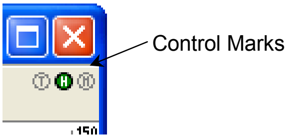
You can drag the local toolbar to any place on your screen or you can dock it at the top or bottom area of the Glyph Window. To show and hide the local toolbar, use this button in the top-right area of the Glyph window:



Some editing tools (which we discuss later) may have their own toolbars that may also be docked to the sides of the Glyph Window or they can be left floating around:



There is a control marks panel in the right-top area of the local toolbar.



This panel duplicates some of the information that appears in the character cell of the Font Window so that you can instantly get important information about the current glyph.

Three icons may appear in this area:

Ⓣ	The glyph has either imported or visual TrueType hints
Ⓗ	The glyph has a Type 1 hint replacement program
Ⓜ	The glyph has a Mask layer that is “compatible” with the outline.

Control marks area may also be located on top of the horizontal ruler. In any case, it will be somewhere in the top-right area of the Glyph window.

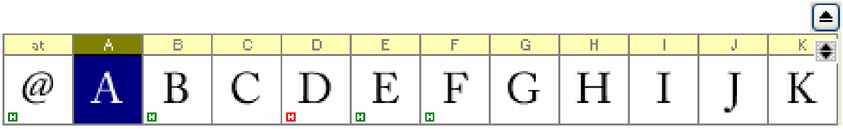
Below the default (top) location of the Local toolbar and at the left of the window you may see rulers that are used to preview positions of various structures in the glyph space. You may switch the rulers on and off with the **View > Rulers** command or using the context menu that appears if you right-click one of the rulers.

In the bottom-right corner of the Glyph Window you will find a little button ▼. Click it and you will see the Glyphs Bar – a small subset of the Font Window that lets you quickly browse the font or select characters for editing.

The following describes the functionality of the Glyphs Bar.

The Glyphs Bar

To open the Glyphs Bar you click on the Glyphs Bar expand button ▼, press the TAB key or press the **B** key when the Glyph Window is active.



Once the Glyphs Bar is open it has focus and is slightly highlighted.

Glyphs bar may be located on the bottom or on the top of the Glyph window. Click on this icon to switch its location: ⬍

To customize the Glyphs Bar's appearance, right click it and select one of the options in the popup menu:

Show caption	To show or not show the cell's caption
Name, Unicode, Index, Width, Decimal, Hex, Octal, ANSI	Choice of information to show in the caption. Options are the same as the choices in the Font Window
Show Marks	To show or not show additional glyph information in every cell. Same as "Show additional information in the characters cells" Font Window Option
Add Note	To add a note to a glyph's cell.

To select a glyph for editing double click the glyph cell. Or, if the Glyphs Bar is active, choose the cell with the left and right arrow keys and click the ENTER key.

If you hold down the **Shift** key while using the left and right arrow keys glyphs are opened instantly.

The fastest way to open a glyph is to use the keyboard:

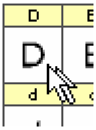
1. Open the Glyphs Bar with the **Tab** key.
2. Press the key of the character that you want to open on the keyboard.
3. If the glyph is not directly accessible from the keyboard, enter its name. You have one second to enter each character of the name.
4. Click the **Tab** key again to close the Glyphs Bar.

You may close the Glyphs Bar at any time by clicking the Glyphs Bar collapse button ⏏ or pressing the **Tab** key. When the editing area is active, you can just press the **B** key.

Selecting a Glyph for Editing

In addition to using the Glyphs Bar you can open a glyph in the Glyph Window using any of the following methods:

- Double click the glyph's cell in the Font Window to open it.

  If you already have an open Glyph Window with a glyph from the same font, the new glyph will be opened in the same Glyph Window (where the previous glyph was shown). Hold the Ctrl key down when you double-click on the glyph cell to open it in a separate Glyph Window. Note that if this method doesn't work it usually means that it is switched off in the Font Window's options in the Options dialog box.

  You can force FontLab Studio to **always open a glyph for editing in a new Glyph Window**. Use the **Double-click opens a new window** option in the Font Window page to activate this feature.

- Click the right mouse button in the Font Window and select the **Open Glyph Window** command to open the glyph in a separate Glyph Window.

- The **lock button** 🔒 allows **direct keyboard access** to glyphs in your font. If the button shows a closed lock, single-letter keystrokes are used for keyboard shortcuts such as **Z** for zoom in. If the button shows an open lock, pressing single keys on the keyboard takes you to the corresponding glyph in your font; so pressing **Z** will open the "z" glyph for editing (Shift+Z will open the uppercase "Z"). **To access an extended character, quickly type its glyph name.** For example, to open the "ä" glyph, type adieresis on your keyboard. Note that usually, just typing adi will do if there is only one glyph in the font with the name that starts with that string. Use Shift for uppercase names.

- Click the left mouse button on the glyph selected in the Font Window and drag it into any Glyph Window.

- Select the **Find** command in the **Edit** menu and find the glyph that you want to open.

- If you have a **wheel** on your mouse, hold down the Ctrl key and scroll the wheel to move to the previous or next glyph.

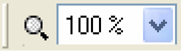
Creating Glyphs

If you want to create a new glyph in an empty place in the font (a gray cell in the Font window), double-click the cell.

If you want to create a group of new glyphs with a single command, select the cells and use the **Glyph > Create Glyphs** command.

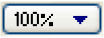
Changing the View in the Glyph Window

Use the zoom level and scroll bars to change the view in the editing field of the Glyph Window. By using the scroll bars you can scroll the viewing field of a symbol. With the zoom level you can define how the glyph unit coordinates are converted to screen coordinates and vice versa. If you choose a higher zoom level you will see more details of the glyph and you can do the editing operations more precisely. However, in the larger zoom levels only part of the glyph will be visible so you will have to use the scroll bars to see the different parts of the glyph.

There are fixed zoom levels and custom zoom levels. You can select one of the fixed zoom levels in the **Zoom** combo box located in the upper part of the Glyph Window: 

. When you choose a fixed zoom level FontLab Studio will return to this glyph mode on every **Zoom Out** command (or when you press **CTRL+0**).

You can also use the **Zoom** menu in the bottom of the window, it will show the same selection of the zoom levels and is very useful when the Zoom toolbar is hidden:



To magnify part of the glyph, select the **Zoom** tool (button on the toolbar, the + key or **CTRL+SPACE** on the keyboard) and declare a custom zoom level using a marquee. This zoom level is temporary and you can always return to the previously selected fixed zoom level by clicking on the button (or by clicking on the – key or **CTRL+0**).

Alternative keyboard shortcuts are:

Mac	Windows	
CMD+SPACE	CTRL+SPACE	Zoom in
CMD+OPTION+SPACE, then click	CTRL+ALT+SPACE	Zoom out
SPACE and drag		Scroll (hand cursor appears)

After you select the zoom tool, move the mouse pointer to one of the corners of the rectangular area that you want to zoom on and click the left mouse button. Then, holding the button down, define the zoom-in area by dragging the cursor to form a rectangle. Release the button and the new custom zoom level will be selected.

If your mouse has a **wheel**, use it to scroll the Glyph Window vertically, press the SHIFT key to scroll it horizontally, press the ALT key to zoom in and out, and press the CTRL key to go to the next or previous glyph.

Quick Zoom Selection

You can quickly change the zoom level of the Glyph Window by selecting the **Zoom In** or **Zoom Out** command from the **View** menu. Alternatively you can click the **Z** key for zooming in or the **X** key for zooming out.

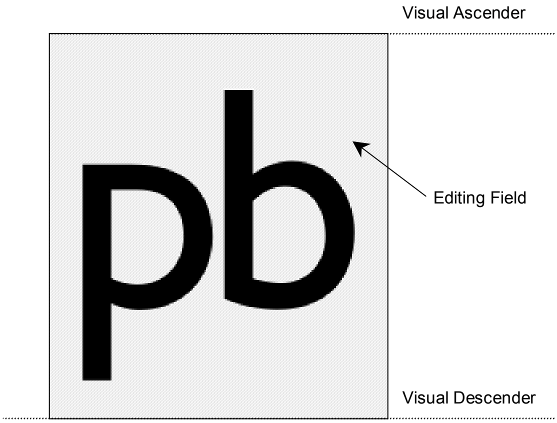
This command increases or decreases the zoom level by a factor of two. If the mouse cursor is in the editing area of the Glyph Window the new zoom level will be centered around the cursor position.

These keys are active even when you drag something with one of the editing tools.

If you have a **wheel** on your mouse, you can press the **ALT** key and use it to change the zoom level.

Vertical Alignment Options

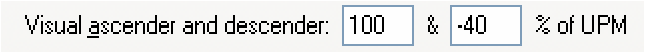
When you select 100% as the zoom value, FontLab Studio needs to choose a scaling factor to fit the font unit space in the Glyph Window. Two vertical levels in the font space define this scaling: Visual Ascender and Visual Descender:



When you select 100% zoom, it means that Visual Ascender is fitted to the top of the editing field and Visual Descender to the bottom.

The same values are used to build the icons that you see in the Font Window or panels like the Classes panel.

To set Visual metrics, use the **Glyph Window** > **Dimensions** page of the **Options** dialog box (**Tools > Options** menu):


Visual ascender and descender: 100 & -40 % of UPM

Values are measured in percentage of the font UPM size, so –20% is –200 if UPM size is 1000 and –410 if UPM size is 2048.

Tools and Operations

FontLab Studio’s Glyph Window may work in several modes. The four most important modes are:

Edit mode	The main mode used to draw new glyphs, move everything in the glyph, from guidelines to nodes to glyph margins
Sketch mode	Used to draw new outlines in an alternative manner, using only on-curve points (remotely similar to Ikarus®)
VectorPaint mode	A set of tools used to create new glyphs or modify existing glyphs using vector drawing tools that simulate natural bitmap tools
Meter mode	Used to measure contours, distances or angles.

Other modes include TrueType and Type 1 hinting and eight additional operations:

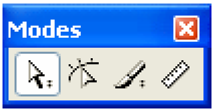
Free Transform	Scales, rotates or skews the selected portion of the outline
Interpolate Nodes	Manually modify the outline by moving a few nodes, other nodes intelligently follow
Move and Scale Background	Sets the size and position of the bitmap background layer
Envelope	Modifies the outline as if it was stretched on rubber
Simplify Path	Manually approximate a segment of the outline with a curve, can be used to remove nodes without much change in the shape of the outlines
Move Node	Precise positioning of outline points
Reverse Path	Manually reverse direction of single contours
Set Startpoints	Manually change the startpoints of contours and rearrange contours
Type 1 hinting	Type 1 hinting
TrueType hinting	Manual TrueType hinting.

When the Glyph Window is switched to one of these modes, you may see additional toolbars, panels and dialogs. They are shown and hidden automatically, depending on the mode and most of them hide when the Glyph Window is deactivated.

Use the buttons on the Tools and other toolbars or keyboard shortcuts **to switch modes**. The four most important modes are:

Alt+1	Edit mode
Alt+2	Sketch mode
Alt+3	VectorPaint mode
Alt+4	Meter mode

Though the Tools toolbar contains a button only for Meter mode you can easily customize it (Tools > Customize) or even create the custom special toolbar containing buttons for switching modes:

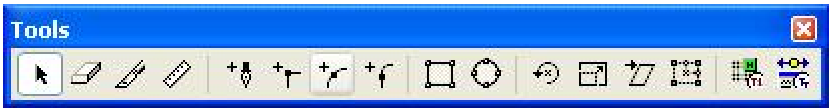


Edit Mode

The **Edit** mode is the most important in FontLab Studio. In this mode you can modify the contents of all the editing layers.

All operations performed with the edit tool can be undone with the **Undo** command of the **Edit** menu, or just by clicking the **Undo** button ↶ on the toolbar at the top of the Glyph Window. You can undo up to 200 operations. All undone operations can be redone with the **Redo** command of the **Edit** menu or with the **Redo** button ↷ on the toolbar.

In Edit mode you can use eleven different Edit Tools. You can easily choose one of the tools using the Tools toolbar:



Note that the Tools toolbar also contains buttons of other modes.

Alternatively you may use the keys from 1 to 9 to quickly select edit tools:

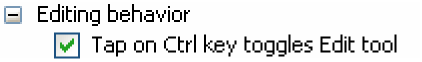
	1	**Edit**	Main tool, used to drag objects on the editing layers and perform other operations. In the following chapters we will assume that this tool is active in the Edit mode
	2	**Eraser**	This tool is used to quickly remove unnecessary nodes
	3	**Knife**	Tool to insert nodes and break outlines
	4	**Magic Wand**	Tool to quickly select contours (just click anywhere near the contour and it is selected). Note that this tool is not available in the Tools toolbar by default
	5, 6, 7	**Add Corner, Add Curve, Add Tangent**	Tools to create new contours or insert nodes
	8	**Bezier Drawing**	Tool to draw the contour with the Bezier curves
		Rotate, Scale, Slant	Tools to quickly transform outlines.

Temporary Activating the Edit Tool

There are two methods to temporary activate the Edit tool while you are using any other tools: **Ctrl**-hold and **Ctrl**-Click-Click.

First mode is active by default and means that you can press and hold **Ctrl** key while using most tools to temporary activate the Edit tool.

To switch to the Click-Click mode, us the Glyph Window page of the Tools > Options dialog box:



⊟ Editing behavior

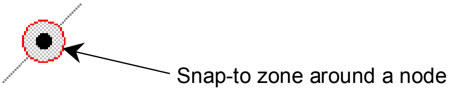
☑ Tap on Ctrl key toggles Edit tool

When this option is active, you can temporary activate the Edit tool from *any* other tool. Just click on the **Ctrl** key on the keyboard. Second click on the **Ctrl** key will return the tool you were using before.

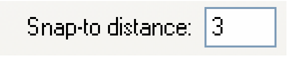
Snap-to Distance

In the following sections we will discuss how to use the Edit tools to modify the outline and other editing layers. All other tools will be explicitly named.

When you need to select a node or any other object on any of the layers, you need to click it with the mouse. You don't need to click the object precisely, but you must be within a certain distance, which is called the "snap-to distance".



Snap-to is used when you select an object for which the feature is allowed. By default the snap-to distance is set to 3 screen pixels, but you can change it on the **Glyph Window > Dimensions** page of the Options dialog box:



Snap-to distance: 3

Editing Layers

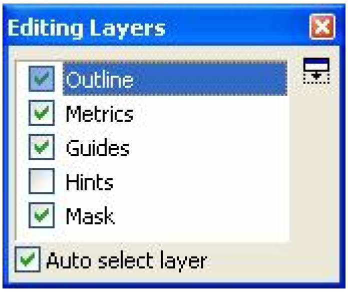
In FontLab Studio every glyph contains several editing layers. Some of them are used when the font is exported; others are FontLab Studio-only and are used to help you work with the glyph. Below is the list of all the layers that you can see in the Glyph Window. Later we will describe them in full detail.

Outline	Main layer containing the glyph's outline
Grid	Regular grid which helps to align the outline
Guidelines	Horizontal, vertical and/or diagonal guidelines
Hints	Type 1 hints – pairs of vertical or horizontal lines set at a fixed distance
Mask	Outline template
Background	Bitmap background
Alignment zones	Special zones that define the overshoot positions in the font
Glyph metrics	Glyph metrics – left and right sidebearings and a baseline
Vertical metrics	Vertical font metrics, such as ascender, descender or cap height
Global Mask	Global (font-wide) mask
Anchors and carets	Anchors are special named marks and carets that define stop positions in ligatures
Shape Group	Shapes of glyphs from the same group
Neighbors	Shapes of glyphs defined as neighbors of the current glyph.

You can control the layers' appearance and features with the **View** menu:

Show layers	Lists all layers (and a few other options) and lets you switch them on or off. You cannot switch off (hide) the outline layer
Lock layers	Lists the layers that you can lock to protect from accidental modification. E.g. if the Outline layer is locked you will not be able to add, move or delete any nodes or change any curves
Snap to layers	Controls which layers have the "snap to" feature activated.

An alternative way to control the editing layers features is the special Editing Layers panel, which you can put on the screen with the **Window > Panels > Editing Layers** command (or with this button ☰ on the Panels toolbar):

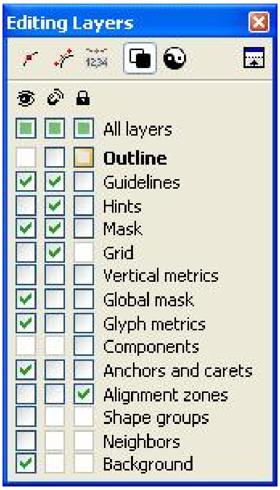

Editing Layers

☑ Outline
☑ Metrics
☑ Guides
☐ Hints
☑ Mask

☑ Auto select layer

In this panel you can **select a layer for editing** (just click on the layer name) and control layers appearance using the check boxes to the layer names.

If you want to get more control over the editing layers, click on ▤ button to expand the Editing layers panel:


Editing Layers

■	■	■	All layers
□	□	□	**Outline**
☑	☑	□	Guidelines
□	☑	□	Hints
☑	☑	□	Mask
□	☑	□	Grid
□	□	□	Vertical metrics
☑	□	□	Global mask
☑	□	□	Glyph metrics
□	□	□	Components
☑	□	□	Anchors and carets
□	□	☑	Alignment zones
□	□	□	Shape groups
□	□	□	Neighbors
☑	□	□	Background

The left column 👁 of checkboxes controls the layers' appearance in the Glyph Window.

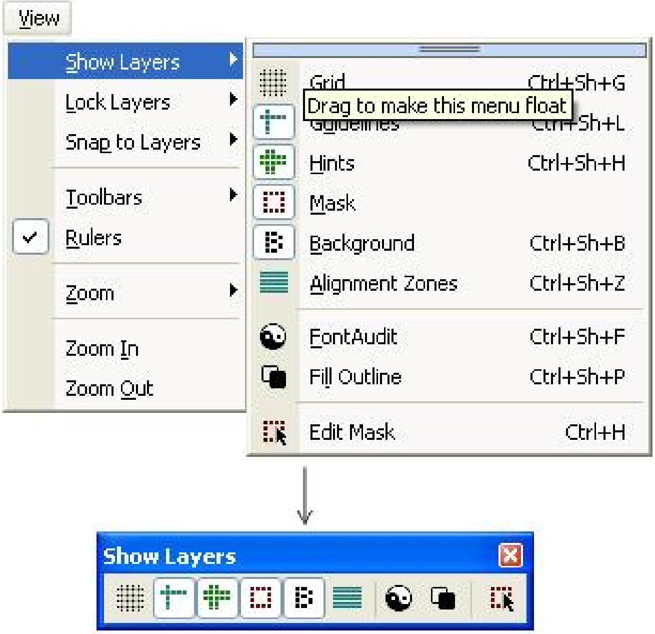
The middle column controls the "snap to" feature and is equivalent to the **View > Snap to Layers** menu

The right column 🔒 lets you lock layers and is equivalent to the **View > Lock Layers** menu.

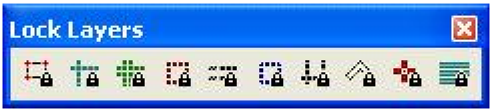
Please note that you must open the Glyph Window to make it possible to open the Editing Layers panel.

With the panel you can easily control all the layers at once using the check boxes in the top row:

If you frequently need to switch some layers on and off you can drag the **View > Show Layers** menu and convert it to a toolbar:



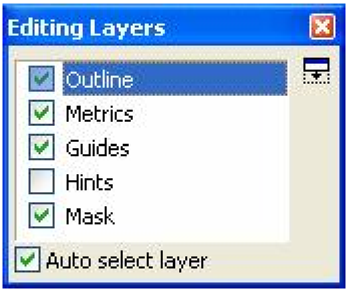
The same operation is possible with the **View > Lock Layers** menu:



In the following sections we will describe all the editing layers and their modification and control.

Easier Way to Control Editing Layers

The Editing Layers panel may be opened in the simple mode:



☑ Outline
☑ Metrics
☑ Guides
☐ Hints
☑ Mask

☑ Auto select layer

Use this button to switch the panel between simple and expanded mode (which is described in the previous section). In simple mode you have a list of five layers and you can control their lock and show status.

To activate the layer, just select it in the list. When you do it, this layer becomes unlocked and all other layers are locked. If activated layer was hidden, it will appear until it is deactivated.

Use check boxes to the left of the layer names to control layer appearance.

For example, **to edit the glyph metrics**, just select the “Metrics” in the list. Glyph and font metrics layers will appear in the glyph window and will be available to edit while all other layers (outline, hints, guides and mask) will be locked.

To edit the Mask layer, just select “Mask” in the list. The outline layer will be shown as a mask (and will be locked), hints will disappear and the mask layer will be set to front and open for editing.

Use the **Auto select layer** option to let FontLab Studio to automatically switch to the layer that you begin to edit in the Glyph window. If this option is off and some layer is active, all other layers are "locked" so to edit them you need to activate the layer in the Editing Layers panel. If option is on, all layers are "unlocked" and editable.

Use the panel in the expanded mode to have more control over all layers.

Outline Layer

The Outline layer is the most important of all the layers. It stores information about the glyph shape while all the other Studio editing layers and most of the tools are designed to help you create good outlines. Before we turn to the outline editing tools let's talk about outline structure.

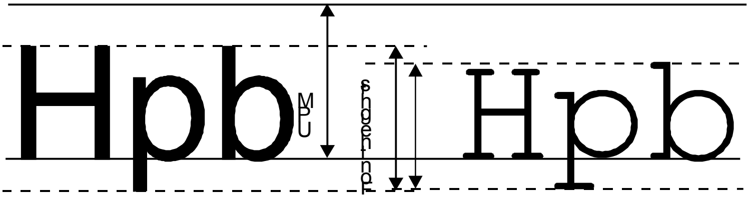
Units of Measurement

The coordinates of any object in the font are presented in a standard measurement system. One unit of this system is called a font unit. The scale of font units used in a particular font is the *Units Per eM (UPM)* size. The program that scales the font knows the UPM size of the font and can use it to properly scale it. To get a text string of the same visible size a font that has a larger UPM size must be scaled with a smaller scale factor.

Usually Type 1 and OpenType PS fonts have a UPM size of 1000 font units. Therefore, to get a text string with a height of 100 pixels (assuming that we use a raster output device) we would scale this font with a scale factor of 10%.

TrueType fonts can have practically any UPM size. They often have a UPM size of `1000` or 2048 units. If a font has the UPM size of `2048`, to get a text string of 100 pixels we would scale this font with a scale factor of 4.9%.

A more “graphical” font parameter is the *font height*. The font height (measured in font units) is the measurement of the font that is used to align strings in text. It is important not to confuse UPM size and font height. UPM size is just a scaling base, and, for example, all Type 1 fonts have the same UPM size of 1000. Font height depends on the font design and may be different:



The font height can be defined as the distance from the bottom of a letter that is partially located below the baseline, like the ‘p’ character, and the topmost point of an uppercase character, like ‘H’, or a tall lowercase character, like ‘b’. Sometimes a font contains special glyphs that can be taller than ‘b’, like an integral sign, but usually these glyphs are not counted when font height is measured.

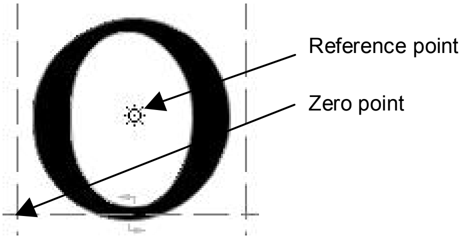
✐ **Note:** When a font is shown on screen on printed, the UPM size is always scaled to the chosen point size.

Let’s say that your UPM size is1000 units and that your uppercase H letter is 700 units high. If you set some text in your font at10 pt size, the 10 pt will correspond to the UPM size, that is 1000 units. This means that your uppercase H letter will be7 pt high. In a different font, the uppercase letter H can be 800 units high so set at 10 pt, the letter H will be 8 pt high. This is why point size of typeset text is not really related to any “graphic” element of the typeface

Therefore, if you would like to make your letter H to appear visually larger when set at a specific point size, you need to increase the ratio of the size of the letter in units to the UPM size. With the letter H being 700 units high and the font having the UPM size of 1000, the ratio is 700/1000 = 0.7 or 70%. To increase this ratio, you have two possibilities: you can either increase the size of the letter H in units (i.e. rescale the glyph) or you canreduce the UPM size. The visual effect will be identical. Let’s say you wish to visually increase your letterforms so the letter H is8 pt high (rather than 7 pt) when the font size is 10 pt. Your desired ratio of the height of the letter H to the UPM size will be 0.8. So you can either*increase* the size of the letter H so it is 800 units high and *keep* the UPM size of 1000, or you can*keep* the height of the letter H at 700 units, but reduce the UPM size to 875, since 800/1000 = 700/875. Note that the change of the UPM size is not practical for all font formats. You can use an UPM size of875 (or any other) with TrueType and OpenType TT fonts safely, and to a large extent, with OpenType PS fonts. However, Type 1 fonts work best with the UPM size of 1000.

Reference Points

By default all coordinates are measured relative to the *zero point* of the glyph. This is located at intersection of the baseline and the left sidebearing line:



As an alternative, distances may be measured relative to the *reference point*, which may be positioned by the Edit tool to any point in the glyph space. Often a reference point is very useful when you are working on a symmetrical shape.

To set the precise position of the reference point, you can just Ctrl-click on it. You will see the reference point properties dialog box and will be able to enter the horizontal and vertical position of the reference point.

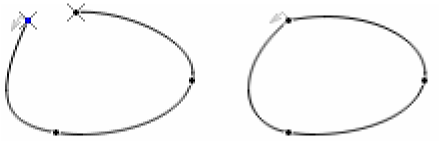
By default the reference point is located on the position of the zero point.

Contours

The most important and most complex information in a font is the glyph's shape. All glyphs are defined as a series of contours. All contours consist of a series of segments: straight lines and curves. Nodes – that is outline points – define all segments.

Open and Closed Contours

Contours may be open or closed:

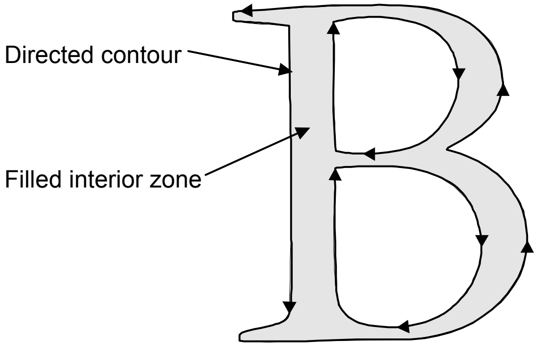


All known font formats require contours to be closed, but during outline editing it may be useful to have some contours in an open form and later connect them to each other to build final closed contours.

In FontLab Studio it is very easy to open closed contours or to close open contours. It is also possible to customize the appearance of the open contours: they may be automatically filled (they are automatically closed by an invisible straight line that connects their starting and ending points) or not and their starting and finishing point may be optionally highlighted.

Filled and Unfilled Contours

Contours can be of two types: black or white. They can also be of two directions: clockwise or counterclockwise. The basic rule that applies to Type 1 fonts is simple: clockwise-directed contours are white and counterclockwise contours are black. A simpler form of the rule, known as the rule of the *left hand*, is: if you face along the direction of a contour, black (fill) will be on your left side.

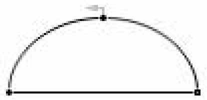


In the TrueType specification the opposite is the case, so a contour is filled on the right hand side. However, not all TrueType rasterizers require glyphs to follow this rule, so it is recommended, but not necessarily required, that you reverse contour directions when you are converting Type 1 fonts to TrueType.

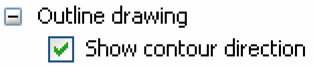
Startpoint and Closepath

All contours have a *startpoint* (start point). The startpoint is the first node of the contour. The last node of the closed contour is automatically connected to the startpoint with a straight line, which is called *closepath*. The color of the startpoint in the Glyph Window is **blue**.

Optionally, a contour-direction mark may appear on a startpoint:



You can switch this direction mark off with the option in the **Tools > Options > Glyph Window**:

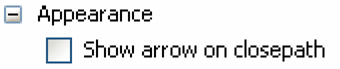


⊟ Outline drawing

☑ Show contour direction

Also you may want to see arrows on all closepath lines.

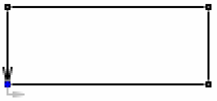
Use the following option:



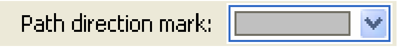
⊟ Appearance

□ Show arrow on closepath

If this option is active, closepath appears as an arrow:



You can customize the appearance of the color direction mark on the **Tools > Options > Glyph Window > Colors** page:

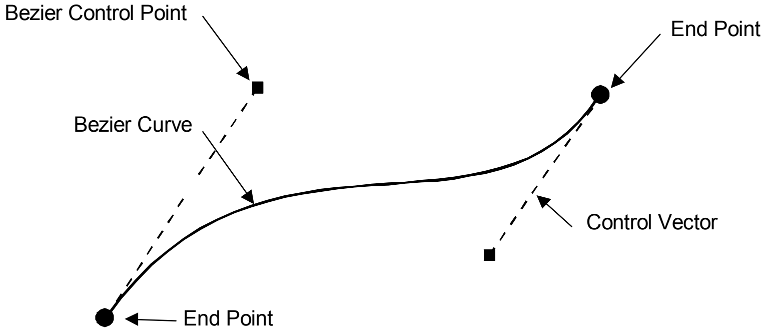


Path direction mark:

This feature allows you to make the direction marks almost invisible, but still know the direction of the contours.

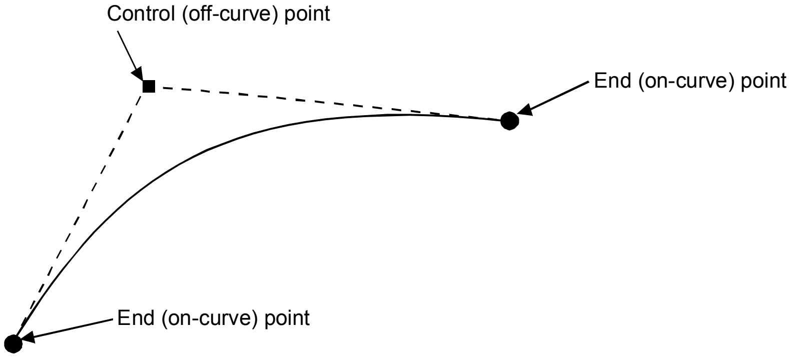
Curves and Lines

Segments are of three types: straight segments, PostScript curve segments or TrueType curve segments. Straight segments (sometimes called *vectors*) are straight lines that connect two sequential nodes. PostScript curves (also called Type 1 curves) are *Bezier curves* (3rd order, cubic B-splines). To modify the form of the curves two additional sub-nodes are used:

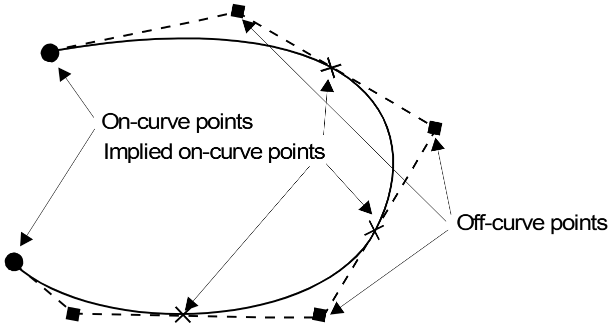


These *sub-nodes* are called Bezier *control points (BCPs)* and the vectors that connect the control points with the curve's ends are called *control vectors*. In the Glyph Window straight segments end in **square** (in black-white mode) or **red** (in color mode) dots and curves end with **round** or **green** dots. Note that the contour direction plays a role here: it is always the shape or color of the *final* node of a segment that tells you about the type of the segment.

TrueType curves are 2nd-order curves (quadratic B-splines) that have one control point, called the "*off-curve*" point:



Some TrueType curves may appear linked together and form a long curve with off-curve points only. In such curves, the intermediate on-curve points do not exist explicitly, but are implied by the rasterizer:



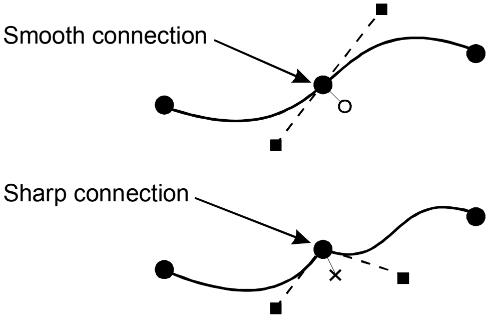
TrueType curves end with points that look exactly like straight segment points. Off-curve points of the TrueType curves have a “**plus**” (in black-white mode) or **light-blue** (in color mode) appearance.

Connections

The type of connection between segments is very important if you want to keep the contour smooth at appropriate nodes. There are two types of connections: sharp and smooth.

At a sharp connection, the two connected segments (curve and curve or straight segment and curve) are absolutely free in their angle relative to each other at the connecting node.

At a smooth connection, the direction of the straight segment and the control vector of a curve or the control vectors of two sequential curves are kept collinear (lie on the same straight line). I.e. the angle between the two segments at the node is fixed at 180 degrees.

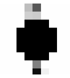


It is very important to maintain the smoothness of the glyph's contours at the appropriate places. Small corners (sharp connections that are invisible when glyphs are small) become visible (and ugly) when you print large text. Furthermore, rasterizing programs that convert outline glyphs into bitmap images on paper do not like outlines where sharp connections are present in places where the outline should be smooth.

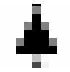
✐ **Note:** A quick way to change the connection type is to double-click on a node. More detailed control is available on the Properties panel. Use **Contour > Correct Connections** to automatically fix incorrect sharp connections, that is sharp connections that can be turned into smooth connections without any change in the shape of the contour. **Contour > Optimize** will do some additional clean up to your contours but may slightly change the shape.

Node Type

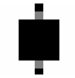
FontLab Studio has several types of nodes that are represented by different **node symbols**. The node symbol unifies two essential kinds of information: the type of segments that the node connects (straight segment or curve segment) and the type of connection (sharp or smooth).



Curve node. (Green) round node symbol indicates a smooth connection between two curve segments.



Tangent node. (Violet) triangular node symbol icon indicates a smooth connection between a curve segment and a straight segment.



Corner node. (Red) square node symbol indicates a sharp connection between any types of segments.

A blue node indicates the startpoint. To display the nodes similar to Fontographer, in black-and-white only, enable **Tools > Options > Glyph window > Appearance > Black/white**. To display the additional color information as in older FontLab versions, disable that option.

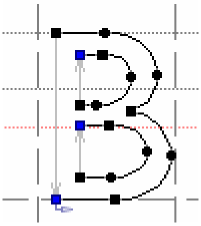
✎ **Note:** Corner nodes may exist between any types of segments (straight or curve). If possible, you should convert a corner node between two curve segments into a curve node, and a corner node between a curve segment and a straight segment into a tangent node (see the section "Connections" above). A smooth connection between two straight segments does not exist – it is always a sharp connection; also, it usually constitutes a "collinear vector" and should be simplified into just one segment.

To visually emphasize the connection type (smooth or sharp) of all nodes, you can enable the Connections layer: **View > Show Layers > Connections**. If enabled, additional connection symbols appear next to each node. A small "x" next to the node indicates a sharp connection; a small "o" next to the node indicates a smooth connection.

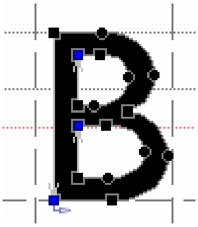
In older FontLab versions the node symbols indicated only the type of the incoming segment (in contour direction order). A square node symbol indicated that the incoming segment was straight, a round node symbol that it was a curve segment. The connection type was always indicated by the additional "x" or "o" symbol next to the node. To restore this behavior in FontLab Studio, disable the option **Node shape shows point and connection type** in **Tools > Options > Glyph window > Appearance.**

Outline Appearance

You can view an outline in contoured or filled mode. These modes are equivalent for all editing operations, but the filled mode is a little bit slower. However, in the filled mode you always see how the glyph will look in the resulting font. Switch between modes with the ⧉ button on the **Show layers** toolbar or with the **View > Show Layers > Fill Outline** command.



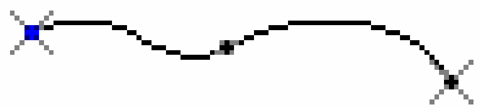
Outline mode



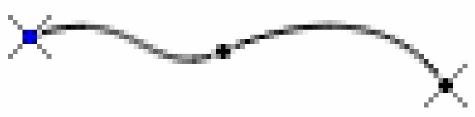
Fill Outline mode

Smoothed Contour

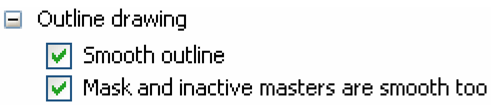
By default a contour is rendered with black color and sometimes this may result in jaggies:



Optionally you can smooth the contour appearance on screen, which will result in a much smoother outline appearance:



To smooth contours, use the Glyph Window page of the Options dialog box **(Tools > Options):**



⊟ Outline drawing

☑ Smooth outline

☑ Mask and inactive masters are smooth too

You can use the **Apply** button in the bottom-right of the Options dialog box to check the result of the changes you make in the Glyph Window options.

✏ **Note:** If your computer is slow and a contour is complex, smoothing the outlines may degrade the performance of the editing tools. Turn it off in this case.

High-quality Preview

No matter which mode is active you can quickly view a high-quality preview of the outline by pressing the ‘`’ key on the keyboard (the key under **Esc**). Until you release the key you will see a high-quality preview of the outline. Note that you can use the ‘**,**’ and ‘**.**’ keys to browse characters without releasing the ‘`’ key.

✏ **Note**: On the U.S. English keyboard layout, the ‘`’ key is located between the **Tab** and the **Esc** keys. On other keyboard layouts, you may need to use a different key, e.g. **Ö** on the German keyboard.

Outline Preview Options

You can choose other options in the View > Show Layers menu for previewing the contour layer:

Nodes	To show nodes or not
Control vectors	To show curve control vectors or not
Connection mode	To show connection mode marks
Positions	To show the coordinates of each node.

You will see the positions of nodes only when the nodes are visible. All other contour presentation modes may be combined in any way.

A few more notes about outline appearance:

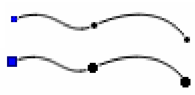
Selected parts of an outline appear red in color. Selected nodes are marked as red rectangles and they are visible even if non-selected nodes are hidden.

Many options related to outline appearance can be customized on the Appearance and Outline Drawing sections of the Glyph Window page of the Options dialog box (Tools > Options) described in the "FontLab Studio Options" section.

Here is a list of some available options and a description of the features they control:

Small nodes

Nodes may be small or large:

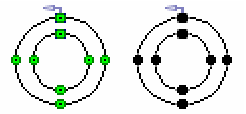


Node shape shows point and connection type

Activate this option to show node type. Otherwise only the type of the segment and a connection type will be visible (this is how it was in FontLab 4.x)

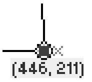
Black/white nodes

Nodes may be colored or black/white:



Show node position

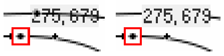
One node may be selected as the current node. It will be highlighted and its position will appear on screen:



To deselect the node, click anywhere in the empty space of the editing field or click the **Esc** key

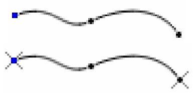
Node position is on top of the outline

Position of the node (see above) may appear below or above the path:



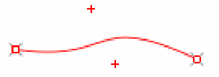
Highlight first node of an open contour

When this option is on, start and end nodes of the open contour are highlighted with a small diagonal cross:



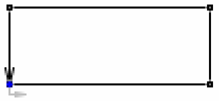
Bezier control points are visible in selection

When this option is on and **Show Layers>Control Vectors** is off, the control points become visible when the curve is selected:



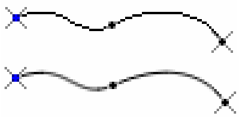
Show arrow on closepath

Activate this option to see small arrows on every closepath line:



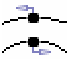
Smooth outline

Allows one to select between standard and smoothed rendering of the outline:



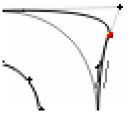
Show contour direction

An outline consists of several contours and each contour is directional. The direction of the contour is marked with a small arrow:



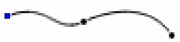
Leave echo while editing

When editing contours the original contours shape/position is shown gray:



Fill open contours

When this option is off, the open contour appears unfilled in fill outline (preview) mode:

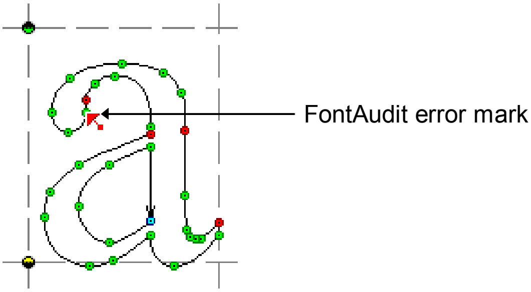


FontAudit

FontAudit is a set of algorithms that analyses a glyph's outline to find errors that may decrease glyph rasterization quality.

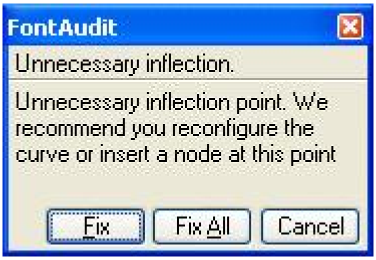
To switch on FontAudit, press the ☯ button on the Show Layers toolbar.

If FontAudit finds what it thinks is an error, it shows an error mark in the editing field of the Glyph Window:



To see a description of the error, activate the Edit tool (↖); position the mouse cursor on the mark; and click the left mouse button.

You will see a FontAudit error message:



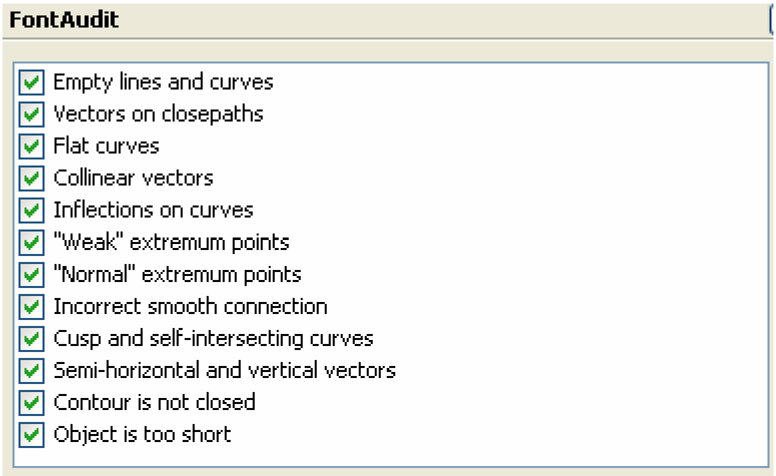
FontAudit

Unnecessary inflection.

Unnecessary inflection point. We recommend you reconfigure the curve or insert a node at this point

This message has two buttons, **Fix** and **Fix All,** which you can use to try to automatically fix an error (**Fix** button) or all errors in the glyph (**Fix All**). Sometimes correcting one error causes others and when you press the **Fix** (or **Fix All**) button you will see even more errors, so use this feature carefully.

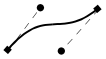
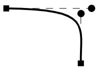
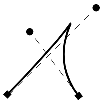
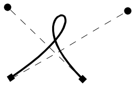
You can customize the FontAudit algorithms using the FontAudit page of the Options dialog box:



FontAudit

☑ Empty lines and curves
☑ Vectors on closepaths
☑ Flat curves
☑ Collinear vectors
☑ Inflections on curves
☑ "Weak" extremum points
☑ "Normal" extremum points
☑ Incorrect smooth connection
☑ Cusp and self-intersecting curves
☑ Semi-horizontal and vertical vectors
☑ Contour is not closed
☑ Object is too short

Here is a short description of each test and the error that it detects:

Empty lines and curves	Lines or curves that have no length (I.e. two nodes on top of each other.)
Vectors on closepaths	Unnecessary straight segments that should be removed. In Type 1 fonts this error can cause problems with rasterization
Flat curves	Curves that can be replaced with a straight segment without loss of quality (I.e. a “curve” that is really a straight line.)
Collinear vectors	Two sequential straight segments are collinear; therefore the first straight segment can be removed (Straight lines with extra nodes in the middle.)
Inflections on curves	Detects curves that have inflections. It is better to replace such curves with a combination of two curves  *Curve with an inflection*
"Weak" extremum points	There are “invisible” extreme points on curves. This error can cause problems with rasterization of the glyph  *Curve with an invisible extreme point*
"Normal" extremum points	Curves need nodes at extreme points
Incorrect smooth connection	A straight segment and curve or two curves are connected very close to a smooth connection, but not precisely. I.e. what looks like it should be a smooth connection is labeled as a sharp connection.
Cusp and self-intersecting curves	 *Cusp curve*  *Self-intersecting curve*
Semi-horizontal and vertical vectors	The direction of the straight segment is close to vertical or horizontal but is not parallel to one of the axes (i.e. not *exactly* horizontal or vertical)
Contour is not closed	Contour appears to be closed (visually) but is defined as open. Use Fix button on the error reporting dialog box to automatically correct this situation
Object is too short	Curve or line is short enough to be deleted.

You can switch off any of the FontAudit tests by switching off their check box in the FontAudit options page.

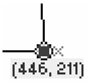
As you can see, FontAudit testing can detect errors that are invisible without your having to do a tough, lengthy analysis. On the other hand, some errors are in fact warnings and do not necessarily impair the glyph's outline quality.

Moving Nodes

The most important editing operation is the modification of the contours that build each glyph. You can modify contours in three ways: moving nodes, editing segments using non-node editing, and selecting several nodes and moving them together.

To move individual nodes:

1. If nodes are hidden, make the node that you want to edit visible: switch nodes on with the **View > Show Layers > Nodes** command or click near the node to make it visible. If you missed and an incorrect node is highlighted, use the **PAGE DOWN** and **PAGE UP** keys to move to the correct node:

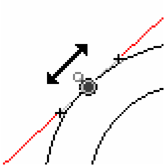
2. Drag the node to the new place. It will stick to the objects in other layers if they are visible and snap-to those layers was activated (**View > Snap to Layers** menu).

   Hold down the **SHIFT** key to constrain the direction of the node's movement in 45-degree increments and to snap the cursor to the original node's position.

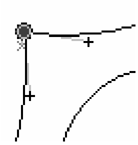
Options

If you are moving a node that is connecting two Bezier (PostScript) curves you have the following options:

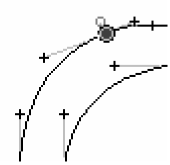
1. If the connection of the curves is smooth, press the **Shift** key before clicking the node to constrain movement to a line between the curves' control points:



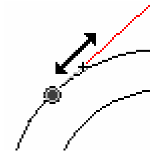
2. If the connection is sharp, press the **Alt** key at any time while dragging the node to move it without the adjacent control points:



3. If the connection is smooth, press the **Alt** key before moving the connecting node to keep the connection's curvature optimised. Hold down the **Ctrl** key to involve all 4 control points in the process:

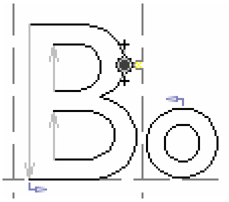


4. When you are editing control points of a Bezier curve press the **Shift** key before clicking the button to keep the direction of the control vector unchanged.

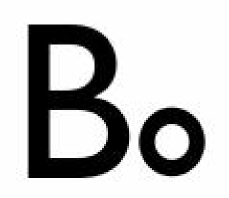


5. If you are moving a control point of a curve with a sharp connection, press the **Alt** key to temporarily change the connection type to smooth, so that the adjacent control vector will be collinear

Do not forget that you can press the ‘`’ key (the key under **Esc**) at any time to get an instant high-quality preview of the glyph outline as it will print:



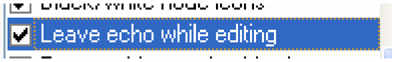
Normal outline



High-quality preview

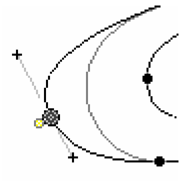
Outline Echo

If you want to see how the outline looked before you moved a node, switch on the Echo mode. Open the **Glyph Window** page of the Options dialog box and switch on this option:



☑ Leave echo while editing

This is how editing field will look when echo mode is on:

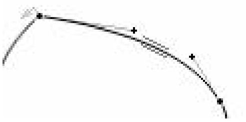


Using the Keyboard

You can use the keyboard to move nodes and to select a node for editing:

Arrow keys	Every click moves current node by one font unit
Shift+Arrow keys	Every click moves a node by 10 font units
Ctrl+Arrow keys	Every click moves a node by 100 font units
Page Up	Selects the previous node for editing
Page Down	Selects the next node for editing
Tab	Alternates between the node and Bezier control vectors
Esc	Drops the selection of the current node.

✐ **Note:** You can make a line or a curve a current object and arrow operations will move it as a whole. Just left-click on a curve or a line with the Edit tool and it will be highlighted by a pair of short lines:



Non-node editing

Sometimes you may want to modify a contour in a more flexible way than by moving nodes. For example, to adjust the shape of a curve in node editing you would usually make the control points of a curve visible and move them to modify the curve. A more intuitive way would be to "grab" the curve somewhere between the nodes and move this imaginary "inside" point. The curve's shape changes accordingly. We call this method "*non-node editing*". This means that you can move not just nodes, but every point of a glyph's contour. You can even switch off nodes and still be able to edit the contour as you wish.

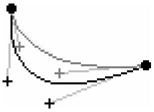
To modify a curve or straight segment using the non-node editing method:

1. Move the mouse cursor onto the place on the segment that you want to move.
2. Press the left mouse button. You will see a small color point that will show you the temporary point that you are moving.
3. Drag the mouse and observe how the shape of the curve changes. After a few experiments (which can be undone) you will have enough experience to use this method of editing.

Several notes that you should remember:

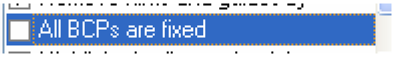
1. In non-node editing, guiding objects are not sticky. So, temporary points do not snap to the grid, guidelines, hints or anything else.
2. If you choose a temporary point near one of the ends of a curve, you will move that end, not just change the curve's shape. This is a useful method to locate a curve's endpoints.
3. When you press the mouse button to begin non-node editing you will see that the endpoints of the curve as well as the control vectors appear, simplifying the editing of this segment.
4. If you want to highlight the line or curve but don't want to modify it, hold down the CTRL key while clicking on the line or curve.

If you drag a "point" on a curve, its control vectors may change direction:



To fix the direction of the control vectors, hold down the ALT key and double-click the node. You will see the connection mark turn yellow. ALT+double-click it again to remove the fixed state. Alternatively you can right-click the node and use the **Fixed BCP Direction** option to control this feature.

You can also fix the direction of all control vectors when you edit a curve using non-nodes editing. Open the Options dialog box (the Tools > Options menu), select the Glyph Window page and use the following option:



□ All BCPs are fixed

Changing Connection Type

The type of connection between segments is very important in maintaining the smoothness of contours. Connections can be of two types: smooth and sharp.

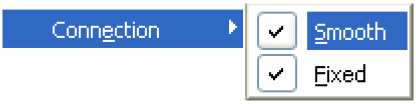
If a connection is smooth the direction of the adjacent curve control vectors or of the curve control vector and line is collinear and the contour is smooth at the connection.

To change the type of connection

1. Make the node visible.

2.1 Double-click the node with the left button

2.2 Right-click the node and select the connection type in the popup menu:



Deleting Nodes

To delete nodes using the Edit tool:

1. Begin moving the node by dragging it.
2. While holding down the left mouse button, click the right button. The node will be removed.

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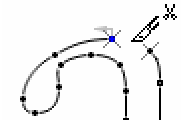
1. Move the mouse cursor onto the node and press the right mouse button.
2. In the popup menu choose the **Delete node** command.

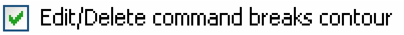
Note: If you click the right mouse button while editing the curve using the non-node editing method or while you are moving the control points of a curve the curve will not be removed. Instead it will change to a straight line.

Deleting Lines and Curves

You can delete a whole line or curve with the Knife tool. Activate the Knife tool with the button on the Tools toolbar or click '3' on the keyboard. Press the Alt key and click on the line you want to delete. Note that with this method you will break the outline:



Another way to delete a line or a curve is to left-click on it with the Edit tool and then select the **Delete** command in the **Edit** menu. This method works differently depending on the following option in the Glyph Window page:

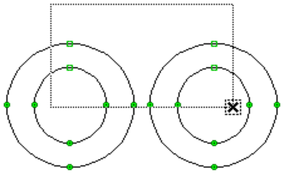


☑ Edit/Delete command breaks contour

Eraser Tool

The eraser tool can be used to quickly remove nodes. Sometimes this is necessary, for example, with contours from an auto-tracing program. The eraser tool can work in two modes: like a standard eraser or as a rectangle eraser.

In the first mode, all nodes that are inside the eraser mouse cursor are deleted. In the second mode, you define a rectangle by clicking and dragging (as when you select nodes with the **Edit** tool or change the zoom of a Glyph Window) and all the nodes inside the rectangle are removed.



The first (eraser-like) mode is the default for the **Erase** tool. To switch to the rectangle mode, hold down the CTRL key.

Inserting Nodes

To insert a new node on a segment with the Edit tool:

1. Activate the Edit tool .
2. Position the mouse cursor on the segment where you want to insert the node.
3. Press and hold the right mouse button. You will see a mark that shows you the current position of the mouse cursor. This mark will stick to all objects in the editing field, including nodes and glyph contours.
4. Position the mark on the point where you want to insert the node and click the left mouse button. The new node will appear in that place.

Using the Knife tool to insert nodes:

1. Activate the Knife tool
2. Click on the point on the contour where you want to insert a node.
3. Press the left mouse button anywhere on the empty area of the editing field and drag the mouse to form a “knife line”. After you release the mouse button new nodes will be inserted at all points where this line crossed the outline. Hold down the **Shift** key to constrain the direction of the “knife line” to 45-degree increments.

   If the “knife” line will cross two lines you may find a part of the glyph to “cut off”. Hold the **Alt** key to limit Knife tool to insert new nodes only.

Using the Add Corner, Add Curve and Add Tangent tools:

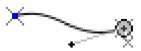
1. Activate one of the tools.
2. Click on any outline point. The Corner tool will add a straight line, the Curve tool will add a smooth connection and curve and the Tangent tool will add a sharp connection and curve.

Note: You can insert nodes on the closing straight segment that automatically connects the first and last nodes of a contour. If you insert nodes on the first half of a closing straight segment (closer to the ending node of a contour), then the new node will be added to the contour. If you insert the node on the last half of the closing straight segment, then it will be inserted before the startpoint and become a startpoint.

Using the Drawing Tool

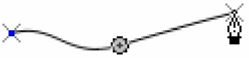
The easiest way to create a new contour is to use the Drawing tool:

You can create a new contour or you can continue any existing contour. If you want to add new nodes to the existing contour, just activate its first or next node:

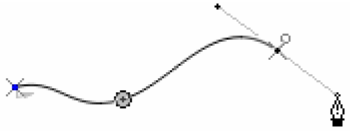


The last node of the open contour is activated

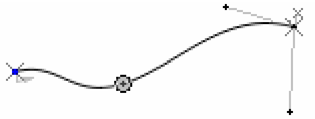
1. **To add a point**, just click the left mouse button.



2. If you want **to create a line point**, just release the button. If you want **to define a curve**, drag the mouse to set the position of the curve control vector:



3. **To adjust the position of the curve control vector** without moving the control vector of the previous curve, hold Alt and left-drag:



You can press and release the Alt key while you drag the mouse – when Alt is released you are defining the positions of the control vector that belongs to the previous curve *and* the control vector of the next curve. When Alt is pressed, you are not moving the previous curve's control vector.

4. When you are adding a new node, you can hold the CTRL key to not move the curve control vector but **move the node** itself.

5. Finally, you can use the SHIFT key at any time **to constrain the direction** of the line (if you are holding the CTRL key) or a curve control vector.

To close the contour, just click on its starting node and drag the mouse to set the direction of the control vectors.

Adding Points to a Contour

In addition to the Drawing tool you can use three more tools to create a new contour or to add points to an existing contour. These tools are: Add Corner, Add Curve and Add Tangent.

To create a new contour:

1. Activate one of the tools.
2. Click anywhere in the empty area of the glyph window to create the first point of a new contour. Drag the mouse to put new node into correct position. Release the mouse button.
3. Click again in the empty area to add a corner line, curve or smoothly connected curve (with Add Corner, Add Curve or Add Tangent tools respectively).
4. Continue the procedure until your newly defined contour is complete. To close contour, drag the last node onto the first node.
5. You can switch to the Drawing tool at any time and use it to add new points to a contour you are creating.

Note: A new node is added to the contour if the last node of the contour is highlighted. If it is not highlighted a new contour is started.

To highlight a node click it. To deselect it, press the **Esc** key on the keyboard.

You can move outline nodes with the Add ... tools. Note that if you click on the contour (not on the node), a new node is inserted. The type of node depends on the tool you are using. To prevent adding a new node, hold down the **Alt** key when you click on the contour.

Converting Segments

Sometimes you may want to convert a curve to a straight segment or vice versa**. To convert a curve to a straight segment** “delete” (drag + right mouse button) one of the control points of the curve, or “delete” (drag + right mouse button) the curve while you are in the non-node editing mode.

To convert a straight segment (normal or closing) to a curve drag an inside point of the straight segment while holding down the **ALT** key.

To convert a curve to a 1/4 part of an ellipse (the curve’s control vectors will be treated as an ellipse axis), press the **ALT** key and click on the curve.

You can also **convert** curves and straight segments **with the popup menu**. Right-click the end node of the segment and select the **Convert PS/TT** command in the popup menu. With this command a line segment is converted to a Bezier curve, a Bezier curve to a TrueType curve and a TrueType curve to one or more Bezier curves.

The last way to convert segments is to **use the selection menu**:

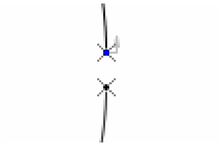
1. **SHIFT**-click any point on the curve or line segment.
2. Right click the highlighted (red) segment. A popup menu appears.
3. Choose one of the commands in the **Convert** submenu: **To curves** (to convert to a Bezier curve) or **To lines** (to convert to straight line segments).

Breaking and Joining Contours

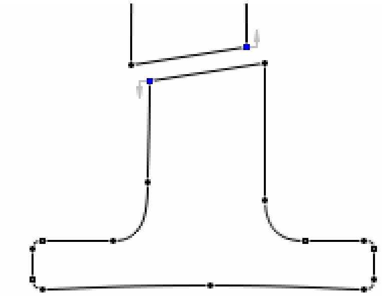
To break the contour with the edit tool hold down CTRL and ALT and left-click the node where you want to break the contour.

To break the contour with the Knife tool just click on the node.

When a contour is broken its first and last nodes are highlighted by diagonal crosses:



You can use the Knife tool **to "cut out" part of the contour:**



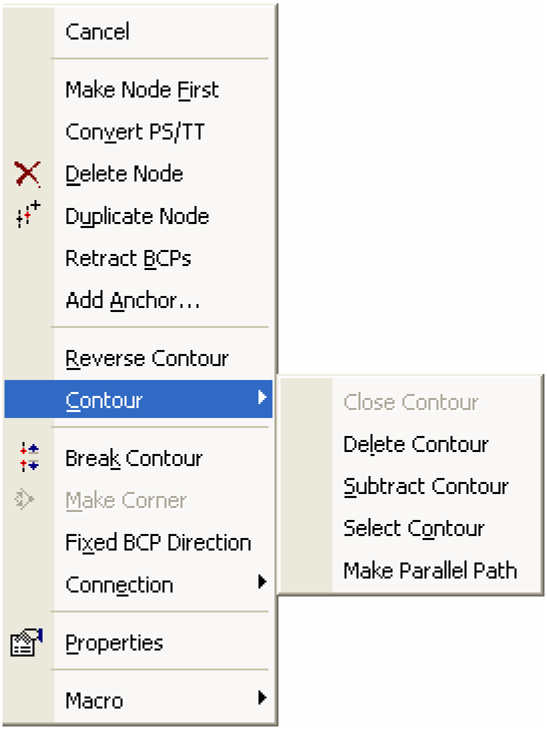
1. Activate the Knife tool.
2. Press the mouse button and drag the cursor to define the "cutting line".
3. Release the button. Note that you can only cut part of a single contour, like in the sample picture above.

To join two contours you need to move the starting or ending node of one contour to the starting or ending node of another contour.

Hold down the ALT key **to prevent the contours from joining**.

Node Commands

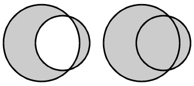
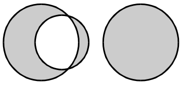
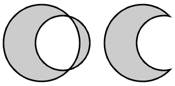
If you right-click a node you will see a popup menu with many useful commands:



Below is a description of all the commands in this menu:

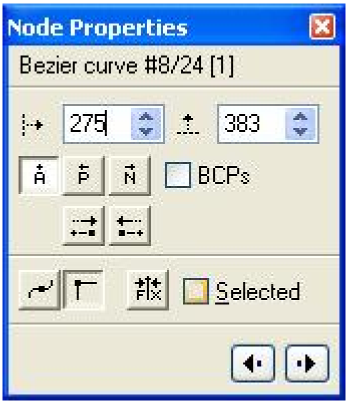
Make node first	Starts the current contour from the selected node (i.e. makes it the startpoint). This command is useful when you need to join contours since you can only connect starting and finishing nodes
Convert PS/TT	Cycles the node type from line to Bezier curve to TrueType curve
Delete node	Removes the node
Duplicate node	Adds a zero-length straight segment to the node. I.e. puts a new node on top of an old one. This command is useful when you are editing Multiple Master fonts
Retract BCPs	Removes the control vectors of the node, making it sharp
Break contour	Breaks the contour at the selected node
Make corner	Makes a 90 degree corner (this operation is not always available)
Fixed BCP Direction	Makes the connection fixed. You can use it instead of Alt+double-clicking the node
Connection	Popup menu with connection settings. You can use it instead of double-clicking node
Contour	Set of commands related to the contour to which the selected node belongs (described below)
Properties	Opens the Node properties panel.

Contour commands:

Reverse contour	Reverses the contour direction 
Close contour	Makes open contour closed
Delete contour	Removes the contour 
Subtract contour	“Subtracts contour” from the outline 
Select contour	Reverses the selection state of the contour
Make Parallel Path	Opens the Parallel Path dialog (described later).

Node Properties

CTRL-click the node or Right-click and choose the **Properties** command in the menu . You will see the Node properties panel:



Node Properties

Bezier curve #8/24 [1]

275 383

□ BCPs

□ Selected

In this property panel you can control the position of the node, the alignment type, the selection status of the node and the position of the control points of the curves.

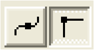
The figures in the first line are the index of the segment, the node index and the contour’s number.

To change the position of a node:

1. Select the origin point you want to use and set the coordinates of the node. By default the origin is the glyph's origin point A. With the radio buttons you can select the previous P or next N node as the origin point.
2. Modify the coordinates of the node in the edit boxes. You can use the spin buttons to increase or decrease the coordinates. The new coordinates will be applied to the node when you press the Enter key on the keyboard or move the focus from one edit control to another or when you close the property panel by clicking on a free space in the edit field.

To change the selection state of a node: modify the state in the **Selected** check box.

To change the connection mode for a node use these check boxes:



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To edit the position of the curve's control vectors: switch on the **Control vectors** check box (it will be gray if you are editing a node between two straight segments) and modify the relative position of the previous or next control point that belongs to that node.

Use the buttons with arrows ◀ ▶ **to edit the previous or next node**.

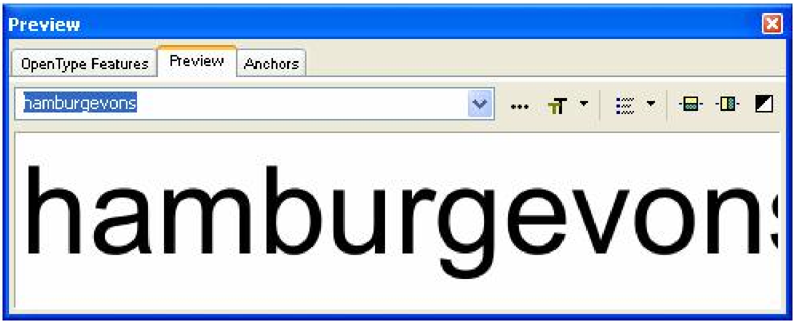
✐ **Tip:** when you are editing node positions in the Properties panel, press the Enter key to accept changes and move the focus to the editing field of the Glyph Window. There you can use the keyboard to move the selected node and the Page Down/Page Up keys to select another node for modification. You will see the node properties change in the Properties panel as you move the node by keyboard or mouse. Click Alt+Enter to put the focus on the Properties panel to set the node position more precisely.

Previewing Glyphs

Sometimes you need to get a high-quality preview of the glyphs you're editing. You can preview any glyph in its Glyph window with the ‘`’ key (the key under **Esc**), but it doesn't give you a feeling of how this glyph will look in a line of text or in multiple sizes.

To get a better preview, use the Preview panel. Open it with the **Preview** command in the **Window > Panels** menu:

You will see a panel containing three pages: OpenType Features, Preview and Anchors. The OpenType Features and Anchors pages will be described later, so activate the **Preview** panel now:



hamburgevons

hamburgevons

High-quality rendering provided by the FreeType library is used to show glyphs in the preview panel, so the visual resolution is higher than the pixel resolution of your screen and is close to what you can get on some printers.

In preview mode the preview panel shows the glyph string in the top area of the window:

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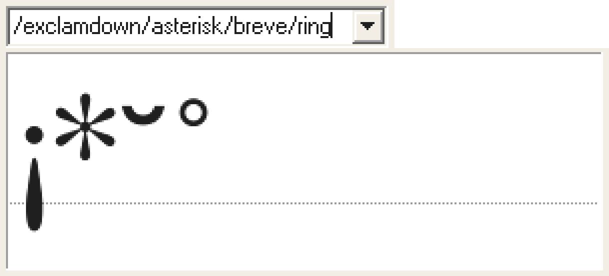
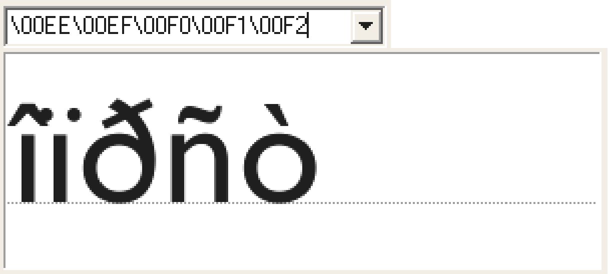
You can type any text in this area or you can **drag-drop glyphs selected in the Font Window or in the Classes panel**.

To preview a glyph that cannot be easily encoded by a single keyboard character, enter the slash character and then the name of the glyph:

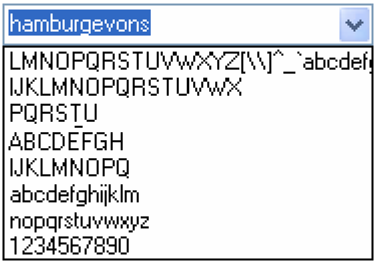

/exclamdown/asterisk/breve/ring

To enter Unicode characters, type the Unicode index (in hexadecimal form, exactly 4 characters) after the backslash:


\00EE\00EF\00F0\00F1\00F2

To enter line break, type "\n". You will get two lines of text in the preview.

To choose one of the predefined sample strings, open the list with the button to the right of the sample string:

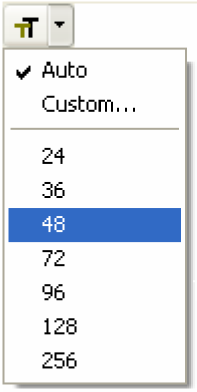

hamburgevons

LMNOPQRSTUVWXYZ[\\]^_`abcdef
IJKLMNOPQRSTUVWX
PQRSTU
ABCDEFGH
IJKLMNOPQ
abcdefghijklm
nopqrstuvwxyz
1234567890

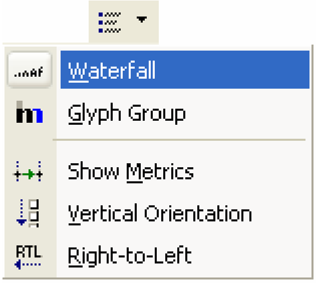
You can **scroll the sample string** in the Preview panel – just left-drag to scroll the window or right-click to reset to the initial position.

Preview Modes

The height of the sample string is determined automatically and depends on the vertical size of the preview panel. You can choose other sizes in the **Size** popup menu:

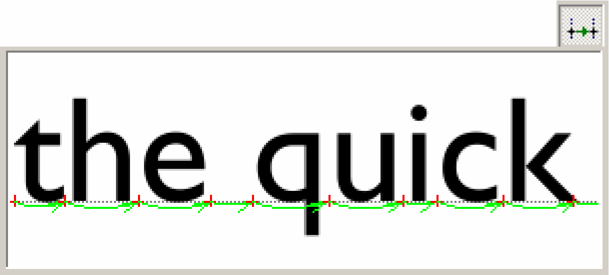


The Preview panel can work in two modes: string preview and waterfall preview. You can switch to the waterfall mode in the **Preview Options**



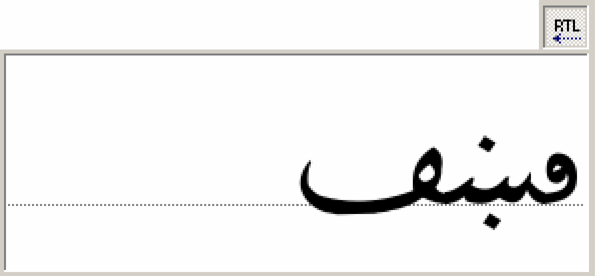
Note that the waterfall preview is possible only when the Glyph Window is active.

With the **Show Metrics** command in the **Preview Options** menu you can activate metrics preview mode:

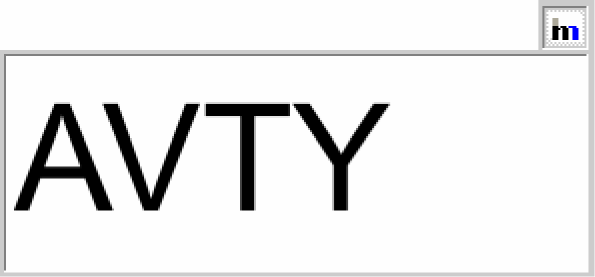


In this mode you can see a preview of every glyph and its width.

If you are working with Arabic or Hebrew script you may need to preview a sample string in right-to left mode. Use the **Right-to-Left** command in the **Preview Options** menu to activate this mode:

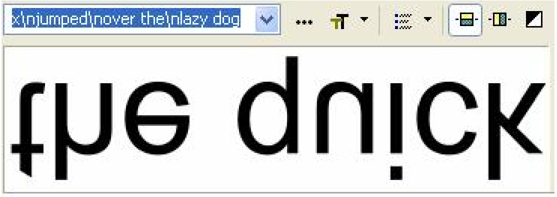


The **Glyph Group** command will show you the current glyph (for example, "A") along with other glyphs from the same shapes group:



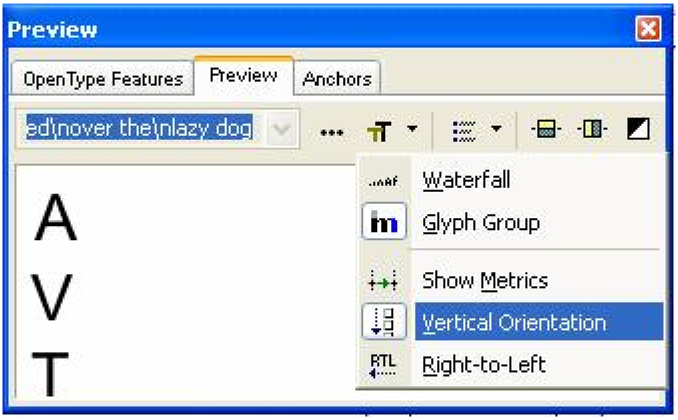
The following three buttons allow you to flip previewed glyphs vertically, horizontally or to see the preview inverted:

Vertical and horizontal mirrors will help you to observe glyphs but not meaningful words:



Vertic al Preview

The **Vertical Orientation** command in the **Preview Options** menu turns the preview into vertical preview mode:

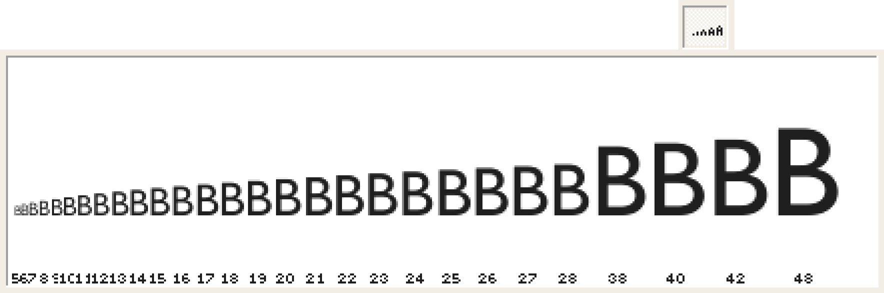


The vertical font metrics or the vertical glyph metrics (if defined) are used to vertically align glyphs. Right-to left preview mode still works when the Preview panel is vertically oriented, so you can align glyphs to the left or to the right to check the balance of their sidebearings.

Waterfall Preview

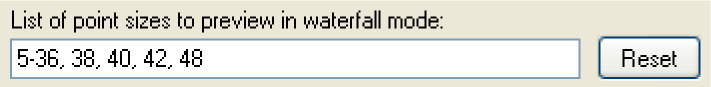
When you are working on a glyph, you may need to see it in many sizes at once. Open the glyph in the Glyph Window and switch the Preview panel to the waterfall mode with **Waterfall** command in the **Preview Options** menu.

You will see multiple sizes of the glyph previewed:



Size is measured as PPM, which means Pixel Per eM. This is a resolution-independent way of defining the pixel height of the glyphs. For standard PC screens, the point size (which you enter to define text size in text editors or page layout programs) is equal to ¾ of the PPM.

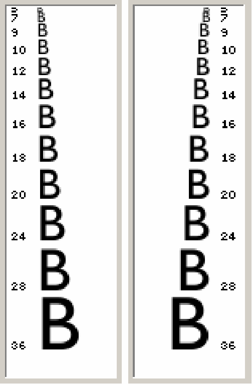
With the Preview Options dialog box (•••) you can choose which PPMs you want to preview:


List of point sizes to preview in waterfall mode:

5-36, 38, 40, 42, 48

You can choose what sizes you need to see in the waterfall preview mode. Enter the sizes separated by ‘,’ or use ‘-’ to define size ranges. Click the **Reset** button to select the default PPM ranges.

Waterfall preview also works in vertical mode with left-to-right or right-to left writing mode:

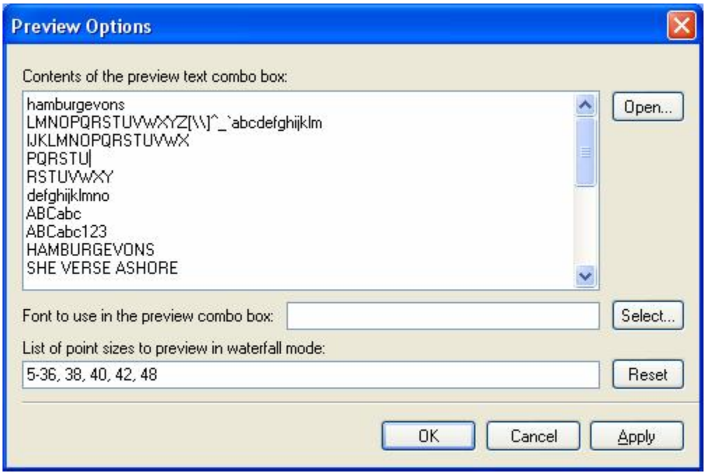


You may print the Waterfall preview of the font if you click on the 🖨 button on the Standard toolbar. Refer to the “Printing and Proofing Fonts” chapter for further details.

Preview Options

To edit the contents of the sample strings list, click on this button: ...

You will see a dialog box that contains all the strings that appear in the list plus a few other options:



Preview Options

Contents of the preview text combo box:

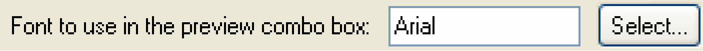
```
hamburgevons
LMNOPQRSTUVWXYZ[\\]^_`abcdefghijklm
IJKLMNOPQRSTUVWX
PQRSTU
RSTUVWXY
defghijklmno
ABCabc
ABCabc123
HAMBURGEVONS
SHE VERSE ASHORE
```

Font to use in the preview combo box:

List of point sizes to preview in waterfall mode: 5-36, 38, 40, 42, 48

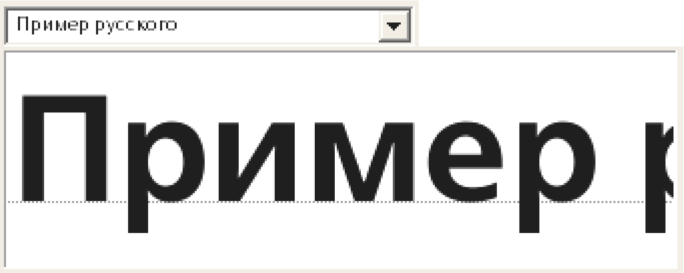
By clicking the **Open** button you can select the text file that will be used to preview sample strings.

This option:



Font to use in the preview combo box: Arial

allows you to choose the system font that is used to show text in the sample string. You may need to change this font if you are working with non-Latin fonts:

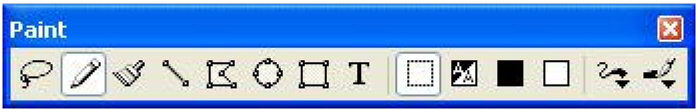


Пример русского

VectorPaint Mode

VectorPaint is FontLab’s unique set of tools that allow you to paint vector contours with tools that look and feel like bitmap tools. You can choose brushes, pens, freeform selections and even enter text. The idea of VectorPaint is that all the tools produce contours that combine with the existing glyph contours using our unique contour-processing technology.

When you click on one of the tools on the Tools or Paint toolbar you enter the VectorPaint mode. To open the Paint toolbar select it the **View > Toolbars** menu:



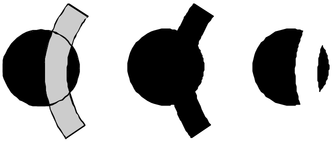
The keyboard shortcut for the mode is **Alt-3**.

The type of interaction between existing and new contours depends on the selected color mode. This process is very fast and is completely transparent to you, so if you switch on the preview mode (where the glyph appears filled), the illusion of bitmap-like editing of a contour-based glyph image is very realistic.

All the paint tools can work in 4 different color modes:

⬚	**Transparent**	Newly created vector objects that are generated by the application of VectorPaint tools do not interact with the existing glyph’s contour and appear selected for easy editing
▨	**Automatic**	The color of the brush depends on the point where you begin drawing. If you begin in a white area, a white brush will be selected, if in black, a black brush will be selected. Use this color mode to easily extend white or black areas of the glyph
■	**Black**	Generated contours are added to existing contours, expanding the black area of the glyph. It looks like a black brush applied to a black picture
□	**White**	New contours are subtracted from existing contours, simulating a white brush.

Here is an example of a brush stroke applied with Transparent, Black and White “colors”:



✎ **Note**: VectorPaint tools have an option to automatically activate the Free Transform operation when any of the painting operations is completed. This option allows you to instantly move, scale, rotate or slant the newly created shape.

Here is a list of all available VectorPaint tools with a short description of each:

	Freehand Select	Used to select non-rectangular areas of a glyph. It selects not the nodes, like the Edit tool, but actually cuts lines and curves and selects black areas that can be moved or otherwise transformed
✎	**Pen**	Used to create new contours or modify existing ones. It is not really a “paint” tool, because it deals with contours, but it is a very natural and flexible tool used to adjust the result of the application of VectorPaint tools
	Brush	Exactly that - a brush. It can be round or calligraphic. A calligraphic brush can be of any size and slant angle
╲	**Line**	Used to draw straight lines with a selected brush
	Polygon	Has two modes: point-by-point polygon drawing with easy combination of straight segments and curves, or point-by-point definition of a polygon that will be drawn by using the selected brush
○	**Ellipse**	Used to draw ellipses or circles
□	**Rectangle**	Used to draw rectangles or squares
T	**Text**	Used to enter text (vector based) using any TrueType font installed in the system.

Freehand Select Tool

This tool works like a precision knife. You can cut part of a contour, and it will be automatically selected so you can transform it, delete it or copy it.

To select part of a glyph with the freehand select tool:

1. Select the freehand select tool () in the Paint toolbar.
2. Position the cursor on the point where you want to start the selection and press the left mouse button.
3. Drag the mouse to extend the selection polygon in freehand mode, or click the left mouse button to extend the selection polygon by straight segments.
4. Click the right mouse button to finish the selection.

When you finish the selection, you will see that the selection polygon was applied like a knife and you have a new contour (or several contours) that is separated from the glyph. The new contours are selected so you can use the Edit tool to move them or transform the selection. Of course, you can use any **Edit** menu command with this selection.

Pen (Contour) Tool

With the Contour tool ✎ you can create new contours or modify existing contours in a more artistic manner than with the Edit tool. When you use the Contour tool, you can draw new contours just as you do on paper. FontLab Studio will trace your drawing and replace it with a series of curves and lines.

How to create a new contour

If you begin a contour in a free area (where the cursor has its ordinary shape), you will define a new contour. If you want to begin a new contour but its startpoint is on an existing contour press the **Ctrl** key to force FontLab Studio to create a new contour.

How to modify an existing contour

When you move the cursor of the Contour tool onto an existing contour or node, it changes. If you begin drawing (without holding down the **Ctrl** key) the new contour will be inserted into the existing one. If the finishing point of your drawing is on an existing contour also, and the starting and finishing points are on the same contour, then the new drawing will replace the part of the existing contour that lies between the starting and finishing points.

How to draw a single curve

Hold the **Shift** key down when you release the mouse button after drawing a new line. Your drawing will be approximated by a single curve. This is a good way to draw a new contour step-by-step.

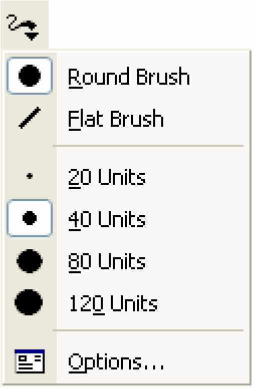
Brush Tool

The Brush tool works like the usual bitmap brush that you find in any bitmap-editing program. You begin a brush stroke by pressing the left mouse button. Draw the stroke by dragging the mouse and finish drawing it by releasing the mouse button.

To change the color of the brush, use the color selection buttons on the Paint toolbar:

⬚	for the “empty” color
▨	for the “auto” color
■	for the “black” color
□	for the “white” color

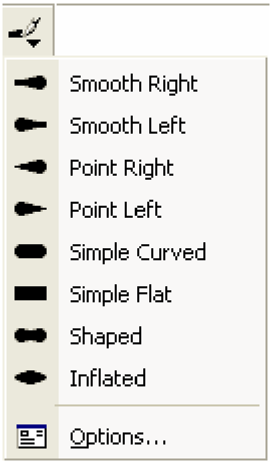
Other brush options are accessible in the VectorPaint options menu:



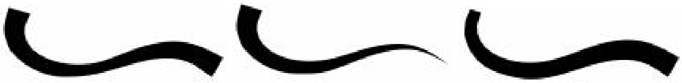
You can paint with round or calligraphic brushes of different widths:

╱	Calligraphic-style brush
●	Round brush
•	20 unit wide line
●	40 unit wide line
●	80 unit wide line
●	120 unit wide line

You can also specify a brush stroke shape. Press the button and select a shape in the popup menu:

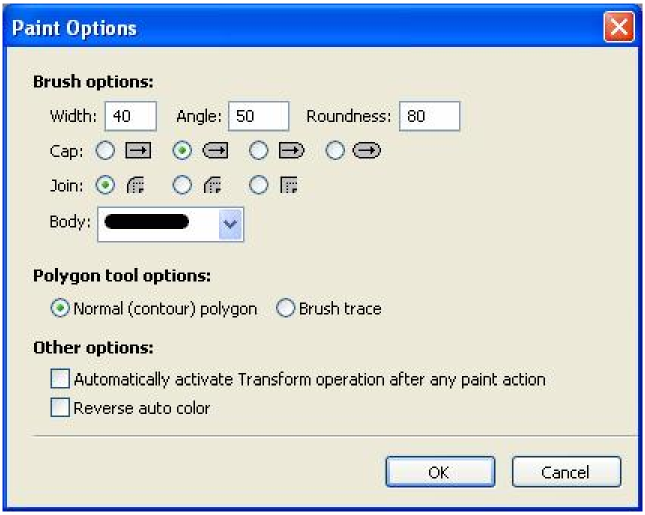


This is an example of different brush strokes:



VectorPaint Options

You can also change the brush properties in the Paint Options dialog box. **To open the Paint Options dialog box**, choose the **Options** command in the Brush options menu ( ) or Brush style menu ( ). You will see following dialog box:



Paint Options

Brush options:

Width: 40 Angle: 50 Roundness: 80

Cap: ○ ● ○ ○

Join: ● ○ ○

Body:

Polygon tool options:

● Normal (contour) polygon ○ Brush trace

Other options:

□ Automatically activate Transform operation after any paint action

□ Reverse auto color

In the **Paint Options** dialog box you can enter the width of the brush and change the slant angle of a calligraphic brush. Additionally, you can select how the brush strokes are started and finished. Choose the brush's starting and finishing shape by activating one of the radio buttons.

You can also select the style of the connection between two sequential segments of brush strokes. It can be sharp, smooth or flat. Select one in the dialog box. Icons near the radio buttons give an explanation of the styles of connections.

Last field in the Brush options area lets you to select the shape of the brush stroke.

Other options relate to the Polygon tool (described later) and the options for automatic activation of the Free Transform operation and reversing of the "auto" color.

To choose one of the Polygon tool modes use the options in the Polygon tool field. If you choose **Normal (contour) Polygon** the polygon tool will create a simple contour that can include straight segments and curves. If you choose the **Brush trace** option the current brush will be applied to the created polygon’s contour. In the Brush trace mode you cannot draw curves while defining a new polygon.

If you mark the **Automatically Activate Transform Operation** check box and select the Transparent painting color the Free Transform operation will be activated and applied to the contour that you created after the completion of any paint operation.

The last option, **Reverse auto color,** changes the behavior of the "auto" color brush mode. If you begin drawing in a white area, a black brush will be selected, if in black, a white brush will be selected.

The following option on the Glyph Window page of the Options dialog box

□ VectorPaint tools have separate view settings

allows you to have different view settings (View > Show Layers set) when you enter the VectorPaint mode. To use this option, first turn it on; then enter VectorPaint mode for the first time and switch editing layers to create the most comfortable environment. For example, in Edit mode you may use an unfilled outline with all nodes switched on. In VectorPaint mode you may switch on the Fill Outline mode and switch off all nodes. Now when you enter VectorPaint mode the next time, the editing layers will be switched automatically to your preferred environment.

Line Tool

The Line tool ╲ allows you to apply brushes to straight-line segments.

To draw a line segment:

1. Position the mouse cursor on the beginning point and press the left mouse button.
2. Move the mouse to the end point and release the button. Hold down the **SHIFT** key to constrain the direction of the line to 15-degree increments.

Polygon Tool

The Polygon tool can be used in two modes: as a tool to draw a polygon consisting of lines and curves or as a tool to draw an outline of a polygon with a selected brush. The second mode can be treated as a series of applications of the line tool. The mode of the polygon tool can be selected in the **Paint Options** dialog box.

To draw a polygon using the Polygon tool:

1. Select the Polygon tool in the Paint toolbar. Be sure that the Polygon tool is in the polygon mode.
2. Move the mouse cursor to the first point of the polygon and click the left mouse button.
3. Move the mouse cursor to the position of the next polygon point. To add a line segment, click the left mouse button. To add a curve segment, click the **TAB** key, press the left mouse button and drag the mouse to define the control vector of a curve. Hold down the **SHIFT** key to constrain the direction of the control vectors to 15-degree increments.
4. If the polygon in its present state is finished by a curve, the next segment that the polygon tool will try to add will be a curve. To switch between adding a straight segment or a curve, use the **TAB** key on the keyboard.
5. Repeat steps 3 and 4 for all points of the polygon.
6. Click the right mouse button to finish creating the polygon.

The **Brush Trace** mode of the polygon tool works just like the normal (contour) mode.

Ellipse and Rectangle Tools

The Ellipse ○ and Rectangle □ tools are very similar. The only difference is in the result.

To draw an ellipse or rectangle:

1. Select the tool that you want to use.
2. Position the mouse cursor on the spot where you want to place one of the rectangle corners (or on one of the corners of the rectangle that surrounds the ellipse). If you hold down the **Alt** key the mouse cursor will become the center of a rectangle or ellipse.
3. Press the left mouse button and drag the mouse to define the rectangle (or ellipse).
4. Hold down the **Shift** key to draw a square or a circle.
5. Release the button to finish creating the rectangle (ellipse).

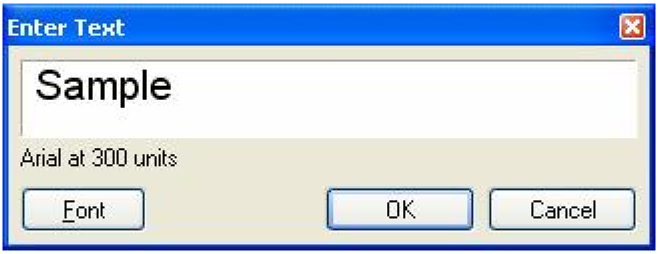
Text Tool

With the Text tool you can add text to a glyph. Carefully select the color mode when planning to use the text tool. It is usually best to use the "Empty" color because in that mode the text stroke will not interact with the existing contour and you will be able to adjust its position using the Edit tool or the Free Transform operation.

Select the **Automatic Activation of Transform Operation** option in the Paint Options dialog box. With this option on the Free Transform operation will be activated immediately after entering the text string, allowing you to modify its size or position.

To enter a string of text:

1. Select the Text tool T in the Paint toolbar.
2. Position the mouse cursor (with the crosshair and the "suggested rectangle" of the future string) on the place in the editing field where you want to add the string.
3. Click the left mouse button.
4. In the dialog box, enter the character string. Use the **Font** button to select the font that will be used.



Enter Text

Sample

Arial at 300 units

Below the sample string you will see the name of the current font and the size of the text string. The size is presented in font units. You can change the string size in the Font dialog box. The size of the placed text will be 10 times the selected point size. For instance, if you select a 24 pt. font you will get a string that will be 240 units in height.

5. Press **OK** to enter the string or **Cancel** to abort this operation.

Selections

Many operations can be applied not only to single nodes or segments but also to several nodes together. For example, you may want to move many nodes or delete part of a contour. First, select the nodes that you want to process.

To select nodes with the selection rectangle:

1. Make sure that the Edit tool is active.
2. Press the left mouse button anywhere in the empty area and drag the mouse to surround the nodes with a rectangle. Hold down the **Shift** key to reverse the selection state of the nodes.

To select or deselect individual nodes just shift-click them.

To select the contour segment (line or curve) – shift click on it.

To select the whole contour double click the contour (not the node) with the left mouse button or press the **Ctrl** key and click anywhere on the empty area close to the contour. Hold down the **Shift** key to reverse the selection state of the contour's nodes.

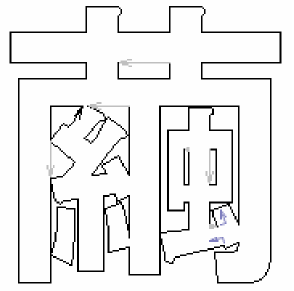
To select all the contours in a glyph use the **Edit > Select all** command.

To deselect all nodes click the left mouse button somewhere in the free space of the editing field or use the **Edit > Deselect** command.

To reverse the selection state of all nodes in the glyph use the **Edit > Invert Selection** command.

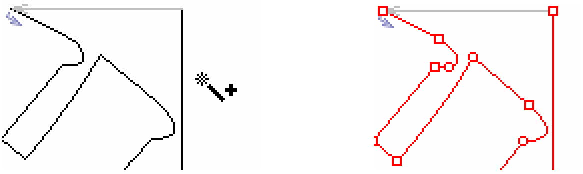
Using the Magic Wand Tool

With the **Magic Wand** you can easily and precisely select contours. It is especially useful when you are working with glyphs that have many contours, such as Far-Eastern ideographs:

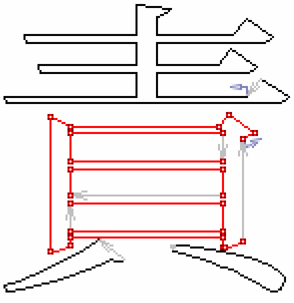


To select the contour with the Magic Wand tool just activate the tool (press "4" on the keyboard) and click anywhere near the contour. You don't need to be precise – FontLab Studio will automatically locate the closest contour.

To reverse the selection state of the contour, hold down the **SHIFT** key and click anywhere near it:



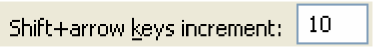
You can also select a contour and all contours that are inside it. Just hold the **ALT** key when you using the Magic Wand tool:



Moving the Selection

You can move the selected part of the contour by mouse – drag any selected part of the contour or use the arrow keys. If you press the arrow key then the selection will move in that direction by one font unit. Hold down **Shift** or **Ctrl** while pressing the arrow keys to accelerate the movement of the selection.

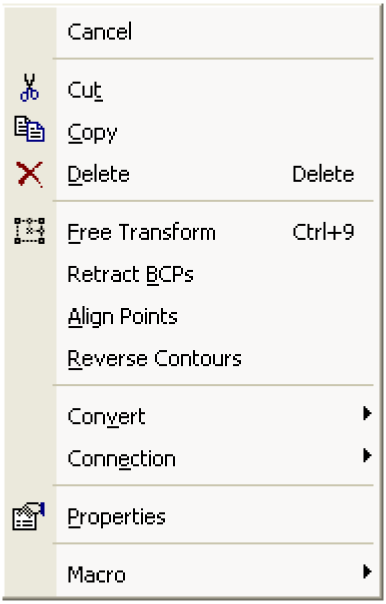
You can change the value of **Shift** -arrow increments on the Glyph Window > Dimensions page of the Options dialog box:



Shift+arrow keys increment: 10

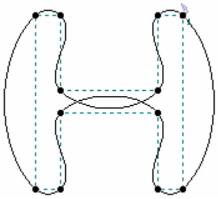
Selection Commands

When a part of the glyph is selected, right-click it to get access to the popup menu:

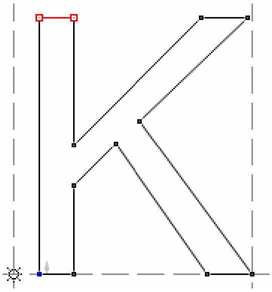


Some commands are just copies of the **Edit** menu commands, but others are much more interesting:

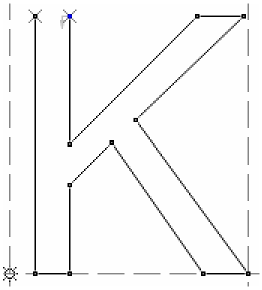
Cut	Copies the selection to the Clipboard and removes it
Copy	Copies the selection to the Clipboard and leaves original untouched
Delete	Removes the selection
Free Transform	Activates the Free Transform operation
Retract BCPs	Removes the control vectors of the selected nodes, making them sharp
Align Points	Aligns the selected nodes vertically or horizontally
Reverse Contours	Reverses the contour's direction
Convert	Converts all selected segments to lines, Bezier curves or off-curve points

Connection	Changes the connection mode of the selected nodes. If the mode is changed to smooth, all connections are forced to be smooth: 
Properties	Opens the Selection properties panel.

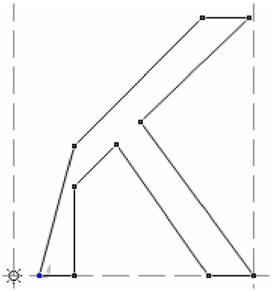
There are some differences between the **Cut** and **Delete** commands. First of all **Delete** doesn't put anything on the Clipboard. But the main difference is that the **Delete** command removes nodes with their adjacent curves:



Selection



*Result of **Cut***

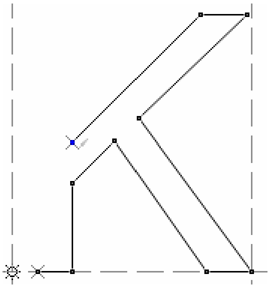


*Result of **Delete***

If you switch on the option

□ Edit/Delete command breaks contour

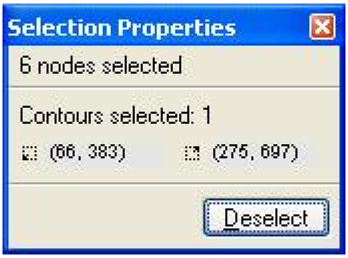
on the Glyph Window page of the Options dialog box the result of the **Delete** command will be the following:



Selection Properties Panel

To make the Selection Properties panel visible, choose the **Properties** command in the selection context popup menu or use the **Option-Return** keyboard shortcut.

The Selection Properties panel is very simple:



Selection Properties

6 nodes selected

Contours selected: 1

(66, 383) (275, 697)

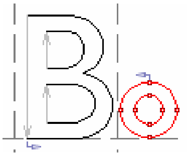
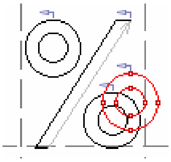
It contains the following information about the selection: the number of selected nodes, the number of selected contours, and the selection bounding box's bottom-left and top-right corner coordinates.

You can click on the **Deselect** button to discard the selection and get the Glyph Properties panel instead.

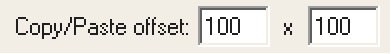
Copying the Selection

Sometimes you need to copy glyphs or parts of glyphs to another place in the font or even into a different font. With FontLab Studio you can put any part of a glyph or an entire glyph (with hints, guides, etc.) into the Windows Clipboard and paste it into a different place.

To copy parts of the glyph's outline use the commands from the **Edit** menu or the buttons on the Standard toolbar:

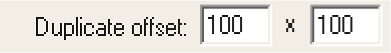
Cut	To copy a selected part of the glyph onto the Clipboard and delete it from the glyph
Copy	To copy a selected part of the glyph onto the Clipboard
Paste	To add a contour part copied to the Clipboard into the current glyph as a new contour 
Insert	To replace the current selection with the Clipboard contents
Delete	To remove the selected part of a glyph's contour
Duplicate	To insert a copy of the selection into the current glyph as a new contour 

When you use the **Paste** command, the selection is pasted without offset from the original location. If needed you can set the amount of shift in the Options > Glyph Window > Dimensions dialog box (**Tools > Options** command):



Copy/Paste offset: 100 x 100

On the same page you can adjust the amount of shift during the Duplicate operation:



Duplicate offset: 100 x 100

Because the Clipboard is used as a buffer for copying contours you can paste glyphs and their parts not only to the current font but also to any glyph of any font of any application that is compatible with FontLab Studio (ScanFont 3.0, for example).

Transforming the Selection

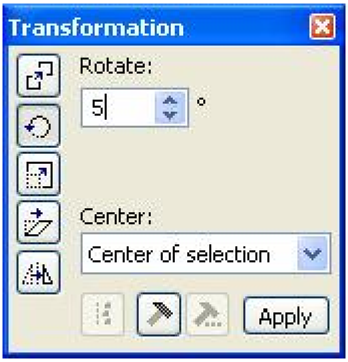
Sometimes you need to scale, rotate or slant a whole or part of a glyph outline. In FontLab Studio you can do this using several methods:

1. Using the Transformation panel
2. Using the Transform tools
3. Using the Free Transform operation

✎ **Note:** To avoid naming confusions, former Tools > Transform and Tools > Transform Range features have been renamed to Action and Action Sets, respectively. Starting from FontLab Studio 5, the user interface uses the terms Transform and Transformation to refer to geometric transformations such as rotation or scaling that can be applied to glyph outlines. Actions refer to operations that may affect outlines but also other font elements such as metrics or hints.

Using the Transformation Panel

The Transformation panel allows you to apply several simple transformations to the selected area or to the whole glyph. To open the Transformation panel you can select a **Transformation** command in the **Window > Panels** menu:



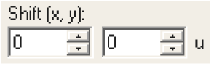
Rotate: 5 °

Center: Center of selection

To transform the glyph or the selected area:

Select the type of the transformation by clicking on one of the buttons in the left and the transformation options in the right area:

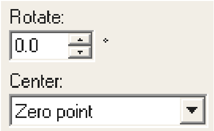
Shift



Shift (x, y): 0 0 u

Enter a distance to move the selection in font units

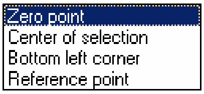
Rotate



Rotate: 0.0 °

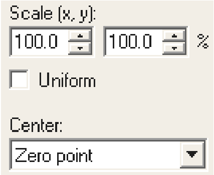
Center: Zero point

Enter the rotation angle (degrees, counterclockwise) and select a center of rotation:



Zero point
Center of selection
Bottom left corner
Reference point

Scale



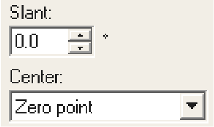
Scale (x, y): 100.0 100.0 %

□ Uniform

Center: Zero point

Enter the scaling factor and select a center point of transformation. Use the Uniform option to scale proportionally

Slant

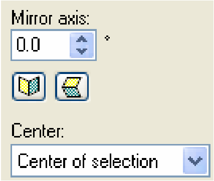


Slant: 0.0 °

Center: Zero point

Enter the slant angle (degrees, positive value slants to the right) and select a center point

Mirror



Mirror axis: 0.0 °

Center: Center of selection

Enter the direction of the mirror axis and select the center point of the transformation. Use the buttons to mirror horizontally or vertically quickly.

Press the **Apply** button or ENTER key to apply the transformation to the selected area.

Pressing the button will align all selected nodes horizontally or vertically.

If you press the button the Actions dialog box will open (see the “Actions” chapter below). Pressing this button is the same as cho0sing the **Tools > Action** command. If you press the button the previous transformation action will be repeated. It is the same as choosing the **Tools > Repeat Action** command.

Using Transform Tools

In the Edit mode you have access to three transform tools (in the Tools toolbar):

	Rotate	Rotates the contour
	Scale	Scales the contour
	Slant	Slants the contour vertically or horizontally.

To transform the outline:

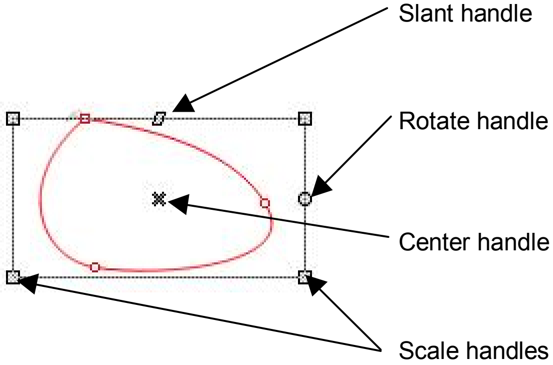
1. Select part of the outline you want to transform or undo all selections to transform the entire glyph outline.
2. Activate one of the transform tools.
3. Position the mouse cursor at the center of transformation, press the left button and drag the mouse to make the transformation. Remember that you can press the ‘``’ key (the key under ESC) at any time to get a high-quality preview of the transformed glyph.
4. Use the SHIFT and CTRL keys to constrain the transformation.
5. Release the mouse button to complete the transformation of the outline.

Using the Free Transform Operation

To activate the Free Transform operation select the **Free Transform** command from the **Contour > Transform** menu or click on the ⬚ button in the Tools toolbar.

Or you can double-click on any selected (red) segment to activate the **Free Transform** operation.

When this operation is activated, you will see a transformation rectangle surrounding the selected area. If nothing is selected, the entire glyph will be subject to transformation.



So, what do all these handles mean, and how can they be used?

To move a selection:

1. Position the mouse cursor somewhere inside the transformation rectangle but not on the center handle.
2. Press the left mouse button and drag the rectangle to its new place.
3. Release the button. The selection will be moved.

To scale or skew a selection:

1. Position the mouse cursor on one of the scale handles ▨.
2. Press the left button and drag the mouse. You will see that the transformation rectangle is scaled. Hold down the **Shift** key on the keyboard to constrain the scale proportionally.
3. Release the button when you are done. The selection will be modified.

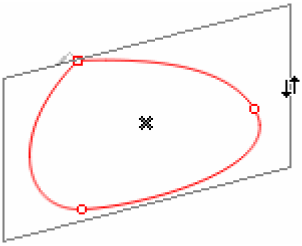
To rotate a selection:

1. Move the mouse cursor onto the rotation handle ◎.
2. Press the left mouse button and drag the mouse. The transformation rectangle will rotate around its center. Hold down the **Shift** key to constrain the rotation angle to 15-degree increments. You can also use the rotation handle for slant – just press the **Ctrl** key to alternate between rotate or slant.
3. Release the button to accept the rotation.

To move the center of rotation just drag the center handle ✖ by the mouse to its new position.

To slant a selection:

1. Move the mouse cursor onto the slant handle ▱.
2. Press the left mouse button and drag the mouse. The transformation rectangle will be slanted. Hold down the **Shift** key to constrain the slant angle to 15-degree increments. You can also use the slant handle for rotation – just press the **Ctrl** key to alternate between rotate or slant.
3. To slant in vertical direction, hold the **Ctrl** key and drag the rotate handle:



4. Release the button to accept the slanting.

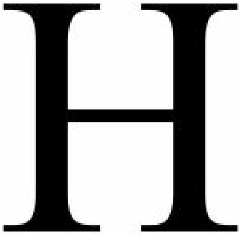
Double-click in the editing field or press **Enter** to accept the completed transformation or press the **Esc** key to reject it.

You can use the arrow keys while the Free Transform operation is active to move the selection by one font unit in the direction of the key you clicked. **Shift**+arrow keys move the selection by 10 font units at each key click. **Ctrl**+arrow keys move the selection by 100 font units at each key click.

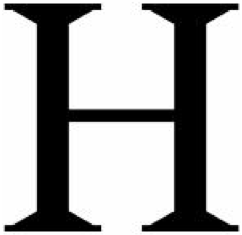
Find and Replace Outline Operation

In FontLab Studio you can perform a unique outline find/replace operation that allows you to replace an identical part of an outline that occurs in many glyphs with an alternative form. It is also very useful in analysing an outline for correctness.

Here is a typical situation where you could use the **Edit** > **Find Outline** command:



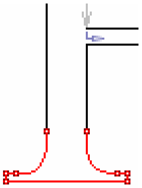
Original glyph



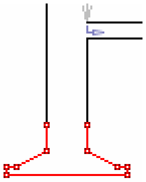
Modification

It is relatively easy to make the change above in a single glyph, but what if you want to do the same thing in all glyphs of the same font that have serifs?

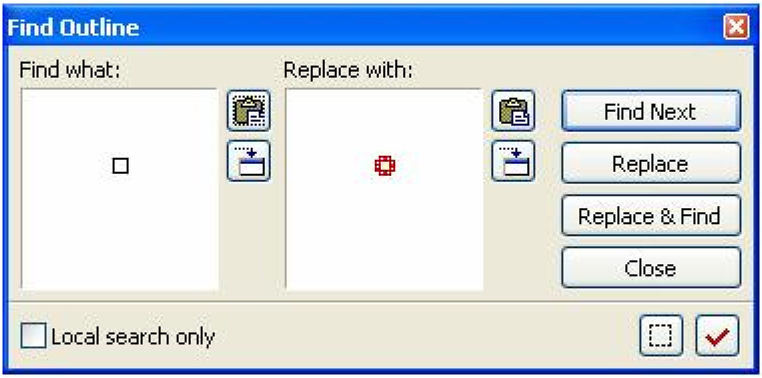
1. Select the element that you want to find:



2. Copy the selection to the Clipboard with the **Edit > Copy** command.
3. Modify the original shape as needed and select the new version of the serif:



4. Using the **Edit** > **Find Outline** command open the Find Outline dialog box:



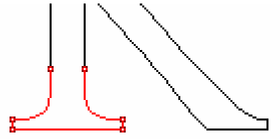
The left panel shows the outline that FontLab Studio will look for and the right pane shows the outline it will use as the replacement.

The two buttons to the right of each pane mean:

📋	Place the Clipboard contents into the pane
▣	Place the current selection into the pane.

In our sample you need to place the Clipboard contents (original outline) into the left pane (click on the 📋 button) and the selection into the right pane (▣) button.

5. Click the **Find Next** button to find the next appearance of the source outline in one of the glyphs. The first such glyph located will appear in the Glyph Window and the outline that is found will be selected:



6. Click **Replace** to replace the old outline with the new one or click **Replace & Find** to replace and find the next location of the outline.

7. Check □ Local search only to limit the search area to the current glyph only. If this option is unchecked, FontLab Studio will look for the outline in all glyphs of the font.

Use the buttons at the bottom of the dialog box for additional features:

⬚ to select all glyphs with the found outline in the Font window

✓ to mark all glyphs with the found outline in the Font window in red.

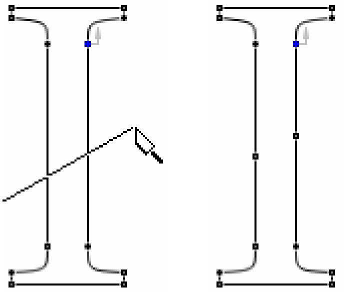
Using these buttons doesn't replace contours, but only finds glyphs.

Building an Outline from Blocks

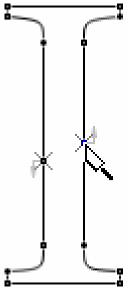
Now you know how to select parts of an outline and copy it, so let's do a few experiments to show how to use this knowledge.

Suppose that we have an 'I' character and we want to create an 'H' character.

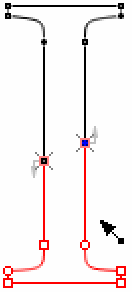
1. Open the 'I' in the Glyph Window (double-click the 'I' cell in the Font Window, use the Glyphs Bar in the Glyph Window toolbar or just browse the font with the arrow buttons).
2. Cut the character in the middle. Activate the Knife tool, press the left mouse button at the left of the character, hold the ALT key on the keyboard and drag the mouse cursor to the right to define a cutting line. Release the mouse button:



3. Click on each inserted node to break the contour:



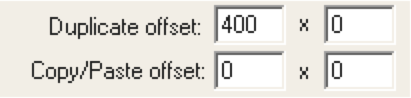
4. Select the bottom half of the ‘I’. Temporarily activate the Edit tool (click on the Ctrl key on the keyboard) and Ctrl-click near the bottom area of the glyph:



5. Copy it to the Clipboard with the **Edit > Copy** command.

6. Go to the ‘H’ character. Use the **Glyph > Create Glyphs** command to remove the contents of all editing layers.

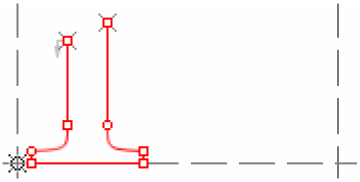
7. Open the **Options > Glyph Window > Dimensions** dialog box and set the **Copy > Paste offset** to zero and **Duplicate offset** to 400 x 0:



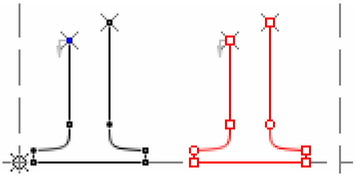
Duplicate offset: 400 x 0

Copy/Paste offset: 0 x 0

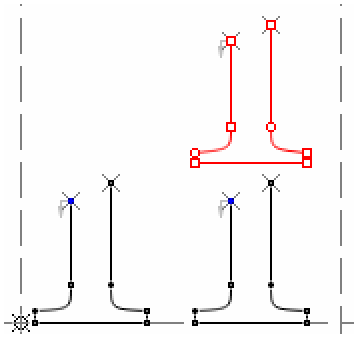
8. Click **OK** to close the Options dialog box and use the **Edit > Paste** command to place a copy of the ‘I’ bottom:



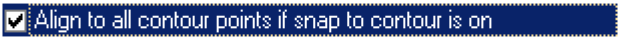
9. Use the **Edit > Duplicate** command to make a second copy:



10. Duplicate it again and drag it to a place above the first segment:

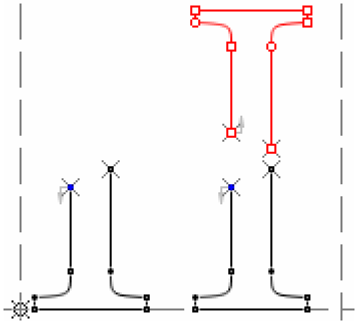


Use the contour snap function to position the segment. Activate the contour snap with the **View > Snap to Layers > Outline**. We also recommend that you activate the feature that will snap a point which you are moving to all outline nodes, by X and Y direction independently. Use the **Tools > Options > Glyph Window** dialog box:

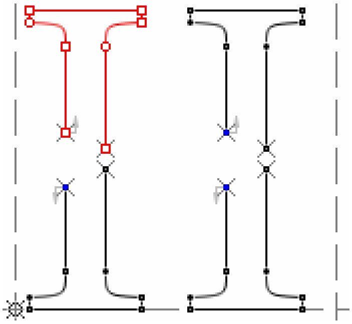


☑ Align to all contour points if snap to contour is on

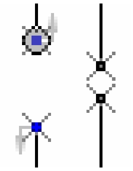
11. Use the **Contour > Transform > Flip Vertical** command to flip the selected segment:



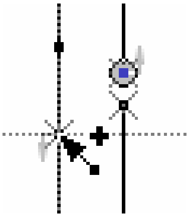
12. Duplicate the top segment and locate the copy above the bottom-right segment.



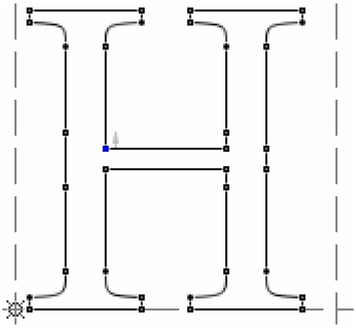
13. Left-click on an empty area of the Glyph window:



14. Activate the **Add Corner** tool click somewhere and drag the line to connect the left line of the top-left and bottom-left segments:



15. Then click on any other starting or ending node of the contour segments and use the **Add Corner** tool to connect them



You'll notice it takes more time to read the instructions than to actually perform the procedure.

Contour-related Commands

You can find the commands described below in the **Contour** menu:

Flip Horizontal	Makes a mirror transformation in the horizontal direction. This operation is applicable to a selection or to a whole outline if nothing is selected
Flip Vertical	Makes a mirror transformation in the vertical direction. This operation is applicable to a selection or to a whole outline if nothing is selected
Merge Contours	Combines all overlapping parts of the outline. This operation and the two following operations are applied to all contours that have at least one node selected. If nothing is selected, they will be applied to the whole glyph
Get Intersection	Leaves only areas that are covered by at least two contours
Delete Intersection	Removes all areas that are covered by more than one contour
Set PS Direction	Sets the direction of all curves to PostScript curves (black on the left)
Set TT Direction	Sets the direction of all curves to TrueType curves (black on the right)
Reverse All Paths	Reverses the direction of all contours of the glyph
Expand Path	Converts contours to strokes
Make Parallel Path	Creates a contour that is parallel to the existing contour. See the next section for more information about this and previous features
Set Startpoints	Opens the dialog allowing you to set the preferred position of the startpoints
Curves to TrueType	Converts all Type 1 (3^{rd}-order) curves to TrueType (2^{nd}-order) curves
Curves to PostScript	Converts all TrueType (2^{nd}-order) curves to Type 1 (3^{rd}-order) curves
Selection to Component	Creates a new glyph from the selection and converts the selection into a component. Current glyph becomes a composite glyph
Correct Connections	Analyses an outline and fixes the types of connections between outline segments (lines and curves)
Join Broken Contours	Automatically joins all "broken" contours in a glyph. This command may not work if the nodes that should be connected are not close enough to each other

	Close Open Contours	Closes all open contours in a glyph creating a straight segment between first and last nodes
	Nodes at extremes	Automatically inserts nodes at the extreme points of curves. We highly recommend that all curves have nodes at their extreme points
	Optimize	Optimizes the outline
	Align to Guides	Move all nodes on to guidelines, hints or grid if they are sufficiently close to them. This command will “snap” nodes only to the guiding layers that are currently visible.

Most of these commands can be applied to many glyphs at a time if you select a number of glyphs in the Font Window. Commands marked with the » sign in the **Contour** menu are tools and were not included in the table above.

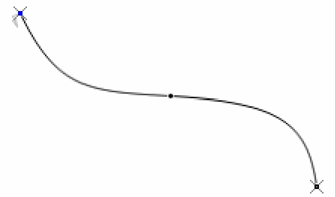
Creating Contours

FontLab Studio has two commands that can help you automatically create contours. These commands are **Expand Path** and **Make Parallel Path**.

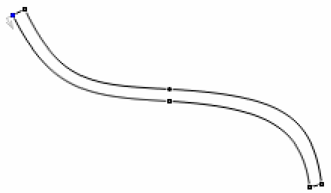
Both commands will take one or more existing contours and create new ones using some options.

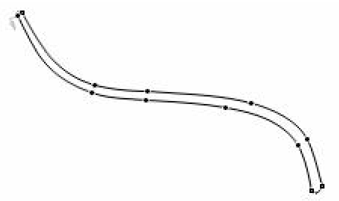
Expand Path

This command will use contours as a trajectory for parallel contours or for the paintbrush:



Source open contour



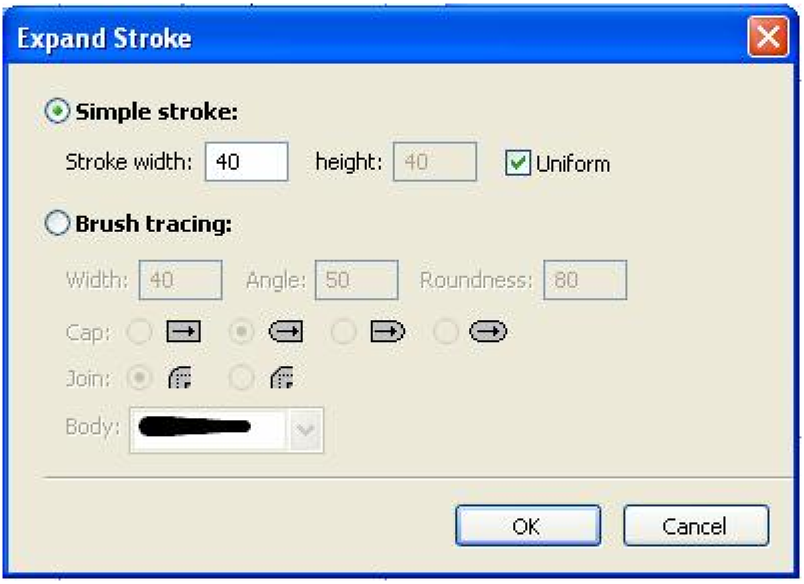


Path is expanded with parallel contour

Path is expanded with the shaped brush

To use this operation first select the contours to which you want it to apply. All contours that have at least one node selected will be processed. If nothing is selected, the whole glyph contour will be taken.

Select the **Contour > Paths > Expand Path** command in the menu. You will see a dialog box that lets you select options:



Expand Stroke

● Simple stroke:

Stroke width: 40 height: 40 ☑ Uniform

○ Brush tracing:

Width: 40 Angle: 50 Roundness: 80

Cap: ○ ● ○ ○

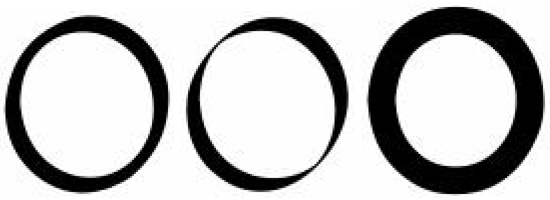
Join: ● ○

Body:

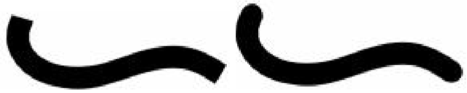
First choose between **Simple Stroke** and **Brush Tracing**.

In the first case you may just set the **Width** and the **Height** of the stroke. The resulting contours will be closed anyway.

In the latter case you may specify brush size and shape. **Width** is the width of the brush ellipse at its widest part. **Angle** is the degree of the brush ellipse slant and **Roundness** is the relation (in percent) of the narrow and wide widths of the brush ellipse. Below is a sample of the path expand with different brushes:

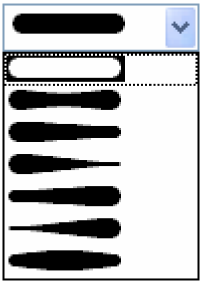


The next line of options specifies the way the expanding algorithm will process the contour corners and the ends of an open contour:

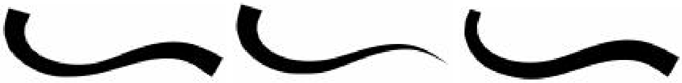


Flat contour ends vs. round ends

The last option lets you specify the shape of the brush stroke:



This is the sample of the stroke above with different brush shapes:

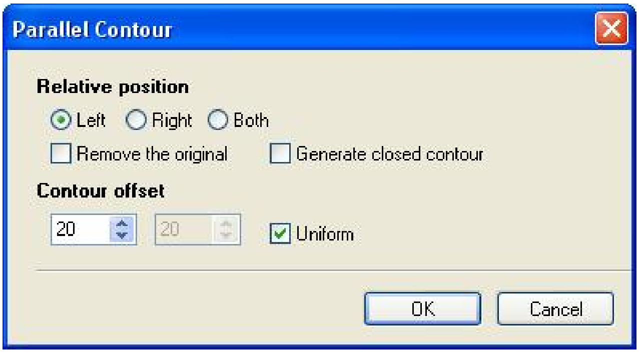


When you finish selecting options, click **OK** to expand the selected contours.

Make Parallel Path

With this operation you can create a path that is parallel to any existing path. The method of selecting contours for processing is simple: all contours that have at least one node selected will be taken into account. If no nodes are selected, the whole glyph outline is processed.

Select the contours that you want to process and choose the **Contour > Paths > Make Parallel Path** command from the menu. You will see a dialog box for specifying the options of the command:



Parallel Contour

Relative position

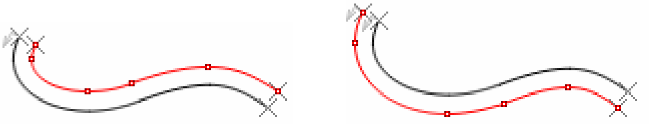
● Left ○ Right ○ Both

☐ Remove the original ☐ Generate closed contour

Contour offset

20 20 ☑ Uniform

The relative position section lets you specify the side of the original path at which the new path will be created:



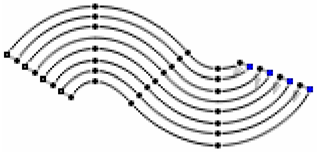
Left and right side option (original path is not selected)

The side depends on the direction of the original path. Select the **Both** option to generate parallel contours on each side of the source contour.

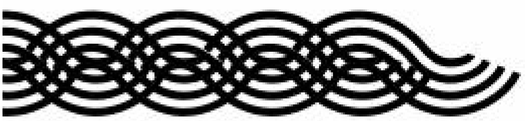
Contour offset defines the distance at which the new path will be created. Use the **Uniform** option to have the same distance set for X and Y directions.

Check the **Remove the original** check box to remove the source contours and keep only the generated parallel paths. Check the **Generate closed contour** check box to create contours automatically closed. This feature is available only if the **Both** option is selected.

Below is a sample of what you can do with the parallel path feature and contour-editing tools:



Glyph contour after multiple parallel paths created and then closed with the Add corner tool



Rendering of the glyphs above

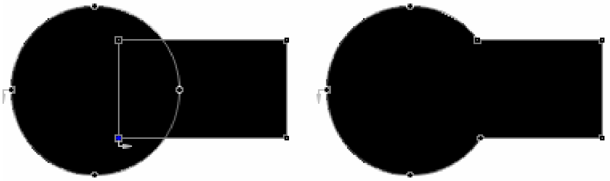
As you can see, with the “Make parallel path” feature you can create complex ornaments in minutes.

Merging and Intersecting Contours

With the **Merge Contours**, **Get Intersection** and **Delete Intersection** commands, which are available in the **Contour > Transform** menu, you can perform very interesting operations on contours.

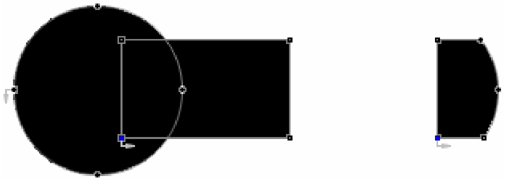
All three operations are applied to contours that have at least one node selected or to the whole glyph outline if nothing is selected.

The **Merge Contours** command combines contours, removing all outline overlapping and keeping the filled result unchanged:



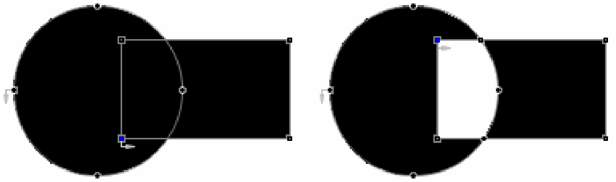
The **Merge Contours** command is the outline equivalent of the Boolean "OR" operation.

The **Get Intersection** command will keep only the area of intersection, removing all other parts:



This command is the outline equivalent of the Boolean "AND" operation.

The last command, the **Delete Intersection** works in the opposite manner of the Get intersection command, keeping only those areas of contours that don't overlap:



This is the outline equivalent of the Boolean "XOR" operation.

✐ **Note**: You can select multiple glyphs, or all glyphs, in the Font Window and apply the commands to many glyphs at a time. You can also use **Actions** or **Action Sets** to apply the "Remove overlap" command in batch mode.

Converting Contours

Several commands in the **Contour** menu are used to change contours' attributes.

Sometimes, you may find that e.g. the interior counter of "o" is black instead of white/transparent, or two overlapping contours create a white intersection. This means that one of the contours in your glyphs has a wrong direction.

FontLab Studio can detect such problems and automatically correct the contour direction for PostScript (Type 1/Bezier) or TrueType outlines. For that, use the **Set PS Direction** (for Type 1 or OpenType PS contours) or **Set TT Direction** (for TrueType / OpenType TT contours) commands in the **Contour > Paths** menu. These commands will reverse some of the contours so that all contours have the contour direction prescribed by the font format.

To reverse *all* contours in the glyph, i.e. change the direction of every contour in the glyph to the opposite, use the **Reverse All Paths** command in the **Contour > Paths** menu.

Use the **Curves to PostScript** and **Curves to TrueType** commands in the **Contour > Convert** menu to convert glyph's outline to 3rd-order curves or 2nd-order curves respectively. These commands only convert curves but do not change their direction so you may need to use the **Set PS Direction** and **Set TT Direction** commands later.

✐ **Note**: You can select multiple glyphs, or all glyphs, in the Font Window and apply the commands to many glyphs at a time. You can also use **Actions** or **Action Sets** to apply the commands in batch mode.

Outline Optimization

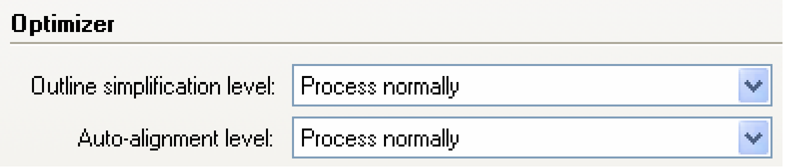
With the **Optimize** command FontLab Studio tries to automatically adjust the outline to remove unnecessary elements and correct others.

To perform optimization, use the **Optimize** command in the **Contour** menu.

Optimization does three things:

1. Removes unnecessary curve and line segments
2. Aligns vertical and horizontal lines that are not precisely directed.
3. Corrects the connection types of lines and curves.

You can control the optimize features with the Font Audit section of the Options dialog box:



Optimizer

Outline simplification level: Process normally

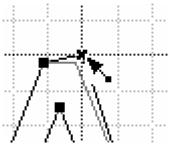
Auto-alignment level: Process normally

Outline Simplification level	Controls curve removal feature, from “do not simplify outline” to “extreme”. The bigger value you choose – the more curves FontLab Studio will try to remove
Auto-alignment level	Controls auto-alignment feature in a range from “do not align” to “extreme”.

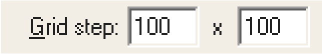
✎ **Note**: You can select multiple glyphs, or all glyphs, in the Font Window and apply the command to many glyphs at a time. You can also use **Actions** or **Action Sets** to apply the command in batch mode.

Grid Layer

This layer is very simple: if the Grid is on, you will see a grid of vertical and horizontal lines in the edit Window. If **View > Layers > Snap to Layers > Grid** is enabled (which it is by default) any node that you move will snap to the gridlines.



You can adjust the grid frequency on the Glyph Window > Dimensions page of the Options dialog box (Tools > Options):

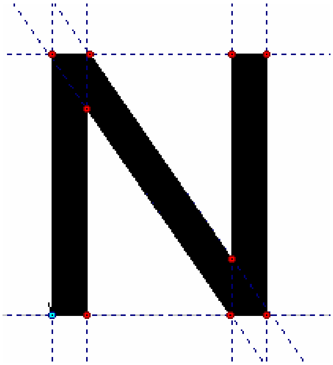


Grid step: 100 x 100

Guidelines Layer

Guidelines are straight lines that are used to guide the drawing of specific elements of a glyph. Guidelines can be vertical, horizontal or slanted.

Guidelines can be slanted at any angle from -45 to +45 from the vertical or horizontal direction. Slanted guidelines can help to mark *italic* characters, or specific slanted elements in normal characters, like the inner bar in the letter 'N'.



You can see little numbers giving the position and slanting angle of each guideline near the edges of the editing field of the Glyph Window where the guidelines cross the rulers.

There are *local* and *global* guidelines. Local guidelines appear only in the glyph where they were set. Global guidelines appear in all glyphs of the font. Global guidelines are very useful to mark important levels in the font (by using horizontal global guidelines) or to set the base direction of an italic or oblique font (using slanted guidelines).

Editing Guidelines

Be sure that the Edit tool is active and the guidelines layer is visible – use the **View > Show Layers > Guidelines** command to switch it on. Note that the Guidelines layer will automatically switch on if you add a new guideline.

To add a new local guideline:

1. Position the mouse cursor on the horizontal ruler bar (for a horizontal guideline) or on the vertical bar (for a vertical guideline).
2. Press the left mouse button. The bar will appear "pressed" and the new guideline will appear.
3. Holding the left mouse button down, drag the guideline to the desired place and release the button.

To add a new global guideline:

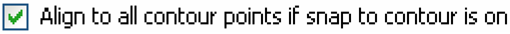
1. Create a local guideline as described above.
2. Position the cursor on the guideline and click the right mouse button.
3. In the menu, select the **Convert to Global** command.

To move the guideline:

1. Move the mouse cursor onto the guideline that you want to move. Be sure that no other objects (such as nodes or hints) are near the cursor.
2. Press the left mouse button and drag the guideline to the new place.

While you are dragging the guideline and the mouse cursor is within the snap-to distance the guideline will stick to the node. Nodes must be visible.

The guideline will snap to all nodes regardless of the mouse cursor position if the option **View > Snap to > Outline** is on and the following checkbox on the Glyph Window page of the Options dialog box is also switched on:



☑ Align to all contour points if snap to contour is on

To slant the guideline:

1. Move the cursor onto the guideline near one of the sides of the editing field of the Glyph Window.
2. Press the left mouse button. The mouse cursor will change to a pair of curved arrows that shows you the guideline slant direction.

3. Moving the mouse, slant the guideline to the angle that you want. Hold down the SHIFT key to constrain the slanting angle to 3-degree increments.

To remove the guideline:

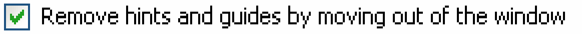
I.1. Start moving or slanting the guideline.

I.2. While holding down the left mouse button, click the right mouse button.

II.1. Position the cursor on the guideline and click the right mouse button.

II.2. In the menu, select the **Delete** command.

You can use this option:



☑ Remove hints and guides by moving out of the window

located on the **Glyph Window** page of the **Options** dialog box, to remove any guideline or hint by simply dragging it from the editing field of the Glyph Window.

To remove all guidelines use the **Remove guidelines** command in the **Tools > Hints & Guides** menu. Options of this command include:

Both	to remove all guidelines
Vertical	to remove only vertical guidelines
Horizontal	to remove only horizontal guidelines.

The same command is available in the rulers popup menu that appears if you right-click the vertical or horizontal ruler.

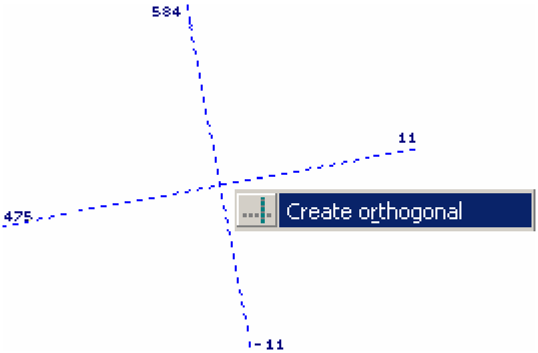
Guidelines Popup Menu

More commands are available in the guideline's popup menu.

There are two different guideline popup menus - one for local and one for global guidelines. Both menus include **Align**, **Delete** and **Properties** commands. The **Properties** command, as usual, will open the Property panel for the active guideline. The **Delete** command will remove the active guideline. The **Align** command is available only for slanted guidelines and will align them to the vertical or horizontal axis (i.e. remove their slant and make them vertical or horizontal guidelines).

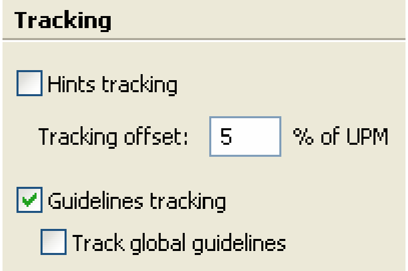
Global guidelines have an additional set of commands located in the **Guideline Is** submenu. By selecting the commands in this submenu you can set the font parameters: **Ascender**, **Descender**, **Caps Height**, **x Height** or **Visual Ascender** and **Descender** that are used to set 100% zoom in the Glyph Window. The **Create Local** command will create a new local guideline on top of the global one.

The local guideline menu has one additional command, **Create Orthogonal**, which you can use to create a guideline that is orthogonal to the current one:



Guidelines Tracking

There is a special feature that lets you modify an outline by moving guidelines. You switch this feature on in the **Glyph Window** page of the **Options** dialog box (choose the **Options** command in the **Tools** menu to open the dialog box):



Tracking

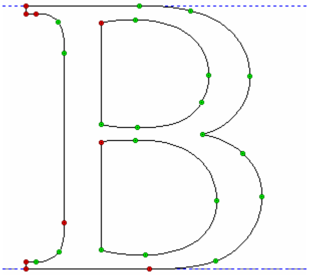
☐ Hints tracking

Tracking offset: 5 % of UPM

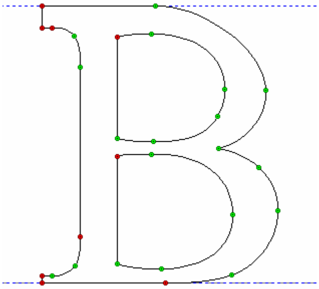
☑ Guidelines tracking

☐ Track global guidelines

When guidelines tracking is active and you move a guideline a distance not greater than the **Tracking offset** parameter all outline nodes that were on the guideline will be moved with it:



Original outline

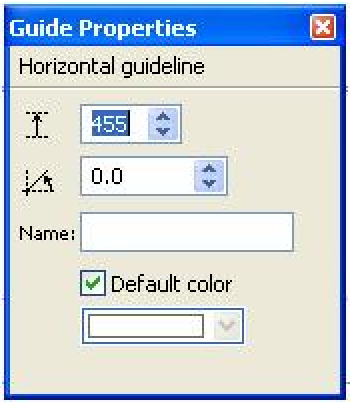


Same outline after topmost guideline moved up

If you move a global guideline and the **Track global guidelines** option is on, then all glyphs of the font that have nodes on this guideline will be modified. Be careful with this feature because the results of global guideline tracking are not undoable.

Guidelines Properties Panel

To open the guideline properties panel, CTRL+Click the guideline or right-click it and choose the **Properties** command from the popup menu:



Guide Properties

Horizontal guideline

455

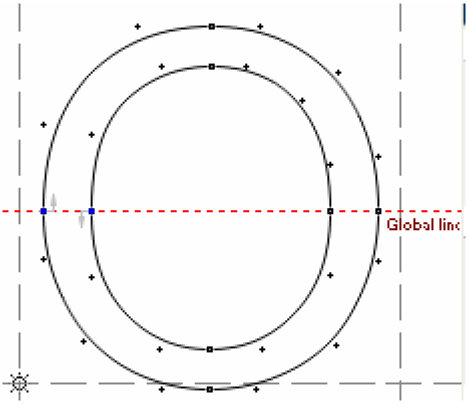
0.0

Name:

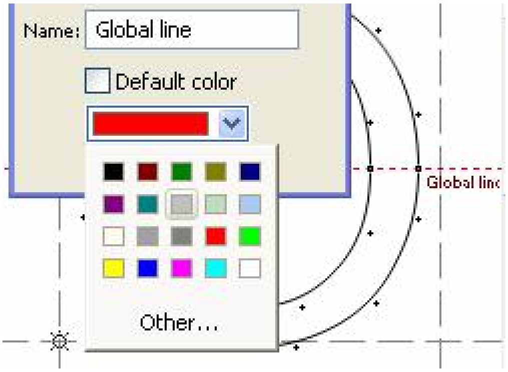
☑ Default color

In this properties panel you can change the position and slant angle of a guideline. You also can name the guideline (or global guideline) and change its color. This will help you to distinguish different guidelines.

To name the guideline, just enter some text in the **Name** field and press ENTER. The guideline will get a label:



To change the guideline color, click on **Default color** to switch it off and then select some color in the color palette:



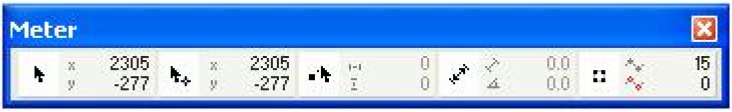
Guidelines' default colors are set on the **Options** > **Glyph Window** > **Colors** page.

Meter Mode

With this tool you can measure any distance and angle in your glyph. It is very useful if you want to create very precise, extremely high quality symbols.

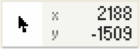
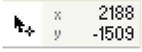
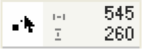
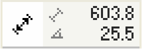
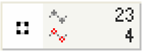
To measure distances between two points:

1. Select the **Meter** tool in the Tools toolbar. The **Meter** tool panel appears:



x 2305 y -277 | x 2305 y -277 | 0 0 | 0.0 0.0 | 15 0

This is a brief description of the fields on the Meter panel:

 x 2188 y -1509	Absolute position of the point (relative to the glyph zero point)
 x 2188 y -1509	Reference distance (relative to the position of the reference point)
 545 260	Horizontal and vertical distance (from the beginning to the end of the metering line)
 603.8 25.5	Geometric distance an angle of the metering line
 23 4	The total quantity of nodes and of selected nodes in the glyph.

Note that you can open the panel at any time if you click on the button in the bottom-left corner of the Glyph window. A second click on this button will close the panel.

2. Position the mouse cursor on your first point.

3. Press the left mouse button and drag the mouse to the second point. In the **Meter** panel you will see the vertical, horizontal and direct distance between two points and the angle of a vector that would theoretically connect these points. Hold down the **SHIFT** key while you drag the mouse to constrain the measurement to 15-degree increments.

You may dock the Meter panel to any edge of the Glyph Window.

While you are dragging the mouse you will see that the **Meter** tool arrow sticks to any object that it can find in the editing field.

To measure the distance from a contour:

1. Put the mouse cursor on the contour from which you want to measure.
2. Press the left mouse button and drag the mouse to what you want to measure to. Hold down the **SHIFT** key and the direction of the mouse's movement will be constrained to the normal direction of the contour startpoint.
3. When you're done, release the button.

Setting Guidelines, Anchors and Sidebearings

With the Meter tool you can not only measure angles and distances but also mark glyph elements with guidelines and anchors and set right and left sidebearings.

Press the right mouse button instead of the left one and measure the distance. When you release the button a popup menu appears.

Here is what you can do:

Add two guidelines	Two guidelines, vertical and horizontal, will be added. The point where they will be added depends on the option selected in the secondary menu: 100% means that the guidelines will be added at the end point of the measured distance. 50% means that the guidelines will be added in the middle of the measured line segment and 200% means that guidelines will be added at twice the measured distance
Add horizontal guideline	The same as above, but only a horizontal guideline will be added. This command with the 50% option can be very useful in finding the middle of a glyph element
Add vertical guideline	The same, but only a vertical guideline will be added
Add slanted guideline	A slanted guideline will be added along the meter tool's arrow. Note that the next guideline that you drag from the rulers will be parallel to this one
Set right sidebearing	Set the right sidebearing at the destination point
Set left sidebearing	Set the left sidebearing at the destination point. Set sidebearing commands are very useful when you need to set sidebearings at given distance from some glyph element
Add anchor	An anchor point is added at the destination endpoint of the meter line.

Mask Layer

When you need something more than guidelines or a grid to help with glyph editing you can use the *mask layer*. The mask layer is an outline that is created with the same segments as the glyph's outline. It appears in the Glyph Window as a dashed outline and the glyph's nodes "stick" to the mask. You can think of the mask as a "freeform" guideline.

The mask layer is very useful when you want to use one font as a template for another font. For example, you can put the sans-serif version of the typeface into the mask layer while you are working on the serif version in the outline layer.

Another application of the mask layer is the creation of Multiple Master fonts. In this case you put one style of the typeface in the mask layer, another style on the outline layer and, after defining the design axis, you can put one of the masters on the mask, using the mask's "snap" feature or some other techniques that will be discussed later.

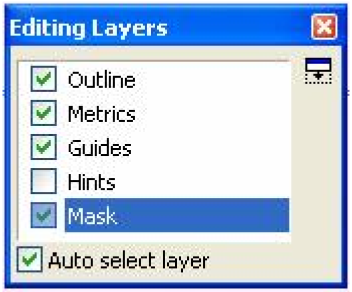
The mask layer can be filled in two ways: by copying the selected part of the outline to the mask layer or by using the **Assign Font Mask** command.

To copy the selected part of the outline to the Mask layer use the **Copy Outline to Mask** command in the **Tools > Mask** menu. If nothing is selected in the outline layer the entire glyph outline will be copied.

You can customize colors of the Mask layer background and outlines on the **Glyph Window > Colors** page of the **Options** dialog box described in the "FontLab Studio Options" section.

Editing Mask

To edit the mask layer with the usual editing tools you need to activate it with the Editing Layers panel:



Alternatively you can use the **Edit Mask** command in the **View > Show Layers** menu.

When the Mask layer is selected for editing, the outline layer will be shown as a mask and may be filled, if **Fill Outline** (preview) mode is active, so you can use it as a reference. The editing field changes its color to remind you are in the Mask layer. Use any tool of the Edit mode to create, edit or remove the nodes and contours of the Mask layer outline. (Re)Activate the Outline layer when you are finished working on the mask.

You can switch to the Mask layer and back to the Outline layer simply by double-clicking contours of the mask and outline. The editing field background color will change accordingly showing you whether you are in the mask-editing mode or not.

Mask Operations

All operations related to the Mask layer appear in the **Tools > Mask** menu:

Paste Mask to Outline

Adds the contents of the mask layer to the outline. The added part will be selected so you can start to work with it immediately.

Clear Mask

Clears the mask layer, removing all its contents.

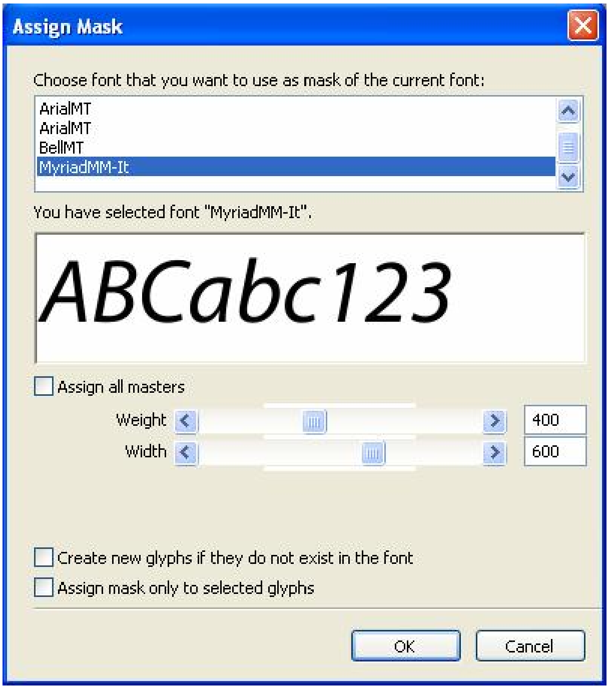
Swap Outline with Mask

Exchanges the Outline layer and the Mask layer.

Assigning a Mask

With this command you can take glyphs from one font and put them into the Mask layer of another font. The glyphs of the fonts are linked using their names, so the glyph with the name “zero” in the assigned font will be placed into the Mask layer of the glyph with the name “zero” in the font where the mask is being made.

When you select the **Assign Font Mask** command from the **Tools > Mask** menu, you will see the dialog box:



Assign Mask

Choose font that you want to use as mask of the current font:

- ArialMT
- ArialMT
- BellMT
- MyriadMM-It

You have selected font "MyriadMM-It".

ABCabc123

□ Assign all masters

Weight 400

Width 600

□ Create new glyphs if they do not exist in the font

□ Assign mask only to selected glyphs

There is a list of all open fonts in the top of the dialog box. Select the font whose glyphs you want to put into the Mask layer of the current font (it may be the same font). If you select a Multiple Master font scroll bars and edit controls will appear allowing you to select an intermediate design of the font.

If you switch on **Create new glyphs if they do not exist in the font** options, then FontLab Studio will create definitions for glyphs that are present in the “mask” font but absent in the current font. The newly defined glyphs will not have an outline but they will have a Mask layer that you can use as a template.

You can apply the operation only to the glyphs selected in the Font Window. Check the **Assign mask only to selected glyphs** option in this case.

Global Mask Layer

A global mask is a kind of mask that is font-wide and appears in all Glyph Windows.

Global Mask features and operations are very similar to those of a Mask: you can copy a selected part of any glyph to the Global Mask layer; copy a local mask to the Global Mask layer; paste the Global Mask layer to the outline layer or clean the Global Mask layer.

If the snap-to- global mask function **(View > Snap to Layers)** is on and the Global Mask layer is visible **(View > Show Layers),** all nodes in all glyphs will snap to the template.

Commands related to the Global Mask layer are concentrated in the **Tools > Mask** menu:

Copy Outline to Global Mask	Copies the selected area of the glyph outline (or the whole outline if nothing is selected) to the Global Mask layer
Copy Mask to Global Mask	Copies the Mask layer of the current glyph to the Global Mask layer. In other words, converts a local template into a global, font-wide template
Paste Global Mask to Mask	Copies the contents of the Global Mask layer to the Mask layer of the current glyph
Clear Global Mask	Clears the contents of the font Global Mask layer.

You can customize the color that is used to render the Global Mask layer using the Colors page accessible from the Tools > Options dialog box. Refer to the "FontLab Studio Options" section for description of this dialog box.

✎ **Note**: In previous versions of FontLab, this layer was called the Template layer.

Background Layer

When other methods are not adequate you can use a *background bitmap* template. A bitmap template is a black-white bitmap image that appears on the screen underneath all the other layers. You can use it as a template for a glyph outline (it is especially useful when working with the VectorPaint tools) and you can automatically convert it into an outline.

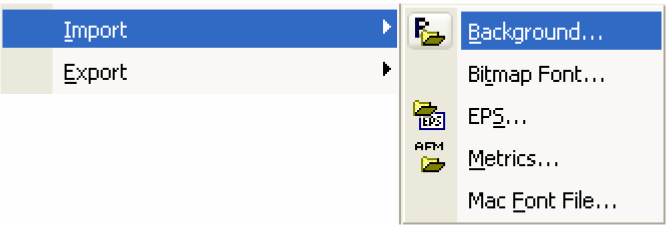
To see the background layer switch it on in the **View > Show Layers** menu.

Create a background layer using any of the three following methods:

1. Open a bitmap image file (in BMP or TIFF format).
2. Paste an image from the Clipboard.
3. Rasterize the current outline to make an image in the bitmap background layer.

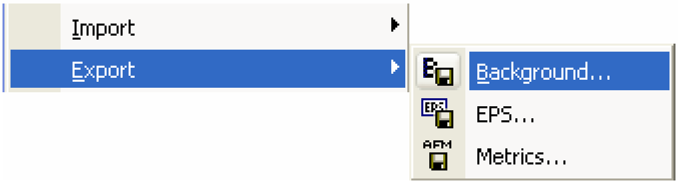
You can also copy the contents of the background to the clipboard to paste it into any Windows image-editing program; save it to the image file; and set its size and position on the screen.

To open a bitmap image, select the **Background** command from the **File > Import** menu:



You will see the standard Windows Open File dialog box where you can select the bitmap file that you want to put into the background layer. Use the format selection combo box to choose the format of the bitmap file. FontLab Studio supports two formats: BMP (standard Windows bitmap format) and TIFF (standard image interchange format). Bitmap files that you import into FontLab Studio must be black and white (line-art) images. Neither color nor grayscale images can be imported into FontLab Studio. Your image editing application can usually make this change.

To export a bitmap image, select the **Background** command from the **File > Export** menu:



You will see the standard Windows Save File dialog box where you can name the bitmap file that you want to save from the background layer. Use the format selection combo box to choose the format of the bitmap file. FontLab Studio supports two formats: BMP (standard Windows bitmap format) and TIFF (standard image interchange format). Select the destination for the file and click **Save**.

To copy a bitmap image from another Windows program into FontLab Studio, select the image in the program using its selection tools; copy the image onto the Clipboard (the image may be color, black-white or grayscale); switch to the FontLab Studio window; and select the **Paste** command from the **Edit** menu.

To rasterize a glyph's outline and make a background layer from it, select the **Create** command from the **Tools > Background** menu.

Below is a table containing all the commands from the **Background** menu related to background bitmap layer:

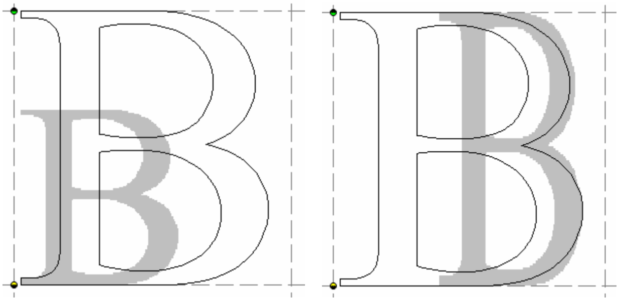
Create	Rasterizes the outline and makes a background layer
Copy	Copies the contents of the background layer to the Windows Clipboard. You can also use the Paste command from the Edit menu to paste the bitmap contents of the Clipboard to the background layer
Remove	Removes the contents of the background layer
Move and Scale	Activates the Bitmap Positioning operation described in the next section
Trace Pixels	Automatically traces the background layer on the pixel basis and adds the tracing results to the outline. This operation doesn't create curves but makes a pixel font outline: each pixel results in a square "staircase" element.
Trace	Automatically traces the background layer and adds the tracing results to the outline. You can customize the autotracing options on the **Trace Options** page of the Options dialog box described in the "FontLab Studio Options" section.

Note that if you apply the **File > Export > Background** command to the glyphs selected in the Font Window (when the Font Window is active), then the backgrounds of all selected glyphs will be saved using filenames that have the last two letters replaced by the sequential number of the glyph, starting from 0.

You can change the color which is used to render the bitmap background in the Glyph window on the Colors page of the Tools > Options dialog box described in the "FontLab Studio Options" section.

Background Positioning

This operation lets you set the size and position of the background layer:



Different sizes and positions of the bitmap background layer

To set size and position of the background layer:

1. Activate the Bitmap Positioning operation. Select the **Move and Scale** command from the **Tools > Background** menu or press the button on the Background toolbar or simply double click on the bitmap background while the Edit tool is active.
2. You will see a control box surrounding the bitmap.
3. Drag the handles in the corner of the control box to scale the background. Hold the **SHIFT** key to keep the proportions.
4. Position the mouse inside the control box and press the left mouse button and drag the mouse to position the background.
5. Use the arrow keys on the keyboard or **SHIFT**+arrow keys to move the background.
6. Press the right mouse button to open a popup menu with the following commands:

Fit to glyph	Aligns the Bitmap background so it will fit the glyph outline
Delete	Remove the contents of the background layer.

Press the **ENTER** key on the keyboard to finish positioning the background or the **ESC** key to cancel changes.

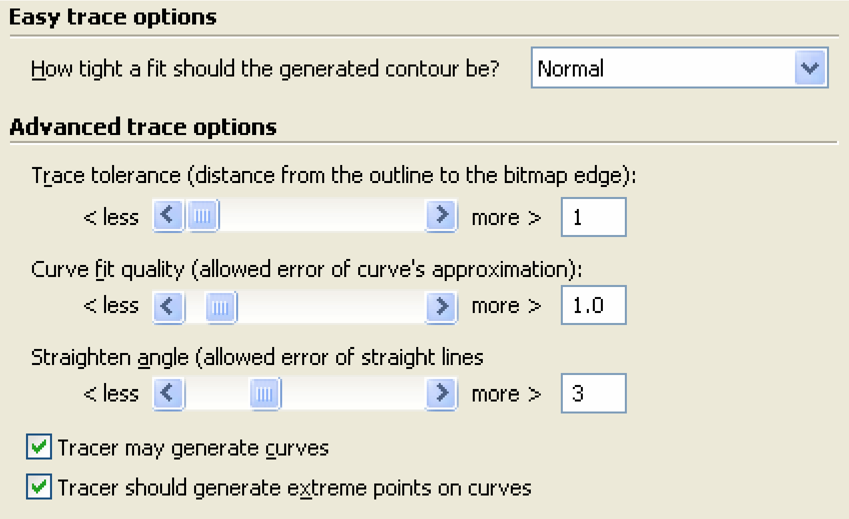
Tracing Background

In FontLab Studio you can easily trace background bitmap that is create contours from it and add to the glyph outline. There are two tracing commands in the **Tools > Background** menu: **Trace** and **Trace Pixels**. These commands stand for *smooth tracing* and *pixel tracing*.

Smooth Tracing

To trace bitmap and put the result in the glyph outline layer, select the **Trace** command in the **Tools > Background** menu. FontLab Studio will autotrace the image accordingly to the options set on the Trace Options page of the Options dialog box, place the result on the outline layer and select it so you can copy, move, transform the selection right after the tracing operation.

The smooth tracing algorithm is customizable:



Easy trace options

How tight a fit should the generated contour be? Normal

Advanced trace options

Trace tolerance (distance from the outline to the bitmap edge):

< less more > 1

Curve fit quality (allowed error of curve's approximation):

< less more > 1.0

Straighten angle (allowed error of straight lines

< less more > 3

☑ Tracer may generate curves

☑ Tracer should generate extreme points on curves

Easy Trace Options

In the **easy trace options** popup menu you can quickly select common predefined options, changing from **Very tight** to **Very loose**. When you select one of these easy options in the popup menu FontLab Studio will automatically adjust all the tracing parameters. The tighter the option you choose the more accurate the tracing will be. In other words, the outline will be closer to the original bitmap image. This is the first law of autotracing. The second law is that the tighter the option you choose the more nodes you will get on the outline. More nodes mean more time and larger font files.

Usually, the **Normal** option will be the best. If you find that the **Normal** autotracing option does not work for you, you can try the other tracing options listed in the popup menu.

Advanced Trace Options

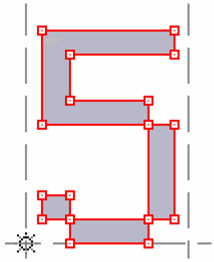
You can customize the autotracer parameters with the more detailed options in the advanced options section:

Trace tolerance	Allows you to change the distance between the generated outline and the edge of the original bitmap
Curve fit quality	Allows you to change the accuracy of curve fitting in the generated outline
Straighten angle	Defines the angle between two lines less than which the autotracer will replace several lines with one line
Tracer may generate curves	This option (active by default) allows the autotracer to generate curves
Tracer should generate extreme points on curves	This option (active by default) forces the autotracer to insert nodes at the extreme points of curves.

The algorithm of smooth tracing used by FontLab Studio is the same as the one used in ScanFont and BitFonter applications.

Pixel Tracing

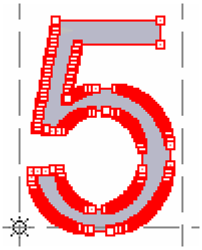
To trace bitmap with the simple pixel-based algorithm, use the **Trace Pixels** command in the **Tools > Background** menu. FontLab Studio will trace bitmap pixels using straight segments only not curves:



You can achieve the similar result using the FontFlasher utility for creating pixel fonts.

Note that the pixels do not overlap each other and some pairs of nodes may have the same coordinates. You may want to further edit the result manually.

In this algorithm the outline depends completely on the size of pixels in the bitmap. If the bitmap is quite smooth you will get too many nodes on the outline:



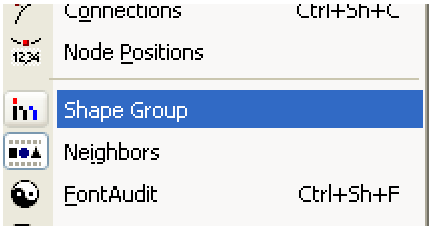
Shape Groups and Neighbors

In FontLab Studio you can define special groups of glyphs that we call *shape groups* and *neighbors*.

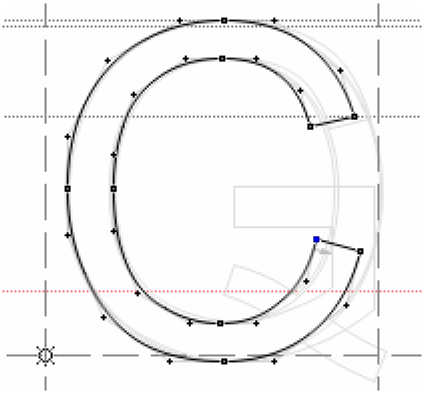
The shape groups and neighbors are useful in the process of working with glyphs that have common design. For example, glyphs "C", "O", "G", "Q" are quite similar and may be designed at the same time, as a group.

Shape Groups

To see glyphs belonging to one shape group in the Glyph window, select the **Shape Group** command from the **View > Show Layers** menu:



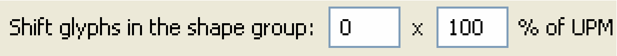
If the current glyph belongs to a group other glyphs from that group will appear grey in the background:



You can now visually compare sidebearings and shapes of all glyphs of the group. And more: you can quickly open any of the glyphs in the group simply by double-clicking its outline.

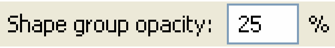
The view of the grouped glyphs are fully customizable on the **Glyph Window > Shape groups and neighbors** page of the Options dialog box.

For example, to place the grouped glyphs vertically, use the following setting:



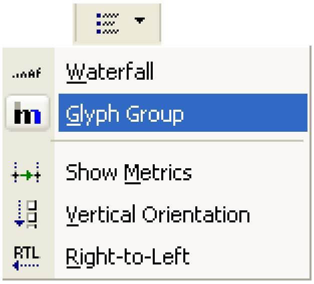
Shift glyphs in the shape group: 0 x 100 % of UPM

To change the opacity of the grouped glyphs, use this control:

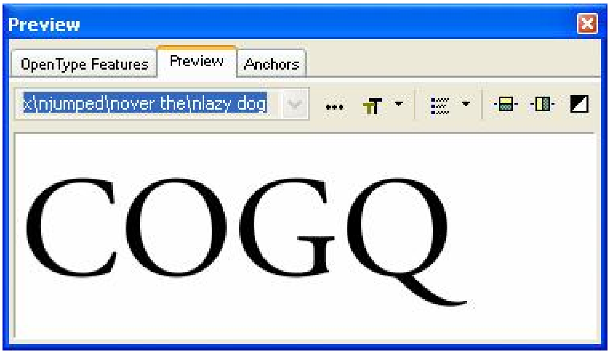


Shape group opacity: 25 %

When the Glyph Window is active and you open the Preview panel you can see the preview of the current glyph group. Select the **Glyph Group** command in the **Preview Options** menu:



The group for the current glyph ("C" in our sample) will appear:

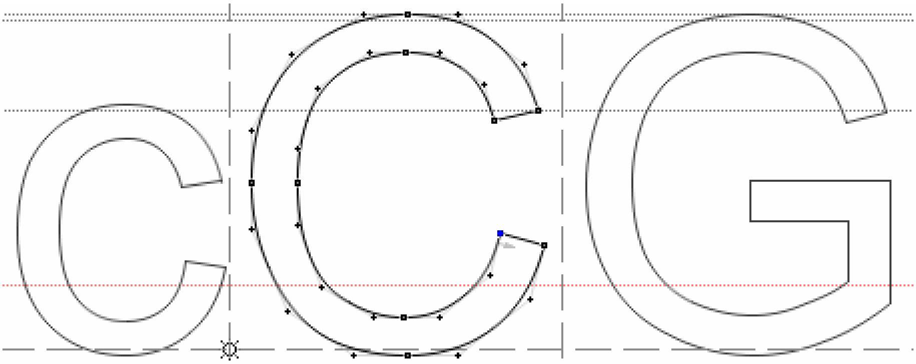


x\njumped\nover the\nlazy dog

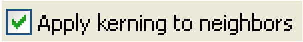
Double-clicking any of the group members will open it in the current Glyph window for editing.

Neighbors

To see glyphs belonging to one neighbors group in the Glyph window, select the **Neighbors** command from the **View > Show Layers** menu. Neighbors of the current glyph defined in the *neighbors.txt* file will appear:



Every glyph may have only two neighbors defined. Neighbors allow you to look at your current glyph in a context. If kerning is defined for neighbor glyphs they are shown with kerning. You may switch this feature off on the **Glyph Window > Shape groups and neighbors** page of the Options dialog box:



☑ Apply kerning to neighbors

Clicking on the neighbor's outline will open it for editing in the same Glyph window. This feature can be switched off in the Options dialog box.

Editing Groups and Neighbors

Shape groups and neighbors are defined in two files: *groups.txt* and *neighbors.txt* located in the *\Studio5\Data\* user data folder. Open these files in any text-editing application and you will see their structure is very simple:

```
%%FONTLAB GROUPS
h a m b u r g e f o n s t i v
q c k w x j p l z y d
zero one two three four five six seven eight nine zero
A V T Y
B P R
```

```
%%FONTLAB NEIGHBORS
l h n
period i j
i j period
h k K
```

In the *groups.txt* and *neighbors.txt* files groups and neighbors are defined as lines of glyph names delimited by space. Each line of text is a group. Lines of neighbors may contain only 3 names. The middle glyph name is the main while others are neighbors. You may edit the content of these files to fit your needs.

You can also click on the **Edit Groups** button on the **Glyph Window > Shape groups and neighbors** page of the Options dialog box to edit shape groups.

Outline Operations

In FontLab Studio, operations are temporary tools that let you modify your glyph. Operations are activated by pressing on their buttons in the Tools toolbar or by selecting a command in the **Contour** and **Tools** menus.

When an operation is activated one or more handles appear depending on the operation. After you make changes double-click to accept them (you can also press the **Return** or **Enter** key on the keyboard) or press the **Esc** key to reject the changes.

When the operation is completed the tool that was selected before will be activated again. As with all permanent tools you can use the zoom selection tool, quick zoom keys and all the other viewing options of the Glyph Window while you are working with the operations tool.

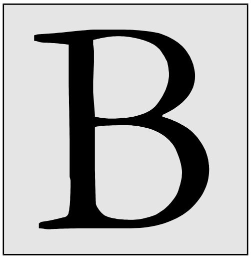
Here is a list of all available operations:

Free Transform	Scales, rotates or skews the selected portion of the outline or the whole glyph (described on page 407)
Envelope	Modifies the outline as if it was painted on rubber
Reverse Path	Reverses the contour’s direction
Set Startpoints	Changes the startpoints of contours and rearranges contours
Simplify Path	Approximates a segment of the outline with a curve
Move Node	Lets you set precise positions of outline points
Interpolate Nodes	Modifies the outline by moving a few “base” points
Position Background (Tools > Background > Move and Scale)	Sets the size and position of the bitmap background layer (described on page 448).

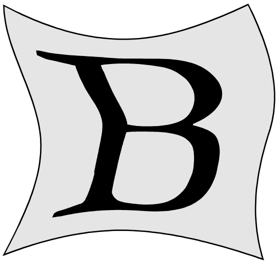
Below you will find a detailed description of the outline operations that have not already been described. The **Free Transform** operation was described on page 407, the **Position Background** operation was described on page 448.

Envelope

This operation transforms your glyph as if it were on a rubber plate and you began to stretch it:



Original glyph



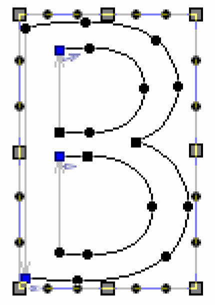
Glyph after envelope transformation

Envelope is the most “freeform” transformation available in FontLab Studio. Be careful with it because it can produce very unusual results.

To apply an envelope to a glyph:

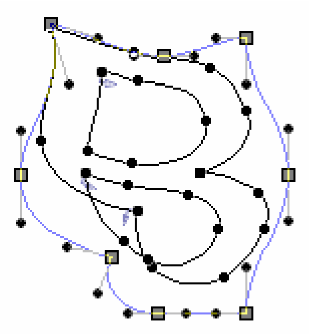
1. Activate an Envelope operation. Select the **Envelope** command in the **Contour > Transform** menu or press the button on the Transform toolbar.

2. You will see a control box surrounding your glyph:



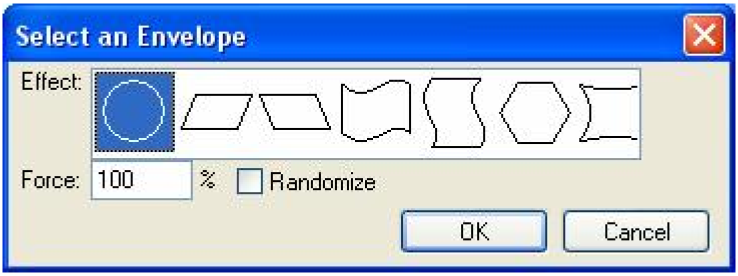
The control box consists of 8 curves with control vectors and control points.

3. Position the mouse cursor on any of the handles of the control box, press the left mouse button and drag the handle to a new location. You will immediately see the results of the transformation:



4. Double-click in the free space of the Glyph Window to accept the changes or press the **Esc** key to reject the changes.

You can select one of the predefined envelopes. Press the right mouse button in the free space of the Glyph Window and choose **Select predefined** command in the popup menu. You will see a dialog box with several predefined envelopes:



Select an Envelope

Effect:

Force: 100 %

□ Randomize

Choose the envelope in the Effect list that you want to apply and fill in a **Force** option. A force of 100% will make the envelope look as it is in the selection list. A value of 0% will make a plain rectangle. Check on the **Randomize** option to apply the envelope with random force.

When you select one of the predefined envelopes you can still modify it using envelope handles.

Reversing a Contour's Direction

Sometimes you need to reverse the direction of a contour. In FontLab Studio you can do this in one of two ways: click on each contour that you want to reverse with the right mouse button and select the **Reverse Contour** command in the popup menu, or activate the Reverse Path operation.

To activate the operation select the **Reverse Path** command in the **Contour > Path** menu.

When you activate the **Reverse Path** operation you will see that all the contours now have arrows that show their direction.

You can reverse any path by clicking on it with the left mouse button.

By double-clicking you can finish the operation and accept all the changes that you just made. By pressing **Esc** you finish the operation and reject all the changes.

✐ **Tip:** We recommend that you switch to the Fill Outline mode when you use this operation. The direction of a contour changes the contour's "colors," and in the Fill Outline (Preview) mode you will see the changes immediately.

Rearranging Contours

Sometimes you need to change a contour's sequence to simplify the programming of hint substitution. An easiest way to do this is to use the **Set Startpoints** operation.

Select the **Set Startpoints** operation in the **Contour > Path** menu.

When you activate this operation you will see the yellow marks that show the sequence number of each contour.

To change a contour's startpoints just click on a new startpoint position.

To change a contour's sequence:

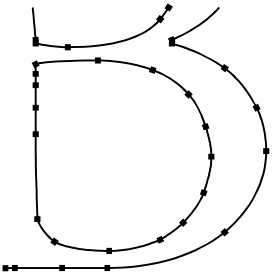
1. Place the mouse cursor on the contour whose sequence you want to change.
2. Press the right mouse button. The selected contour will be highlighted.
3. In the popup menu choose one of these commands:

Up	To move the contour one step up (contour #3 will be #2)
Down	To move the contour one step down (contour #3 will be #4)
First	To move the contour to the top of the sequence (contour #3 will be #1)
Last	To move the contour to the bottom of the sequence (contour #3 will be the last contour in the sequence).

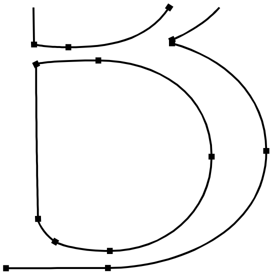
Double-click to accept the changes (you can also press the **RETURN** or **ENTER** key on the keyboard) or press the **ESC** key to reject the changes.

Simplifying Path

Using this operation you can simplify a segment of the glyph's outline to a single curve (i.e. remove excess nodes on a path):



Original outline



Outline after simplifying

To simplify part of the outline:

1. Activate the **Simplify Path** operation: select **Contour > Path > Simplify Path (Ctrl-Alt-C)** or press the button on the Path toolbar.
2. Click the left mouse button on the outline where you want to start the curve. Hold the **Shift** key down to make a smooth transition between the new curve and the old outline.
3. Click the left mouse button where you want to finish the curve. Again, hold the **Shift** key down to make a smooth transition. The shorter segment of the closed path will be simlified. Hold the **Alt** key when clicking to simplify the longer segment.

Note that the starting and finishing points must be on the same contour but don't have to be on exiting nodes.

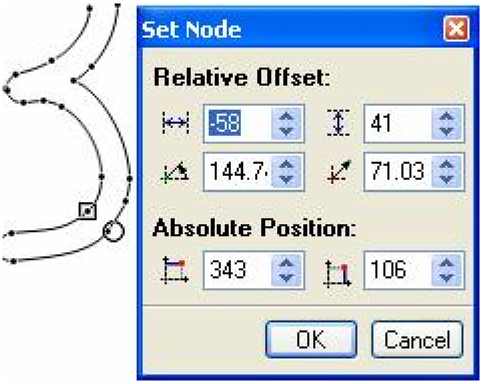
Double-click on the white space to accept the changes and exit the operation. You can also press the **Return** or **Enter** key on the keyboard.

Moving Nodes

This operation lets you set the position of the nodes very precisely. Of course, you can use the nodes' property panel but this operation may simplify the job:

1. Activate the **Move Node** operation by selecting the **Move Node** command in the **Contour** menu.
2. Click anywhere in the editing field to set up a reference point. If you click close to any of the guiding elements or close to one of the nodes the reference point will "stick" to that object. The reference point will be highlighted.
3. Position the cursor on the node you want to move and click the left button again.

The destination node will also be highlighted and a dialog box appears:



Set Node

Relative Offset:

-58 | 41

144.7 | 71.03

Absolute Position:

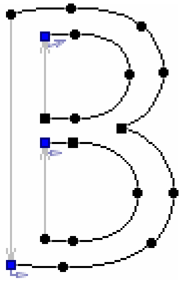
343 | 106

In this dialog box FontLab Studio shows the relative position of the reference point and the destination node in rectangular and polar coordinates as well as the absolute position of the destination node. You can change any value and all the other values will automatically be recalculated.

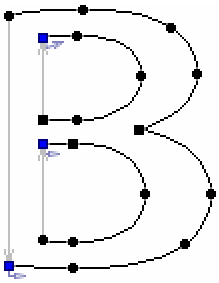
After you press the **OK** button the destination node will be moved to the new location and you can repeat steps 1-3 to move other nodes.

Interpolation

With this operation you can move a few points and all other points of the glyph outline between the moved points will be interpolated:



Original glyph



Glyph after interpolation

As you can see, this operation can save a lot of time when you want to proportionally modify your glyph but want to save some important values, like stem widths.

Interpolation is extremely useful when you are making Multiple Master fonts. Refer to the “Multiple Master Fonts” chapter for more information.

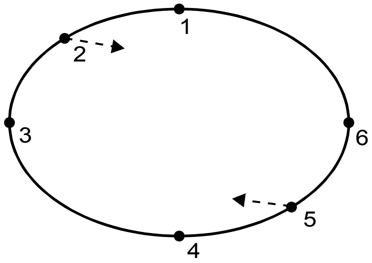
When the Interpolate Nodes operation (the **Contour** menu) is activated a small panel appears, consisting only of two buttons, **OK** and **Cancel**.

Press the **OK** button to accept any changes that you made with the interpolation operation (you can also press the **Return** or **Enter** key on the keyboard) or press the **Cancel** button to reject the changes (the **Esc** key is the equivalent of this button).

How interpolation works

1. You set the new position of several glyph points. We call these points *reference points*.

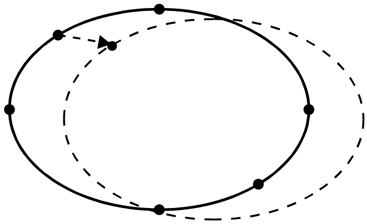
2. All points on contours that are between two reference points are interpolated. All contours are processed independently:



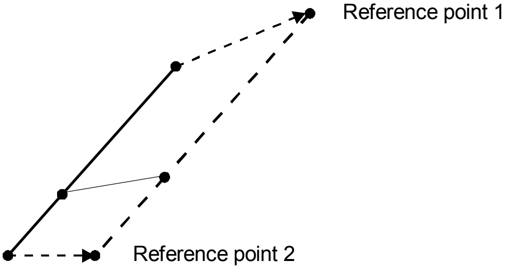
Points 2 and 5 are reference points. Points 3 and 4 are between these points and will be interpolated. Note that points 1 and 6 are *also* between reference points, because all contours in FontLab Studio are closed.

3. All non-reference points are interpolated between two reference points according to the following rules:

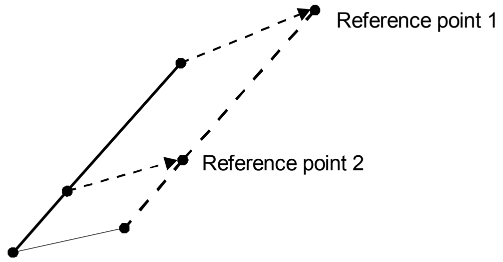
a) If the contour has *only one* reference point, it is shifted with that point:



b) If a point is *between* two reference points, it is proportionally interpolated:



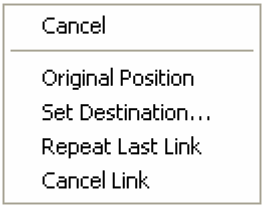
c) If point is outside the interpolated points, it is shifted with the closest reference point:



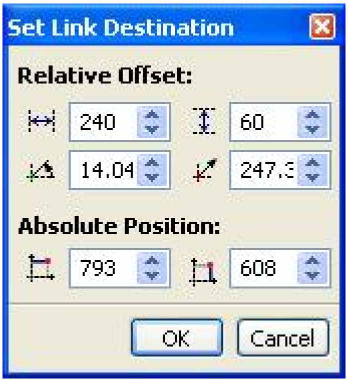
To interpolate a glyph:

1. Activate an Interpolation operation. Select the **Interpolate Nodes** command in the **Contour** menu.
2. You will see a panel with the **OK** and **Cancel** buttons. You can press the **OK** button any time to finish your work with the Interpolation operation or press the **Cancel** button to reject all changes.
3. Position the mouse cursor on the reference point that you want to set; press the left mouse button and drag the point to a new location. Release the button when you are done. Note that the point will "stick" to all guiding layers as well as to other glyph nodes. Hold the **SHIFT** key down to constrain the direction of movement to 15-degree increments.
4. You may want to set a so-called *base point* – a reference point that points to itself. A base point will remain in place during interpolation.
5. When you set the new position of the first reference point, you will see the results of outline interpolation as a gray outline.
6. Click on a reference point with the right mouse button **to remove that reference point**.

7. Click on a link with the right mouse button **to open the following popup menu**:



Choose **Set Destination...** command to open following dialog box:



Set Link Destination

Relative Offset:

240 60
14.04 247.3

Absolute Position:

793 608

Here you can specify properties of the link with all possible precision.

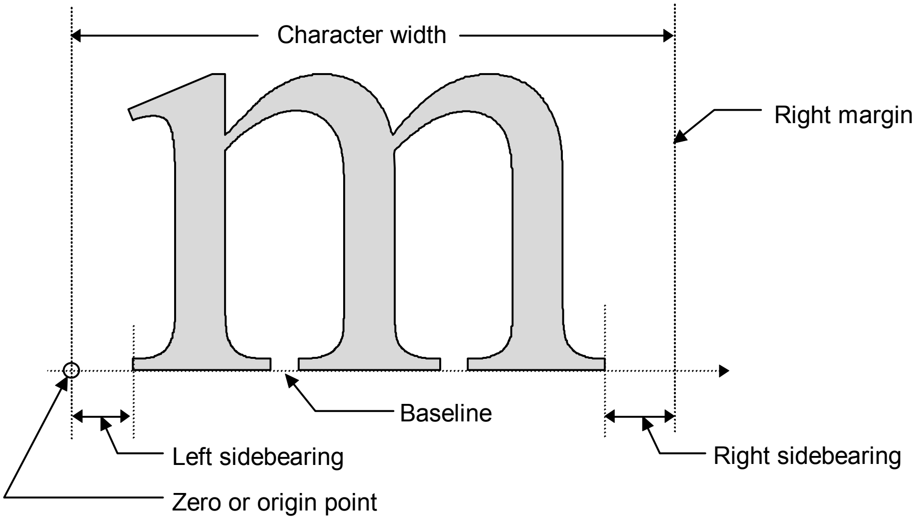
Original Position command will reset link to zero, so node will retain its position.

8. You can **select several points** using the usual point selection procedure. If you add a reference point after selection all selected points will move to the position of the same reference point. Use this technique to "collapse" parts of the outline.

9. Press the **OK** button to finish your work with the Interpolation operation or press the **Cancel** button to reject all changes.

Metrics

The Metric data of a glyph includes information about the horizontal and vertical width. Glyphs have an *origin point*, a *baseline*, *sidebearings*, and *left and right margins*:



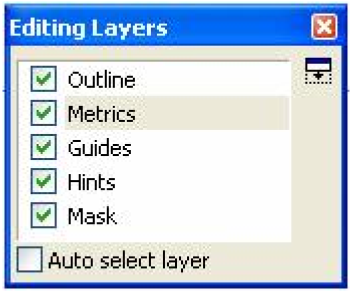
The baseline is used to align characters in a series. The left and right margins are used to define the positions of sequential characters in a series when the horizontal writing mode is selected. In the vertical writing mode the left and right margins are used to horizontally align characters and the top margin is used to vertically align characters.

In FontLab Studio, the position of the origin point is the position of the left margin in the horizontal direction and the position of the baseline in the vertical direction. However, you can modify the position of any of the four margins. If you move the baseline or left margin line you will shift the entire glyph.

Editing Metrics

FontLab Studio has a special window for editing glyph metrics, of course, but you can make small adjustments right in the Glyph Window, using the main edit tool.

To change glyph metrics first activate the Metrics layer in the Editing Layers panel:



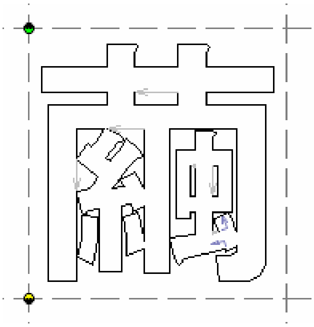
Editing Layers

- ☑ Outline
- ☑ Metrics
- ☑ Guides
- ☑ Hints
- ☑ Mask

☐ Auto select layer

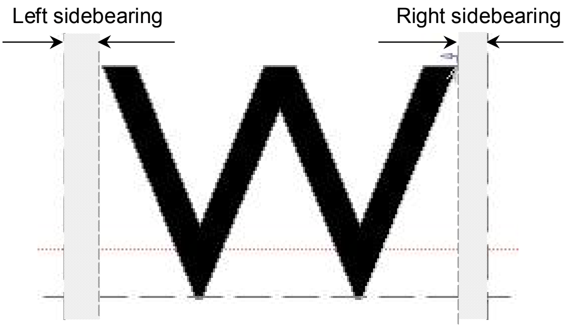
Then use the mouse and drag the left or right sidebearing or the baseline.

In FontLab Studio you can define **vertical glyph metrics**: the vertical advance "width" (called *vertical advance vector*) for Asian glyphs used to type in vertical direction from top to bottom. To define a vertical glyph advance vector, hold the **SHIFT** key while moving the base line:



Using the Measurement Line

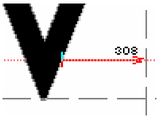
By default the sidebearing values are measured from the rightmost and leftmost points of the glyph:



Sometimes you need to measure sidebearing values from some other point on the glyph outline. In FontLab Studio you can do that by using the measurement line – a horizontal red line that defines the "height" of the sidebearing measurement:

Error! Objects cannot be created from editing field codes.

You can see measured values appear above the line when you move the right or left sidebearing:



The same values appear in the glyph properties panel:

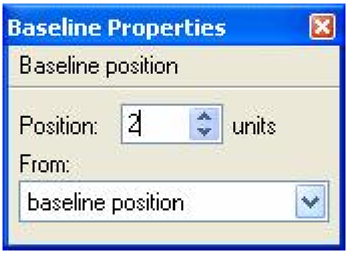
Error! Objects cannot be created from editing field codes.

You can drag the measurement line to any position and the information in the Glyph properties will be updated accordingly.

You also can change the measurement line position in its Properties panel if you left-click the measurement line while holding down the **Ctrl** key on the keyboard.

Baseline Properties Panel

With this property panel you can adjust the position of the glyph's baseline. To open it click the right mouse button on the baseline and select the **Properties** command in the popup menu or left-click the baseline while holding down the CTRL key on the keyboard.



Baseline Properties

Baseline position

Position: 2 units

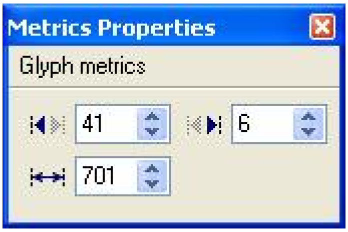
From: baseline position

To change the position of the baseline:

1. Select the base level of the modification. It can be the old position (for relative offset) the top of the glyph, the bottom of the glyph, the top sidebearing, or the bottom sidebearing.
2. Change the position of the baseline relative to the base level.
3. Press the ENTER key or click anywhere in the editing field to apply the changes.

Metrics Properties Panel

To open the metrics property panel, position the mouse cursor on the left or right glyph margin, click the right mouse button and select the **Properties** command , or CTRL-click the left mouse button on one of the margins.



Metrics Properties

Glyph metrics

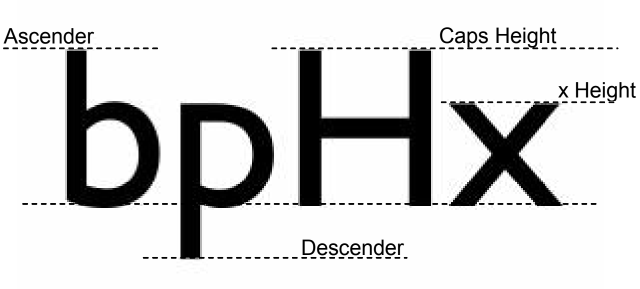
41 6

701

In this panel you can modify a glyph's sidebearings and/or width.

Vertical Metrics

Every font has several **vertical font metrics** for alignment of text:



The Ascender line defines the position of the top of lowercase characters (usually the topmost point of the Latin ‘b’).

The Descender line defines the position of the bottom of the lowercase characters (usually the bottom point of ‘p’).

The Caps height defines the height of the uppercase characters (without overshoot). Usually it is the height of the ‘H’.

The x Height is the height of most lowercase characters, like ‘x’ or ‘v’.

In FontLab Studio you can modify the vertical metrics values in the Font Info dialog box, but you can also preview and change them visually in the Glyph Window.

Make sure that the Vertical metrics layer is active and not locked.

In the Editing field vertical metrics appear as gray lines with a label at the right:

A Ascender

D Descender

C Caps height

X x Height

To change a metric, just drag its line with the Edit tool or Ctrl-click the metric line to open its properties panel and enter a numeric value.

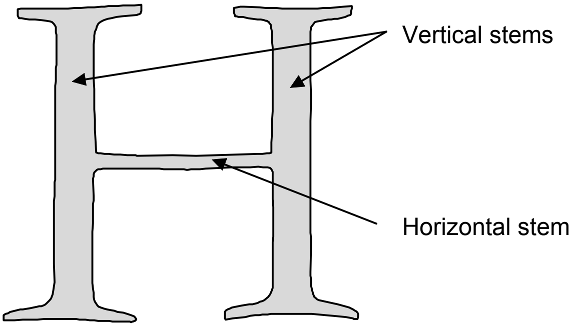
In FontLab Studio you can also define **vertical glyph metrics**: the vertical advance “width” (called *vertical advance vector*) for Asian glyphs used to type in vertical direction from top to bottom. To define a vertical glyph advance vector, hold the **SHIFT** key while moving the base line.

Hints and Links Layer

Hints are used by the font rasterizer to improve a glyph's appearance on devices with low output resolution, like computer monitors or low-res printers. A detailed description of the hinting methods and manual and automatic hinting features available in FontLab Studio is in the "Hinting" chapter. For now we'll just mention that in the Glyph Window you can see font-level alignment zones and Type 1 character-level hints and links.

There are two hinting methods applied to Type 1 fonts (hints for True Type fonts are always generated automatically): font-level hinting and character-level hinting. Font-level hinting is generated automatically in FontLab Studio, so you don't have to edit it manually.

Character-level hinting is applied to the characters' stems:



All important stems in a glyph should have stem hints, a pair of vertical or horizontal lines. The information in the hint includes not just the position of each of the two lines that "build" the hint, but also the position of one (major) line and the width of the hint.

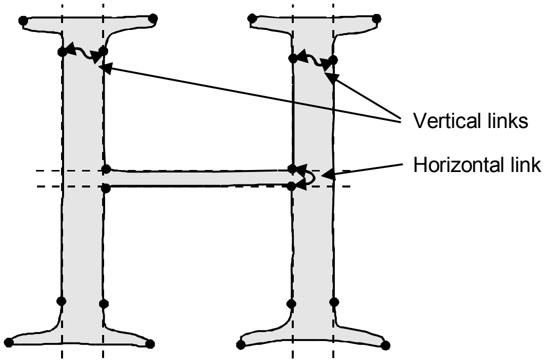
You can declare stem hints in FontLab Studio just by dragging them and modifying their width. Because hints in FontLab Studio are very "intelligent," they automatically snap to the contour, minimising your work. In most cases the autohinting algorithm that is included in FontLab Studio produces good results - usually not any worse than the results of manual hinting.

There is a special feature, called **Hints Tracking** that can be used with hints. It will be described later, when we discuss editing hints.

Links

Stem hints are not connected to the outline - they exist in a different layer. This allows you to use hints as pairs of guidelines while you work on an outline. But if you change the outline after hints are set you have to set all the hints again to reflect the outline changes. Another kind of stem hint, called a *link*, may help in this case.

Links connect two outline nodes, using the position of the nodes and the distance between them, to define a stem hint. If you move one of the nodes connected by a link the link will automatically reflect the changes. Links can also be either vertical or horizontal:



Links are extremely useful when you are working with Multiple Master fonts. In these fonts each point has several “layers”, called masters, which represent different styles of the font. If you try to set hints in Multiple Master fonts, you will have to manually define the hints’ positions in each master. But with links you can just connect two outline nodes and hints will be generated automatically for each master when you export your font. Refer to the “Multiple Master Fonts” chapter for more information about links.

Editing Hints

Editing hints is very similar to editing guidelines. You can add new hints through the ruler bar of the Glyph Window; drag them with the mouse; and delete them by using the menu command or by clicking on both mouse buttons.

In contrast to guides, hints consist of two lines that can be moved together or separately. Hints cannot be slanted.

To add a new hint:

1. Position the mouse cursor on the horizontal ruler bar (for a horizontal hint) or on the vertical bar (for a vertical hint).
2. Press and hold the **Ctrl** key. Press the left mouse button. The bar will appear "pressed" and a new hint will appear. Release the **Ctrl** key.
3. Holding the left mouse button, drag the hint to the desired place and release the button.

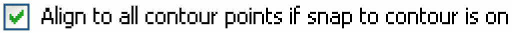
To move a hint:

1. Move the mouse cursor onto one of the hint's lines.
2. Press the left mouse button and drag the hint to its new place. Both hint lines will move together.

To move a hint's lines separately hold down the **Shift** key while dragging one of the hint's lines. Using this procedure you can change the width of the hint.

While you are dragging the hint and the mouse cursor is within the snap-to distance the hint line will stick to the node. Nodes must be visible.

The hint will snap to all nodes regardless of the mouse cursor position if the option **View > Snap to > Outline** is on and the following checkbox on the Glyph Window page of the Options dialog box is also switched on:



☑ Align to all contour points if snap to contour is on

Note: While you are editing the hint, its parameters are shown on the status bar.

To remove a hint:

I.1. Start editing the hint.

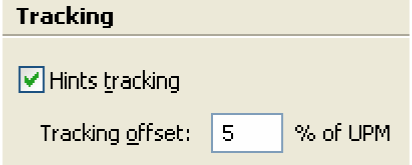
I.2. While holding the left mouse button down, click the right button.

II.1. Position the cursor on the hint and click the right mouse button.

II.2. Select the **Delete** command from the menu.

Hints Tracking

If the Hints tracking option of the **Glyph Window** page of the **Options** dialog box is on:



Tracking

☑ Hints tracking

Tracking offset: 5 % of UPM

and you move hints a distance less than the **Tracking offset** setting, all nodes that are on the hint will be moved with it. Use this feature to keep an outline on the hint when you want, for example, to modify the hint's width. Note that this feature also works when you change a hint through the property panel described below.

Editing Links

Links connect two nodes. The only way to edit links is to connect them to different nodes of the outline.

To add a new link:

1. Click on the **Add New Horizontal (or Vertical) Link** command in the **Tools > Hints & Guides** menu.
2. Click the first node of the link.
3. Drag the mouse cursor to the second node and release the button.

To edit a link:

1. Position the mouse cursor on one of the link's lines.
2. Press the left mouse button and drag the mouse. You will see that when you move the cursor onto the outline's nodes they become highlighted.
3. Position the mouse cursor on the node where you want to connect the link (it will become highlighted) and release the mouse button.
4. Release the mouse button while the link is not connected and a vertical link will disappear. A horizontal link will become a ghost link in this case (more on ghost links later).
5. Click the right mouse button while dragging a links' line to remove a link.

Hint and Link Popup Menu

To open the hint or link popup menu, right-click one of the hint or link's lines.

The **Hint** popup menu includes the following commands:

Convert to Link	Converts the active hint to a link
Reverse	Reverses the direction of the hint
Delete	Removes the hint
Define a Stem	Defines a vertical or horizontal stem (global hinting parameter) as equal to the width of the current hint
Properties	Opens the hint property panel.

The **Link** popup menu includes the following commands:

Convert to Hint	Converts the active link to a hint
Reverse	Reverses the direction of the link
Delete	Removes the link
Properties	Opens the link property panel.

Hint Commands

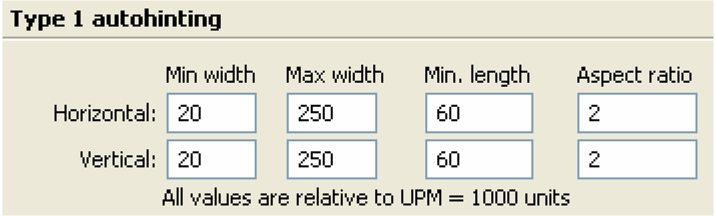
The **Tools > Hints & Guides** menu contains several commands related to hints:

Remove Hints	Removes vertical or horizontal or all hints and links. This command is duplicated in the rulers context menu
Autohinting	Automatically generates hints for the current glyph. Autohinting options can be adjusted in the Type 1 page of the Options dialog box
Autoreplacing	Automatically generates a hint replacement program for the current glyph. Refer to the "Hinting" chapter for more information about hint replacement
Convert Hints to Links	Converts all hints to links
Convert Links to Hints	Converts all links to hints
Type 1 Hinting	Activates the Type 1 hinting tool (described later in the "Hinting" chapter)
TrueType Hinting	Activates the TrueType hinting tool (described later in the "Hinting" chapter).

Same commands are duplicated in the Glyph Window context menu (which appears if you right-click in an empty area of the editing field).

Autohinting Options

You can customize the autohinting algorithms using the **Hinting Settings** > **T1 Autohinting** page of the **Font Info** dialog box (File > Font Info):

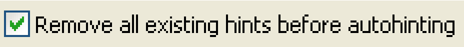


Type 1 autohinting

	Min width	Max width	Min. length	Aspect ratio
Horizontal:	20	250	60	2
Vertical:	20	250	60	2

All values are relative to UPM = 1000 units

You also may need to use the following option



☑ Remove all existing hints before autohinting

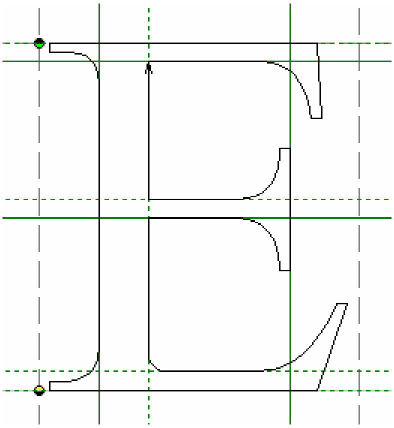
on the **Options** > **Generating Type 1** > **Type 1 autohinting** page.

Width limits	Declares the minimum and maximum width of hints that the autohinting algorithm is allowed to create
Min. length	Declares the minimum length of the nearest vertical (or nearest horizontal) straight segments (or curve control vectors) that can be a candidate for building a hint
Minimal length/ width aspect ratio	Declares a critical correlation between the width of a candidate for the hint and the length of the straight segment that builds that candidate
Remove all existing hints before autohinting	Allows you to remove all existing hints before autohinting the glyph. If this option is switched off new hints will be added to the existing hint set. Of course, a hint substitution program will be built.

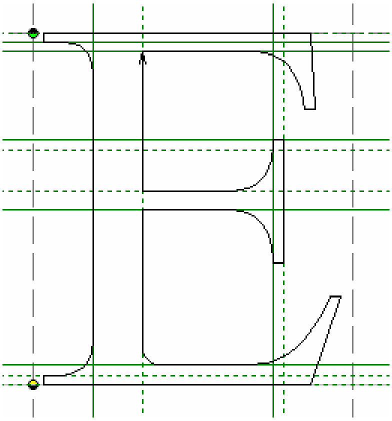
Note that all values are set for a 1000 UPM font and are automatically scaled by FontLab Studio according to the real UPM size.

Some recommendations:

1. If you want FontLab Studio to generate thin hints (horizontal serif hints, for example), set the **Min width** parameter to a value less then the width of the serif. Use the Meter tool to measure the width of the serif. Set **Min. width** to a value that is greater than the serif width to prevent FontLab Studio from autohinting the serifs (the real width of the serif in the picture is 18 units):



Min. width = 20



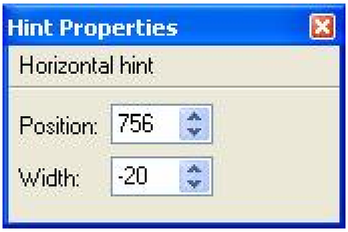
Min. width = 10

2. Decrease the **Min. length** value to generate more hints. Increase the value to generate only the most important hints.

3. Increase the **Max. width** value if you are working on a black or heavy font that has very thick stems.

Hint Properties Panel

To open the hint properties panel, CTRL-click one of the hint lines or right-click and choose the **Properties** command in the popup menu :



Hint Properties

Horizontal hint

Position: 756

Width: -20

In the hint property panel, you can modify the position of a hint in the upper edit box and modify the width of the hint in the lower box. Press the ENTER key or click the mouse outside of the properties panel to apply the changes.

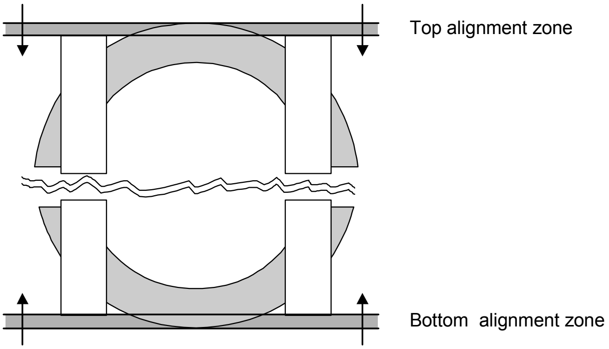
Link Properties Panel

In the Link properties panel you can modify a link's properties: enter the index numbers of the two nodes which you want to "connect" by the link in the editing fields or check the **Ghost Link** checkbox to make a link into a ghost link.

Alignment Zones

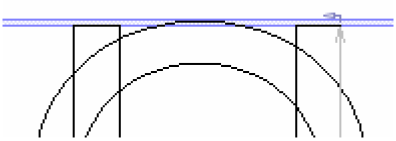
Most fonts have “square” and “round” glyphs. Round glyphs (like “O” and “Q”) usually have 3-4% “overshoot” on the bottom and top. “Overshoot” is the amount that a glyph extends above or below its nominal top or bottom. It is used to optically correct the appearance of “round” glyphs, which tend to appear too small at their nominal height.

When a font is rendered on a device with limited resolution, it is often necessary to “suppress” the overshoots to make a line of text look smooth:



This whole process is described in full detail in the “Hinting” chapter. Here we will only discuss the basic modification of the layer with the Edit tool.

To let a font-rendering program perform overshoot suppression you need to “declare” overshoots using alignment zones:



You can modify alignment zones with the Edit tool: just drag the bottom or top line of the zone to change its width or position.

You may later use the FontInfo dialog (File > Font Info) to check the exact parameters of the zones.

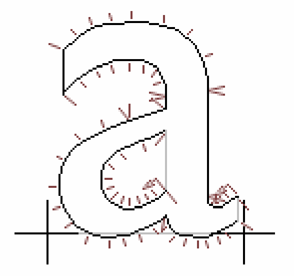
Sketch Mode

Sketch mode is a new easy, alternative way to create outlines. To activate Sketch mode just select the **Sketch mode** command in the **Contour** menu or use the **ALT-2** key combination. To return back to Edit mode, use the **ALT-1** key combination.

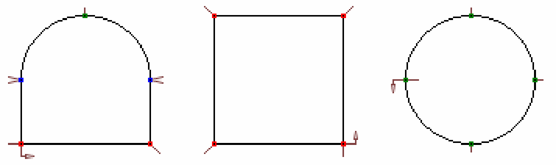
When you enter sketch mode for the first time the glyph outline is automatically converted into a special format that is optimised for “freestyle” editing. Thus the sketch mode has two outline layers: one with the original “real” glyph outline, and one with the sketch outline.

In contrast to the outline representation used in the Edit mode, the Sketch outline is not WYSIWYG. Before exporting to a font file all sketch outlines must be converted into “standard” outlines. I.e. you edit the sketch, but nothing changes in the real glyph outline until you do the conversion.

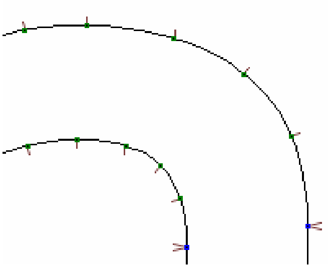
In the Sketch outline, all points that define the outline are positioned on-curve. There are no Bezier control points or TrueType off-curve points:



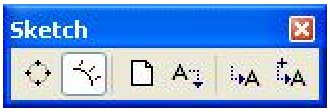
The principle is somewhat similar to the Ikarus® font editor by URW++ but the underlying geometry is not identical. In the Sketch mode, there are 3 types of points: corner, curve and tangent:



When points of known types are set, FontLab Studio automatically “draws” the outline to match their positions. If you want to change the shape of the outline, just move the points or add more points to increase the precision:



When you enter the Sketch mode, you will see an additional Sketch toolbar:



Here is a short description of the commands available on the Sketch toolbar:

	Show outline	Displays the real glyph outline in the background of the sketch outline
	Show marks	Shows point and direction marks
	New sketch	Use to create a new, empty sketch. I.e. delete the current sketch
	Import sketch	Convert the glyph outline to a sketch
	Replace outline	Replace the glyph outline with the sketch
	Add to outline	Add the sketch outline to the glyph outline.

The same commands are available in the popup menu that appears if you right-click the empty space of the Glyph window.

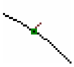
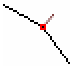
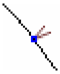
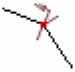
Visualization of the Sketch Outline

Every point in Sketch mode can have 2 marks:

The Node icon, which is similar to how nodes are shown in Edit mode.

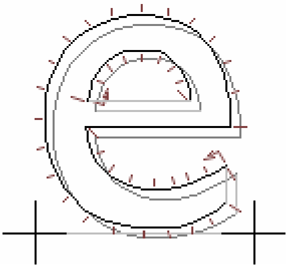
The Direction mark which shows the curve direction (the mark is on the convex side of the curve) at the point.

Direction marks are different depending on the type of the node:

Short mark		Curve point
Longer mark		Corner point
Double mark		Tangent point
Mark with an arrow		Startpoint of the contour

Use the **View > Show Layers > Nodes** ( ) command to switch the node icons on or off and the **Show Marks** button on the Sketch toolbar to show or hide the direction marks.

With the Show Outline button you can turn the real (Edit mode) glyph outline in the background of the Sketch outline on or off:



The glyph outline may appear contoured or filled, depending on the Fill Outline (preview) mode.

Moving Points

To move points simply drag them with the left mouse button. Hold the **SHIFT** key down to constrain movement to the vertical or horizontal direction.

Changing Point Type

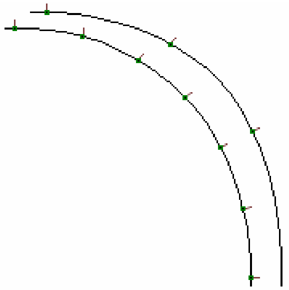
To change point type from corner to curve to tangent simply double-click the node with the left mouse button.

Removing Points

There are two ways to remove unnecessary points:

1. Use the Eraser tool. Select the tool (⌫), position the cursor over the point you want to remove and press the left mouse button. Drag the mouse to remove multiple points. **CTRL**-click and drag to surround the points you want to remove with a rectangle.
2. Using the Edit tool (↖), start dragging the point with the left button and click the right button without releasing the left button.

When you remove a point, you'll notice that FontLab Studio tries to keep the outline smooth:



In normal outline mode you usually try to minimise the number of nodes and use Bezier control points and off-curve points to make the outline look smooth. The main feature and benefit of Sketch mode is that you can add as many curve points as you want to make the outline smooth and precise, and the curves will be aligned and optimised automatically.

Inserting Points

One way to insert points is to use the Knife tool (🔪).

1. Select the tool on the Tools toolbar.
2. Click on the outline where you want to insert a point.

Alternatively you can add points with the Edit tool:

1. Position the cursor on the outline.

2.1. Press the **Alt** key and left-click the outline, or

2.2. Press the right mouse button. Without releasing right button click left button.

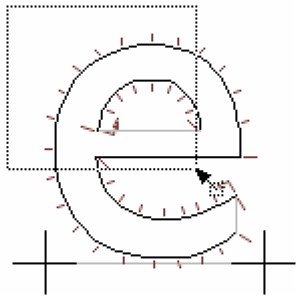
Reversing Contours

Ctrl-click one of the nodes of the contour with the left button to reverse its direction.

Selecting Points

As in the standard Edit mode, you can select many points and perform group operations, like moving the selection or copying to and from the Clipboard.

To select points with the edit tool, press the left mouse button in an empty area and drag the cursor to surround the points you want to select with the rectangle:



Hold the **Shift** key down to invert the selection state of the points.

To select the whole contour, double-click it. Note that you must not double-click one of the points – this operation will change its type.

Alternatively, hold down the **Ctrl** key and click anywhere near the contour.

You can use commands from the **Edit** menu to select or deselect parts of the outline:

Select All	to select the whole outline
Deselect	to remove all selections
Invert Selection	to invert the selection state of all nodes.

Left-click anywhere in the empty area anytime to remove all selections.

Using the Magic Wand Tool

With this tool you can easily select multiple contours. It is especially useful when your sketch contains multiple overlapping outlines.

1. Activate the Magic Wand tool (🪄)
2. Click anywhere near the contour you want to select. The closest contour to the point where you clicked will be selected.
3. Hold down the **SHIFT** key to reverse the selection state of the contour.

Moving the Selection

When multiple points are selected you can move the entire selection with the Edit tool: just click on any selected point or selected part of the outline and drag the mouse. Hold down the **SHIFT** key to constrain movement to the vertical or horizontal direction only.

Transforming the Selection

You may rotate, scale, and slant a selection with the Rotate (), Scale () and Slant () tools on the Tools toolbar.

1. Select the part of outline you want to transform or remove all selections to transform the whole outline.
2. Choose the tool to perform the transformation.
3. Click the left mouse button on the center of transformation and drag the mouse to rotate, scale or slant. Hold down the **SHIFT** key to constrain the transformation.

Note, that the **Free Transform** operation and the Transformation panel don't work with sketch outlines.

Selection Operations

You may copy, paste, delete and duplicate a selected part of the sketch outline. Use the following commands from the **Edit** menu:

Copy	Copy the selection to the Clipboard
Paste	Add the clipboard contents to the current sketch
Delete	Remove all the selected points
Duplicate	Add a copy of the selection.

When you use the **Paste** or **Duplicate** command, the selection is added with a shift from the original position. You may control the amount of this shift on the Glyph Window > Dimensions page of the Options dialog box (**Tools > Options**).

Breaking and Joining the Sketch Outline

You may break the sketch outline at any point with the Knife or Edit tool.

To break the outline with the Knife tool, select the tool ( ) and click on the node where you want to make a break.

To break the outline with the Edit tool, select the tool ( ), hold the **ALT** key and click the point where you want to make a break.

To join two contours, drag with the Edit tool and position the starting or ending point of the first contour over the ending or starting point of the second contour.

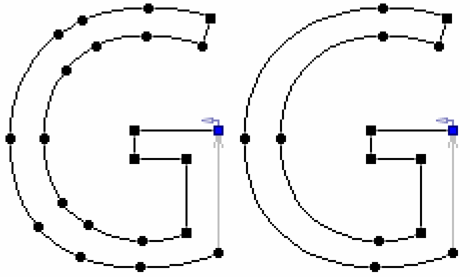
Hold the **ALT** key down while moving the point **to prevent the contours from joining**.

Converting Sketch to Outline

Click the **Replace outline** button to convert the Sketch into a normal outline. FontLab Studio will try to optimise the result using the minimum number of curves while maintaining high precision.

With the **Add to outline** command you can add the contents of the Sketch outline to the normal glyph outline.

To see the converted result simply change to edit mode (**ALT-1**). If you think that the Sketch converter produced too many curves, use the **Optimize** command in the **Contour** menu to fix it:



Working with Composite Glyphs

Composite glyphs are glyphs made up of two or more components, like a letter plus an accent. One or more of the components are referenced. I.e. their contours are not actually present in the composite glyph, but are "copied" from and linked to some other character. Thus whenever the original component contour is changed, all the composite glyphs that copy the component also change. The contour of composite components appears in dashed lines in the Glyph window.

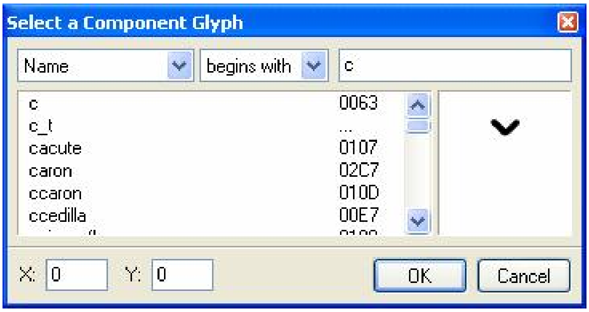
Composites have the advantage of allowing the user to create only one instance of a component that is frequently found in a font and reusing it without having to redraw it each time. Later if the design of the component changes it need only be altered once – in the original component. And finally, a composite takes up less room in the font than an outline, allowing for smaller font files.

There are three operations related to composite glyphs: adding a component to glyphs, decomposing a component and positioning a component.

Adding a Component

To add a component to a glyph currently open in the Glyph Window, select the Add Component command from the Glyph menu.

You will see a dialog box that looks just like a Find Glyph dialog box:



Name | begins with | c

c	0063
c_t	...
cacute	0107
caron	02C7
ccaron	010D
ccedilla	00E7

X: 0 Y: 0

The only difference is that only those glyphs that can be used as component glyphs will appear. Of course, a glyph cannot be a component for itself.

A composite glyph can be used as a component glyph. It is automatically converted to source components.

Another difference is that you can set the position by entering its **x** (horizontal) and **y** (vertical) coordinates. The component position is the distance between the composite zero point and the component's zero point.

To add a component you select the glyph you want to use as a component in this dialog box and press the **OK** button.

Another way **to add a component** is to drag it from the Font Window and drop it in the Glyph Window while the Ctrl key is pressed.

Decomposing

To decompose a composite glyph, select the **Decompose** command from the **Glyph** menu or from the Glyph Window default popup menu. The outlines of all components will be scaled and shifted according to their settings and added to the composite glyph. If the component glyphs had hints then these hints will also be added and a hint replacement program will be automatically generated. The link to the original component will be lost.

To decompose an individual component in a composite glyph, right-click the component and select **Decompose** in the context popup menu.

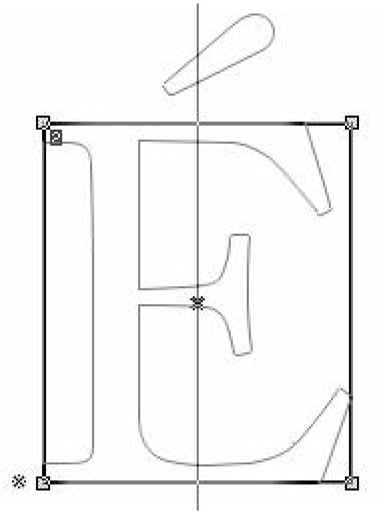
Component Positioning

To activate the component positioning operation, activate the Edit tool, position the mouse cursor on the component's outline and click the left mouse button.

Alternately, if the current glyph is composite-only (so if doesn't have any "normal" outlines), use the **PAGE UP** and **PAGE DOWN** keys **to select a component for editing**.

You will see a control box surrounding the component with four corner handles, a cross in the center, a centerline and the number of the component in the components list.

To select another component, use the **PAGE UP** and **PAGE DOWN** keys or the **TAB** key.



To select several components, click on each of them with the **SHIFT** key pressed.

To move the component position the mouse cursor inside the control box, press the left mouse button and drag the control box to a new location. If you position the cursor on the cross in the middle of the control box you can set the position of the component more precisely because the cross will snap to the guiding elements while moving.

You can also **use the keyboard to move the component**. Arrow keys move the component in one font-unit increments, the **Shift**+arrow keys increase movement to 10 units, and the **Ctrl**+arrow keys increase movement to 100 units.

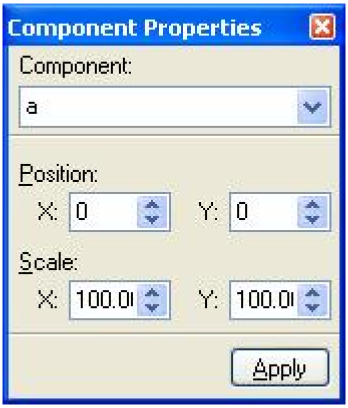
To scale a component position the mouse cursor on one of the handles, press the left mouse button and drag the mouse to change the size of the component. Hold the **Shift** key down to constrain the proportions of the component. Hold the **Ctrl** key down to scale around the component's center.

Some other useful commands are available in the popup menu that appears if you right-click the editing area while component tool is active:

Decompose	Decomposes (adds the outline to the composite glyph) the current component
Delete	Removes the component
Reset Shift	Moves the component to the position (0, 0)
Center	Moves the component horizontally to the glyph's center
Set Scale 100%	Sets the scale at 100% for the component. Note that the Type 1 font format does not support scaled components
H Mirror **V Mirror**	Mirrors the component (sets the scale for x or y direction to –100% and adjusts shift accordingly)
Make First	Sets the component to the first place in the components list
Copy Metrics	Copies metrics data from the component to the composite glyph
Copy Anchors	Copies all anchors from the component glyph to the composite
Edit Component	Opens a new Glyph Window with the currently active component
Properties	Opens the Component Properties panel (described below).

Component Properties

You can **set the precise size and position of the component**. Right-click the component with the Edit tool. You will see a popup menu. Select the **Properties** command in this menu and you will see the Component Properties dialog box:



Component: a

Position: X: 0 Y: 0

Scale: X: 100.0 Y: 100.0

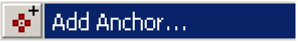
In this dialog box you can select a different glyph to be used as a component and set the component's position and scale. The component position is the distance between the composite zero point and the component's zero point.

✎ **Tip**: You may just double-click on the component to get the component Properties dialog box.

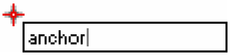
Anchors Layer

Sometimes when you work with a glyph it's helpful to mark particular positions and refer to them later. In FontLab Studio you can use a special editing layer called Anchors to do this. Anchors are simply named points that you can add, remove, move or rename. A special property of anchors is that you can use them in macro programs and in the automatic glyph construction feature.

To add an anchor, right-click anywhere in the empty space of the editing field and select the **Add Anchor** command in the popup menu:



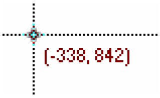
You will see a new anchor (by default it is a small red cross) and an editing field asking you to enter a name for the anchor:



Name the anchor and click the Enter key to complete.

Moving Anchors

To move an anchor, just drag it with the Edit tool. You will see the anchor position highlighted while you are dragging it:



Removing Anchors

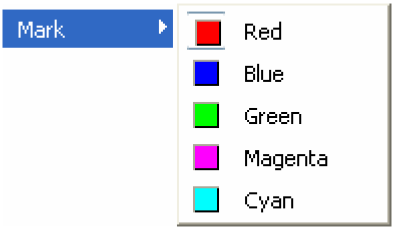
To remove an anchor, right-click it and select the **Delete** command in the popup menu.

Renaming Anchors

To rename an anchor, right-click it and choose the **Rename** command. Change the anchor name in the editing field.

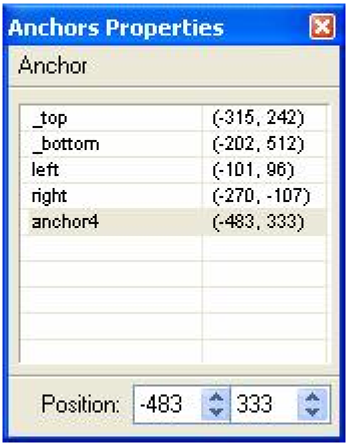
Changing Anchor Color

You may choose one of five colors to mark the anchor. Right-click the anchor; select the **Mark** command from the popup menu; and choose the color:



Anchor Properties

CTRL-click the anchor or right-click and choose the **Properties** command in the menu Properties to open the anchor Properties panel:



Anchors Properties

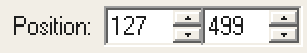
Anchor

_top	(-315, 242)
_bottom	(-202, 512)
left	(-101, 96)
right	(-270, -107)
anchor4	(-483, 333)

Position: -483 333

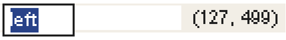
This panel lists all anchors defined for the glyph. To change the properties of one of the anchors, select it in the list and the anchor will be highlighted.

To change the position of the anchor, use the editing fields below the list:



Position: 127 499

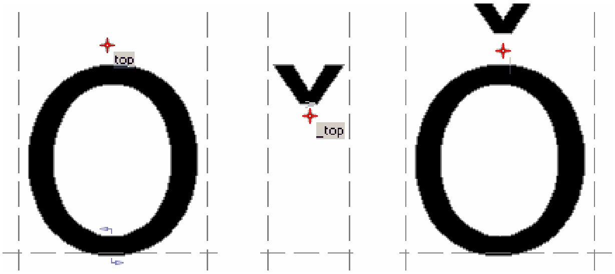
To rename the anchor, left-click the selected anchor in the list and rename it in the editing field:



left (127, 499)

Using Anchors to Build Composites

The main purpose of anchors is to mark important positions in the glyph space. In addition, anchors may be used to "link" some glyphs and form composite glyphs:



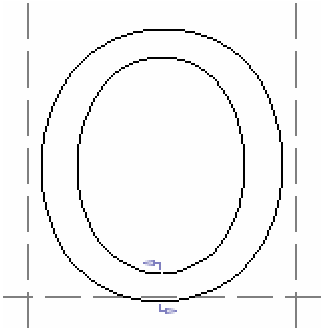
You can define a composite glyph using the Composites tool at any time, but that operation creates "fixed" composites and you would need to perform it manually for every composite glyph you want to create. For composites that consist of a base glyph and one or more "accent" glyphs this operation may take a lot of time.

In contrast, with anchors you can create "virtual" composites, which can be converted to the fixed state at any time with the **Generate Glyphs** command in the Glyph menu.

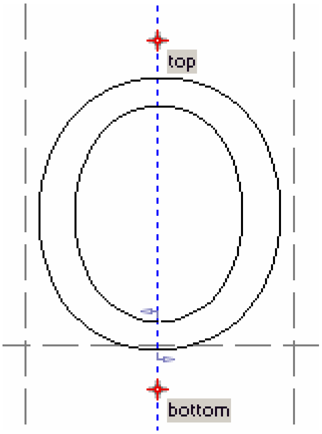
To define a virtual composite you need to define **pairs of anchors** in the base and the accent glyph. Each pair of anchor names must match by the "underscore rule": for each base anchor, there must be a corresponding accent anchor with the same name except that it starts with an underscore. So if there is a base anchor named "top" in the base glyph, there must be an accent anchor named "_top" in the accent glyph – FontLab Studio will be able to match these two anchors and create a virtual composite by snapping them to each other.

✐ **Note:** In our example, we call the anchors "top", "_top", "bottom" and "_bottom", but other names can be used, provided that they match by the underscore rule (e.g. "ogonek" and "_ogonek"). Remember: in each pair of anchor names, the base anchor always has the name without the underscore, while the name of the accent anchor always starts with the underscore.

First, open the base glyph, e.g. “o”:



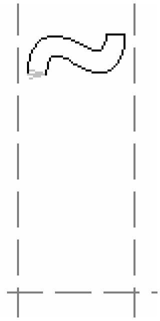
Insert the base anchors there. In our example, we create one base anchor “top”, to which the accent anchor “_top” will snap, and one base anchor “bottom”, to which the accent anchor “_bottom” will snap.



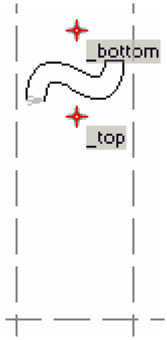
To add anchor points use the **Add Anchor** command from the Glyph Window context menu, and set the names of the anchors accordingly.

✐ **Tip:** There is a special shortcut that creates base anchors with predefined names: every time you use **Alt+Shift**+Right click, a new anchor will be added with a predefined name; first “top”, then “bottom”, “left”, “right”, and later “anchor4”, “anchor5” etc.

The next step is to add matching accent anchors in the accent glyph. Open one of the accent glyphs:



Add an accent anchor named “_bottom” at the point in the accent glyph where it will snap to the “bottom” base anchor in the base glyph. Add the accent anchor “_top” where it connects to the “top” base anchor:



You may use the **Add anchor** command to add these anchors.

✎ **Tip:** Again, there is a special shortcut that creates anchors with predefined names that match the previously. CTRL+ALT+SHIFT+Right click will first add an anchor named “_top”, if you use it again, it will add the anchor named “_bottom”, then “_left”, “_right”, and later “_anchor4” etc.

✎ **Notes:** Whether you use the Add anchor command and use arbitrary names on your own or the special shortcuts using the predefined names, what really matters is that the anchor names match by the underscore rule. Instead of positioning the “top” base anchor above the glyph, you can position it at the baseline and only adjust its horizontal placement. In such case, you would also place the “_top” accent anchor in the accent glyphs at the baseline. They need to snap to each other so their relative position needs to be consistent. Also, it doesn’t always make sense to place all types of anchors to all glyphs – it really depends on the desired character set of your font.

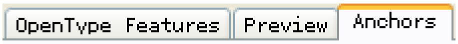
Using the Anchors Panel

Use the Anchor panel to preview “virtual” composites:

1. Open the Preview panel (**Window > Panels** menu).

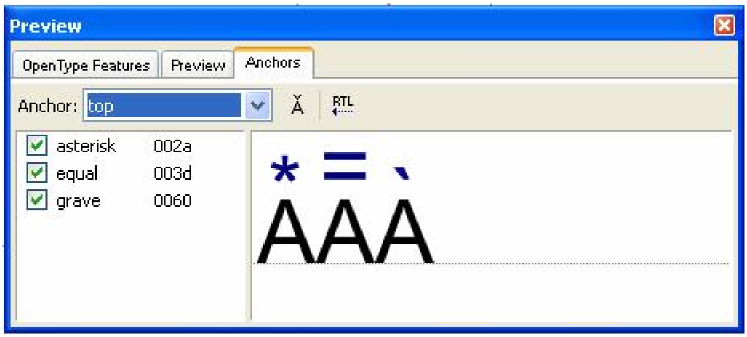
Preview

2. Select the Anchors page of the Preview panel:



OpenType Features | Preview | Anchors

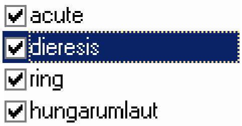
3. Open the base glyph in the Glyph Window. The Anchor panel will immediately list all of the anchors and all matching accent glyphs that have “link” anchors:



Anchor: top

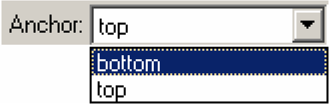
☑	asterisk	002a
☑	equal	003d
☑	grave	0060

The left list includes all accent glyphs that can be linked with the base glyph using one of the defined anchors. The first 10 resulting virtual composites are previewed in the sample string. Use the check boxes to the left of the accent list to choose which composites to preview:



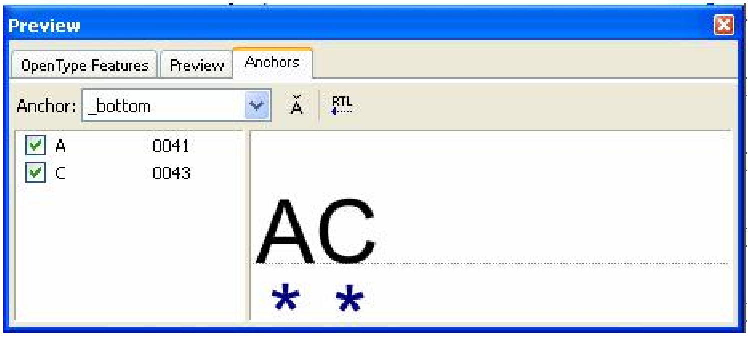
☑ acute
☑ dieresis
☑ ring
☑ hungarumlaut

4. Choose another anchor in the list to update the accent list with accents that can be connected to that anchor:



Anchor: top

5. Double-click one of the virtual composites to select one of the accented glyphs for preview:



Anchor: _bottom

☑ A 0041
☑ C 0043

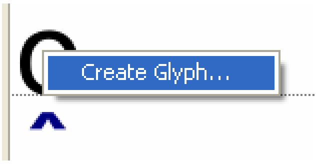
As you can see, now the anchor list includes all virtual composites that can be created using the selected accent glyph and the selected anchor. Double-click one of the virtual composites to select it for previewing.

6. If you move anchor point currently selected in the Anchors panel with the Edit tool you will see the sample string automatically updated to show the new shapes of the virtual composites.

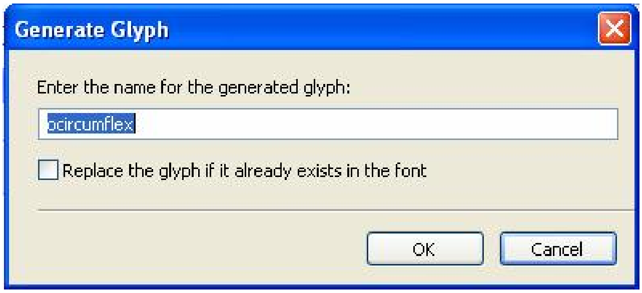
The panel contains two buttons to the right of the anchors list:

Ä	Click this button to get to the Generate Glyphs dialog box and create new composite glyphs
RTL	When this button is pressed, the anchors panel previews text in right-to-left mode, which is useful if you are working with Arabic or Hebrew glyphs.

Right-clicking on the virtual composite allows you to create a glyph after a command is selected in the popup menu:



The dialog box appears allowing you to name the new glyph:


Generate Glyph

Enter the name for the generated glyph:

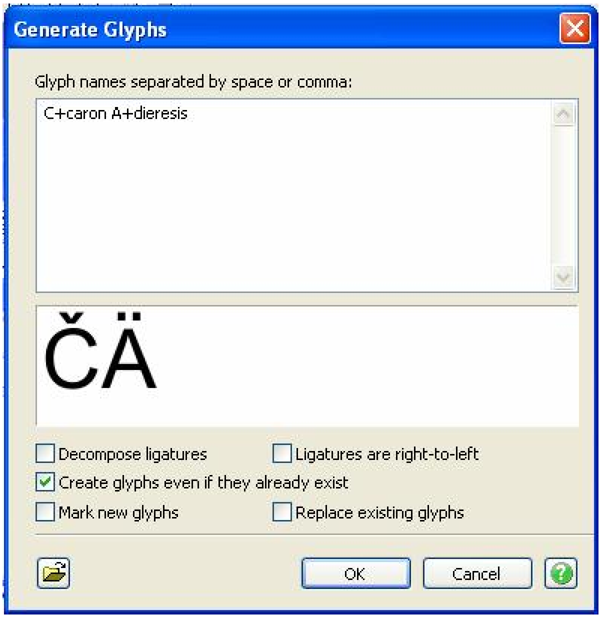
ocircumflex

□ Replace the glyph if it already exists in the font

Name the new glyph, click **OK** and the composite glyph will be added to the font and opened in the current Glyph window.

Creating Composites and Ligatures

Another way to create real composite glyphs from the base and accent glyphs is to use the **Generate Glyphs** command from the **Glyph** menu:



C+caron A+dieresis

□ Decompose ligatures
□ Ligatures are right-to-left
☑ Create glyphs even if they already exist
□ Mark new glyphs
□ Replace existing glyphs

In the dialog box enter the composite name using the simple syntax:

[base glyph name] or [composition recipe]=[result glyph name]

A composition recipe includes one or more base glyph names separated by commands. There are two commands used:

_ (underscore) – appends following glyph to the right.

The "_" command is used for creating ligature glyphs, like “fl, ffl” or others. For example:

f_l=fl, f_i=fi, c_t=ct

+ (plus) – appends following glyph as component of the composite glyph.

For example:

```
C+caron=Ccaron A+dieresis=Adieresis
```

You may enter more than one name separated by a space or colon.

In the composition recipe, the "+" command may be followed by one or two alignment commands:

^	align component to the uppercase position
~	do not move component vertically
<	align component to the left of the base glyph
>	align component to the right of the base glyph
|	center component horizontally

For example:

```
A+^>dot=Adot
```

Add the number after alignment commands to additionally shift the component. For example:

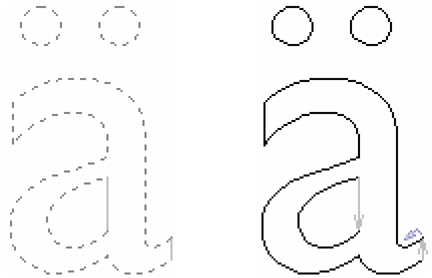
```
A+~-200cedilla=Acedilla
```

Use "%=" instead of "=" to decompose created composite glyph. For example:

```
A+^ring%=Aringdecomposed
```

Click on the ? button to view full description of the commands syntax used in the dialog box.

Check the **Decompose ligatures** option below the names field to “paste” all the components’ outlines and make a decomposed glyph:



Check the **Ligatures are right-to-left** option below the names field to reverse the order of components in ligatures. If this option is on, you will get "lf" instead of "fl", for example.

If you click on the 📂 button you can choose and open the text file with glyph name definitions prepared in advance.

Check the **Mark new glyphs** option to mark created glyphs in the Font window with color.

Check the **Replace existing glyphs** option to place created glyphs in the occupied cells of the font chart. An old glyph will be moved to the end of the chart in this case.

✎ **Tip:** By default, FontLab Studio automatically recognizes if an uppercase composite glyph is generated and shifts the accent components up by the difference of the font’s caps height and x-height. If you are unhappy with the default positioning of the accents in the generate uppercase glyphs, temporarily modify the font’s caps height setting in the Font Info dialog and generate the glyphs again. If your font contains an extra set of specially-positioned uppercase accents and you do not want FontLab Studio to shift them up, use the “~” command in the recipe, e.g. A+~acute.case=Aacute

✎ **Note:** If you are generating a composite glyph from components that already have corresponding base anchors and accent anchors, the anchor positioning will override the positioning used in the composition recipe.

Aliases Table

FontLab Studio comes with an alias.dat file (located in the \Program Files\Common Files\FontLab\Data folder), which is the text file that defines the decomposition of common composite glyphs. Here is a part of the alias.dat file:

```
%%FONTLAB ALIASES
nbspace space
hyphen minus
periodcentered middot
onesuperior one
ordmasculine o
onequarter one_slash_four
onehalf one_slash_two
```

As you can see, every line of the file contains the real name of the component glyph is followed (with a single space as the separator) by the decomposition name:

```
onequarter one_slash_four
```

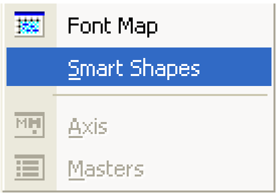
This means that when you request the glyph named “onequarter” in the Generate Glyphs dialog box, FontLab Studio will create a new glyph named “onequarter” but built as a ligature using the “one”, “slash” and “four” components as if you had entered the name “one_slash_four”.

You can modify this table to include glyph names you often need to create.

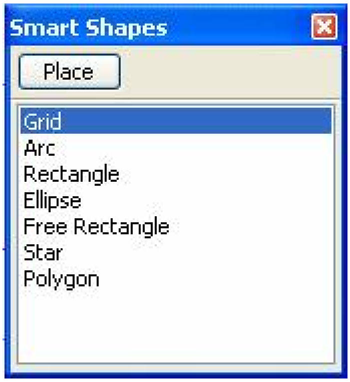
Using the Smart Shapes Panel

In FontLab Studio you can add predefined customisable graphical shapes to glyphs. There are seven shapes included with FontLab Studio and it is possible to add more. You can select a shape from the Smart Shapes panel.

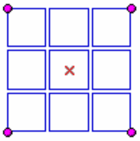
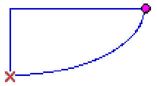
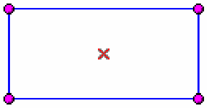
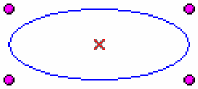
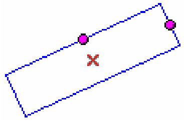
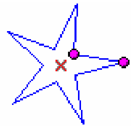
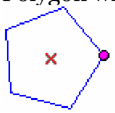
To open the Smart Shapes panel, select the **Smart Shapes** command in the **Window > Panel** menu:



The panel consists of a shapes list and a **Place** button that you click to add a shape to the outline:



Here is a brief description of each shape:

Grid	Simple grid (a customizable set of rectangles or squares) 
Arc	Simple closed or open arc contour 
Rectangle	Simple rectangular contour 
Ellipse	Circle or ellipse 
Free rectangle	Rectangle that can be freely rotated 
Star	Star with customizable number of rays 
Polygon	Polygon with customizable number of vertices 

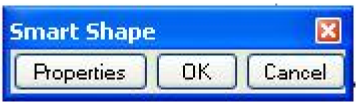
To add a shape to a glyph's outline, select the shape that you want to add and press the **Place** button on the Smart Shapes panel. Or just double-click the shape's name in the list.

When you press the **Place** button you will see the shape appear in the middle of the Glyph Window. Shapes have a blue outline and several control handles that you drag to customize it.

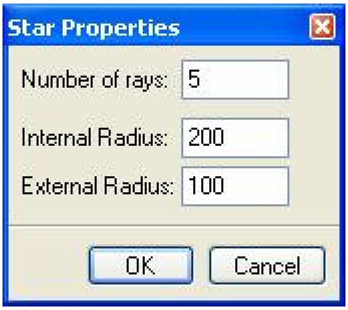
Drag the cross control handle in the center of the shape **to move it**. The behaviour of the other handles depends on the shape's type. For example, in the Star the handles determine the internal and external radius of the star's rays and the angle between vertices that form a ray.

Try placing some shapes into the Glyph Window and drag their control handles to see what they do. Use the **Shift** key to constrain the movement of handles. For example, in the Rectangle shape holding the **Shift** key down will produce a square instead of a rectangle.

Every shape has a property panel where you can set the shape's parameters precisely. Press the **Properties** button on the control panel to open the Properties panel for the shape:



Here is a preview of the Star's panel:



Number of rays: 5

Internal Radius: 200

External Radius: 100

In this properties panel you can change the number of the star's rays and the values of the internal and external radii.

FontLab has a standard for smart shapes modules. Fontlab Ltd. may offer additional Smart Shapes in future.

Importing and Exporting Glyphs

With FontLab Studio you can exchange outline data with other vector-editing programs, either using the clipboard of files. The most common format for vector data is Encapsulated PostScript (EPS).

Vector editing programs such as Adobe Illustrator and Macromedia Freehand typically are able to open and save EPS files. EPS was the native file format of Adobe Illustrator until version 8.0, though more recently, the Adobe Illustrator file format (.AI) is based on PDF rather than EPS.

FontLab Studio can exchange outline data with Adobe Illustrator via the clipboard, and also export and import glyphs to and from AI-compatible EPS files. On one hand, you can use Adobe Illustrator or other compatible applications to draw your glyphs and then import them into FontLab Studio. On the other hand, files exported from FontLab Studio can be opened in any program that supports AI-compatible EPS files, e.g. Macromedia Freehand, Corel Draw, ACD Canvas etc.

By default, **all font units** in FontLab Studio **correspond to points** in Adobe Illustrator or other vector drawing applications. This means that if you want your uppercase letter H to be 700 units high in FontLab, you should make it 700 pt high in Illustrator. 72 pt = 1 inch, so 700 pt = 9.72 inch.

Exporting Glyphs

To copy part of the glyph’s outline to a vector-editing program use the usual copy procedure. The selected portion of the outline will be copied to the Clipboard. Then switch to your vector-editing program (using the Task Bar) and select the **Paste** command from the **Edit** menu.

To export a glyph to an Adobe Illustrator 8-compatible EPS file:

1. Select the **EPS** command from the **File > Export** menu.
2. Select the export directory and enter the name of the EPS/AI file in the standard File Save dialog box.
3. Press the **OK** button in the dialog box, and the EPS/AI file will be exported to the designated directory.

You can also **export several glyphs at once**: Switch to the Font Window, select the glyphs that you want to export and select the **EPS** command from the **File > Export** menu. You will see a Save File dialog box where you enter a prefix file name for the exported glyphs. Each glyph will be exported to its own file with the file name consisting of the prefix plus the sequential number of the exported glyph.

Preparing Artwork in Adobe Illustrator

If you intend to use Adobe Illustrator to draw the glyph outlines:

In Illustrator, go to **Edit > Preferences > Units & Undo** or **Units & Display Performanc**e. Change all units to points (1 point is equal to 1 unit in FontLab). Go to **Preferences > Files & Clipboard**. Disable **PDF**, enable **AICB** and select **Preserve Paths**. In **Preferences > Guides & Grid**, set **Gridline every: 10 pt** and **Subdivisions: 10**.

Still in Illustrator, select **File > New**. Set the width of the document in points to be the double of the UPM size of your font (e.g. 2000 pt for a 1000 UPM font). Set the height of the document to be the same as UPM size – Descender (e.g. 1000 – (–263) = 1263 pt). Select **Window > Info, View > Show Rulers**, **View > Snap to Grid**. Disable **View > Guides > Lock Guides**. Optionally select **View > Show Grid**.

Now click on the top ruler of the Illustrator document window and drag out a guideline. Position it at the height that has the same (positive) value as the (negative) descender of your font (e.g. 263 in our example). From the left ruler, drag a guideline and position it at 0. Click at the top left corner of the Illustrator document window (where the top ruler and the left ruler meet) and drag out the origin point to where the two guidelines you have just drawn cross. Finally, click on the top ruler and drag guidelines to the positions of your ascender, x-height, and caps height.

You can draw your letters. Remember to assign some kind of fill to all your Illustrator drawings and avoid drawing letters that exceed the bottom or the top of the document size.

If you have already drawn some letters before, copy them to the newly created document, place and re-scale so that they fit between the guidelines you've drawn. Remember that all points of your letters should snap to the grid (otherwise FontLab will round their position).

When you finished drawing your glyph in Illustrator, choose **Select > All, Edit > Copy** if you want to copy the outlines via clipboard or **File > Export > Illustrator Legacy EPS** or **File > Save As**, and select **Illustrator 8 EPS** as your file format, if you want to save the artwork as an EPS file.

Importing Glyphs

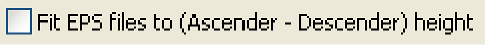
To paste an outline from a vector-editing program into FontLab Studio select the outline object that you want to copy and choose the **Copy** command from the **Edit** menu (in the source application). To place the copied outline in FontLab Studio switch to FontLab Studio (Glyph Window) and select the **Paste** command from the **Edit** menu.

To import an Illustrator 8-compatible EPS file into FontLab Studio, open a Glyph window (make a new glyph if necessary) and choose **Edit > Paste** if you're pasting from clipboard or **File > Import > EPS** if you're importing from a file.

Manual and Automatic Scaling

If the imported drawings end up being too large or too small, go back to your outline-drawing application and scale the artwork accordingly. Remember that if the option **Fit EPS files to (Ascender-Descender) height** in **Options > General > EPS and bitmap background** is disabled, 1 pt in Illustrator/EPS corresponds to 1 font unit in FontLab Studio and artwork is imported without any scaling.

Alternatively, instead of scaling all your artwork to a particular height (e.g. 700 pt) in Illustrator, you can also have FontLab Studio **automatically scale** the artwork for you. This is particularly useful if you import pre-existing logos or similar symbols to FontLab Studio. If you wish that FontLab Studio automatically scales all pasted or imported artwork to fit the font's height, enable the **Fit EPS files to (Ascender-Descender) height** option located in the **Options > General > EPS and bitmap background** dialog box:



□ Fit EPS files to (Ascender - Descender) height

✐ **Nodes in digital fonts can only have integer coordinates.** On the other hand, your Illustrator artwork can have nodes with fractional coordinates such as 161.352 pt or 354.78 mm. When FontLab imports a drawing, it has to round them to integer values – because it cannot generate fonts with fractional coordinates. The smaller your object is, the more extreme the rounding (and therefore, distortion) will occur. Therefore, we advise that you always scale your artwork in Illustrator to the appropriate size before copying it to FontLab Studio so that no rounding will be minimal. Also, if you work in Illustrator or similar applications, avoid fractional coordinates altogether by setting your grid to 1 pt and making sure that all your nodes snap to it.

✐ **Note:** Remember that FontLab Studio can only edit font outlines, not features such as color of outline, outline width or fill color. Regardless of the settings you have in the vector-editing application, only information about outlines will be copied to FontLab Studio. Ideally, in your vector-editing application set the **fill color** of all your objects to **100% black**, and the width of the **outlines** to **none**.

Printing a Glyph

To print a sample of the current glyph, select the **Print** command in the **File** menu while the Glyph Window is active.

Refer to the “Printing and Proofing Fonts” chapter for further details.

Editing Metrics

The tools in FontLab Studio for editing metrics data are common to all FontLab applications, so if you have learned how to use these tools in FontLab Studio you will be ready to use these same tools in any of the FontLab programs.

7

What are Font Metrics?

A program that aligns and spaces text calculates the total width of all the characters in a paragraph. It then adjusts the widths of the space characters that separate the words and tries to put as many characters as possible into one line. The information about the words that are used to make a paragraph, and the information about the width of the individual characters is the only information necessary. To determine distances between lines, the application uses information common to all glyphs in the font, such as the length of ascenders and descenders, and a suggested line gap, and places the lines of text on the page using these distances. This information about horizontal and vertical spacing is what is known as font metrics.

All font and glyph metrics are expressed in font units, the same units that are used to measure node coordinates and settings such as UPM size.

There are **four** principal types of metric information in fonts:

1. **Vertical font metrics** (also known as *font family metrics*): metric values common for the entire font and often shared across a family, used to determine the linespacing. This includes baseline, the ascender and descender lines, the caps height, the x-height and the line gap. These are discussed in the "Font Header" chapter and the "Vertical Metrics" section of the "Glyph Window" chapter.
2. **Horizontal glyph metrics** (usually referred to as *glyph metrics* or just *metrics*): metric values of individual glyphs that are used to compute line lengths. This includes advance widths and sidebearings. These are discussed in **this chapter** as well as in the "Metrics" section of the "Glyph Window" chapter.
3. **Kerning**: pair-wise adjustment of horizontal glyph metrics.
4. **Vertical glyph metrics**: the vertical advance "widths" (called *vertical advance vector*) for Asian glyphs used to type in vertical direction from top to bottom. These are discussed below.

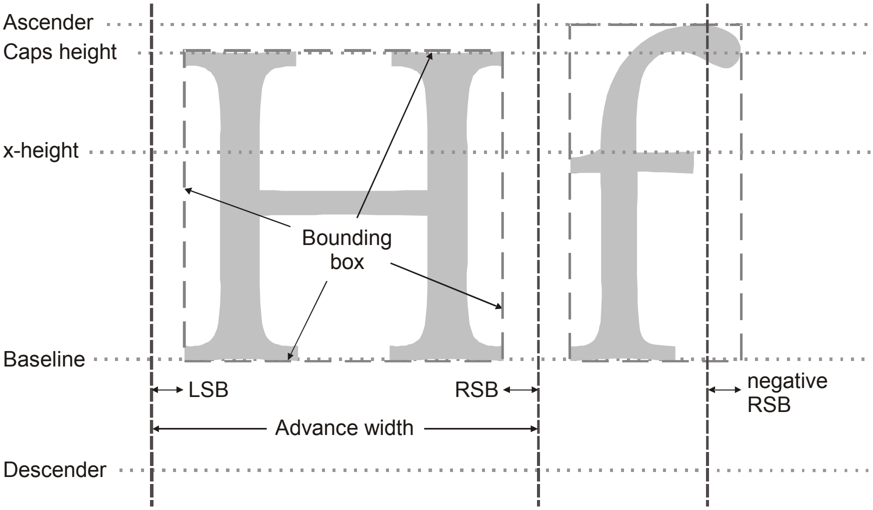
This chapter discusses primarily the horizontal and vertical **glyph metrics** as well as **kerning**. For **vertical font metrics**, please consult the "Font Header" chapter.

Horizontal Glyph Metrics

Each glyph in the font has a **bounding box**, a rectangle positioned in a theoretical rectangular cell. The most extreme nodes of the glyph determine the bounding box. Each glyph usually also has **sidebearings**: extra space to the left of bounding box (left sidebearing, LSB) and to the right (right sidebearing, RSB). The sum of the sidebearings and the bounding box width define the **advance width** (often just called *width*).

The intersection of the baseline and the left sidebearing is called the **zero point**. Horizontal (x) node coordinates to the right of the LSB line are positive and coordinates left of the LSB line are negative. Similarly, vertical (y) node coordinates above the baseline are positive and those below the baseline are negative.

When an application is laying a line, it positions the next glyph's LSB line right at the RSB line of the previous glyph.

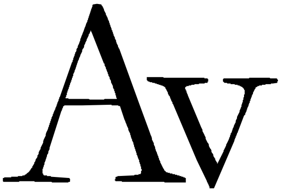


Glyphs may have negative sidebearings, e.g. the rightmost edge of the bounding box may be positioned to the right of the RSB line.

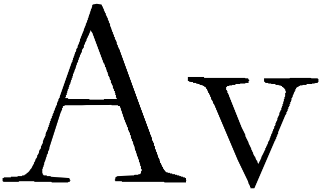
Kerning

Kerning information is used to adjust the space between specific pairs of characters. As you can see in the following picture some characters may be well spaced with just the bearings rectangle but other characters are not. To fix this problem a special technique called kerning has been developed.

A good example is the “Av” pair. In the following picture you can see two examples of inter-character spacing, with and without kerning:



With kerning



Without kerning

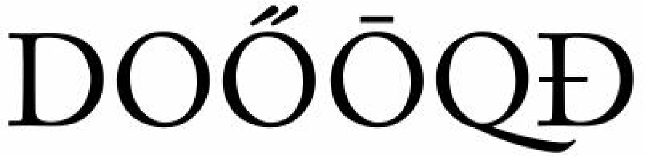
You can see that only the kerned image is optically correct because it can compensate for the problem caused by the special form of the “v” and “A” glyphs printed in sequence that leaves too much space between the letters.

Older font formats (Type 1, MM, TrueType without OpenType tables) implement kerning using kerning pair lists. Each kerning pair defines the number of font units (usually negative) by which the right sidebearing of the first glyph in a pair should be horizontally shifted when the glyph is followed by a specified second glyph. In the example above, the advance width of the “A” glyph may be 400 units and the advance width of the “v” glyph 250 units. The kerning pair “A v -50” defines that if “A” is followed by “v”, the advance width of “A” should be reduced by 50 units.

A typical problem of the plain kerning pair list approach is that for accented characters, many duplicate pairs need to be included in the font. The pairs “Av”, “Äv”, “Áv” etc. usually should be kerned by the same amount, yet each of them needs to be included separately in the font – otherwise it will not be kerned. This results in rather large tables that unnecessary increase the size of the font and may hamper the performance of some applications. Therefore, in OpenType fonts, a more sophisticated kerning approach called class-based kerning has been developed to help address this problem.

Class-Based Kerning

Some glyphs have a very similar appearance on both sides:



All these glyphs have the same shape on the right side

It seems natural to group such similar glyphs into *glyph classes* and then define kerning between these classes. This approach may dramatically decrease the number of individual kerning pairs to declare.

Class kerning, when defined for a font, may be used during the design process to decrease the amount of kerning work.

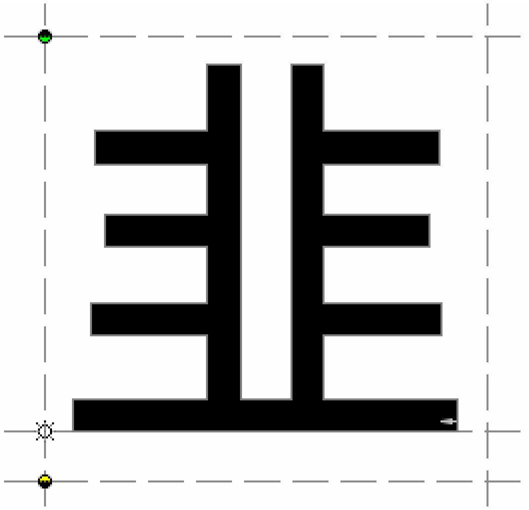
In Type 1, MM and old-style TrueType fonts, class-based kerning should be converted to plain kerning before the font is generated.

In OpenType (PS and TT) fonts, class-based kerning may be exported directly; it will be directly supported by applications that support OpenType Layout features, such as Adobe InDesign, Adobe Illustrator CS, Adobe Photoshop CS, TextEdit, Pages or Keynote on Mac OS X, Mellel on Mac OS X, and many others.

In addition, for OpenType PS fonts, the Adobe system font rasterizer (ATM) on Windows and Mac OS X automatically converts the Western European subset of the class-based kerning included in the font into plain kerning when the font is installed.

Vertical Glyph Metrics

When typing text in some Asian languages, it is often necessary to specify the vertical alignment of characters in the text. In this case, information about the vertical glyph metrics is stored in the font file:



Usually, all Chinese, Japanese or Korean glyphs written in vertical layout have the same vertical advance "width" (called the *vertical advance vector*) so only the position of the glyph within the rectangular glyph cell needs to be specified.

However, it is possible to adjust the vertical advanced vector of individual glyphs. To define a vertical glyph advance vector in FontLab Studio, open the glyph in the Glyph Window, hold the **SHIFT** key and move the base line. You will be able to set the top vertical glyph sidebearing (marked with a black-green symbol) and the bottom vertical glyph sidebearing (marked with a yellow-black symbol).

Note that this information is only used by applications that support vertical text layout, and only if the vertical glyph metric information is specified for all glyphs. Do not confuse vertical glyph metrics with vertical font metrics, i.e. ascender or descender lines that are used in text that is set horizontally.

Metrics Files

Information about the advance width of a glyph is usually located in font files. Kerning information may also be included in the file. In OpenType and FontLab font formats both metrics and kerning data are located in a single font file. In Type 1 (PostScript) fonts the metrics and kerning data are located in separate files.

There are two possible formats for the metrics files that are used with Type 1 fonts: AFM and PFM. AFM files (*Adobe Font Metrics*) are text files containing all the metrics and kerning information for a given font. These files are legible as text and can be edited in any text editor. PFM files (*Printer Font Metrics*) are metrics and kerning files used by the Windows operating system. They are binary files and cannot be read without special utilities. AFM files are a standard format for the exchange of metrics information for PostScript fonts. This information can be read directly by several operating systems and programs.

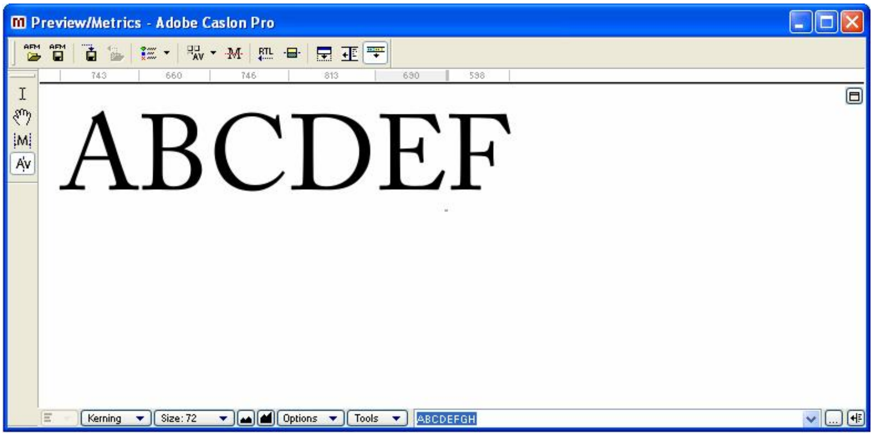
In the Windows OS Multiple Master Type 1 fonts store metrics information in another format. There is a binary Multiple Master Metrics file, which usually has the file extension MMM, and a text Multiple Master metrics file. MMM files include information about the font's axes and masters, multiple-master data for glyphs' metrics and kerning and other font header data. The text metrics files have a composite structure: there is a linking file that describes the font header, axes and masters information, and separate AFM files (with metrics and kerning data) for each master font.

FontLab can import and export metrics and kerning information in any of these formats.

Metrics Window

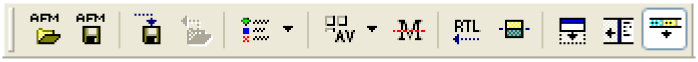
FontLab has a special window where you can edit the metrics and kerning information. It is called the Metrics window.

To open the Metrics window select the **New Metrics Window** command in the **Window** menu. The Metrics window will appear:



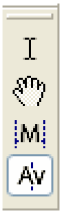
The Metrics window consists of several parts:

1. A Metrics window toolbar with controls for importing and exporting metrics files, automating metrics or kerning generation and other commands:



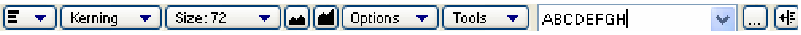
By default the toolbar is docked to the top of the window, but you can drag it to the bottom or leave it floating around.

2. A Metrics Tools toolbar with four buttons that allow you to select one of the metrics tools:



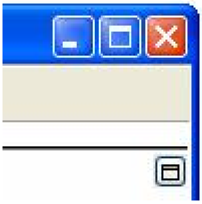
By default this toolbar is vertically aligned and docked to the left side of the window. You can drag it anywhere or dock to any side.

3. A local command area that is used to select a mode for the Metrics window and a string for metrics or kerning editing:



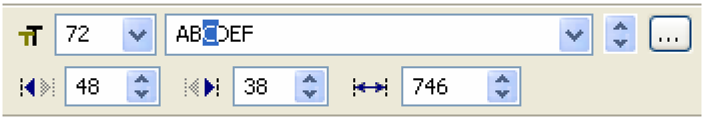
4. The editing area where the edited string with controls appears.

5. The header button, located in the top-right corner of the window:



Use this button to switch the local command area between top and bottom locations (see below).

The local command area of the Metrics window may be located in the bottom (default) or top area of the window. When the local command area is in the top location, it includes controls to modify metrics or kerning:



The content of this properties area depends on the current mode of the Metrics window.

Editing Modes

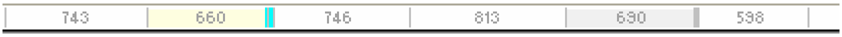
The Metrics window may work in four different modes:

Text mode	Is used to enter and edit text in the main editing area. Works very similar to any standard text editor such as Notepad
Preview mode	This mode is used to preview text with kerning applied and check it at different sizes. Also the position and width of the underline and middle-stroke line can be adjusted in this mode
Metrics mode	This mode is used to adjust the metrics of individual glyphs. Kerning is not visible in the metrics mode
Kerning mode	In this mode you can edit pair kerning (both "flat" and class-based).

Other things that appear in the Metrics window are the: Ruler, Panel and Table.

Metrics Ruler

The Metrics Ruler is a narrow bar located above the editing area:



Its purpose is very simple: to provide an overview of metrics and kerning data for the current line of text in the editing area.

The Metrics Ruler shows the width of the glyphs (in the middle of the glyph cell) and kerning. Kerning data appears on a light-blue background if kerning is negative (as in the AV pair) and on a yellow background when kerning is positive.

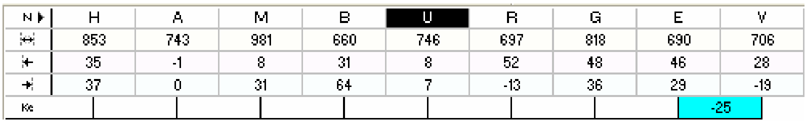
Of course, kerning information appears on the ruler only when the Metrics window is in kerning or preview mode.

The Metrics Ruler also may be used to create new global guidelines, but we will talk about that later.

You can control the appearance of the ruler using the Ruler command in the Options menu (if the local command area is at the bottom) or with the Ruler button on the Metrics Window toolbar.

Metrics Panel

The Metrics Panel is a horizontally oriented table that may appear above or below the editing area:

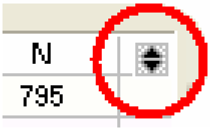


N ▸	H	A	M	B	U	R	G	E	V
↔	853	743	981	660	746	697	818	690	706
⇤	35	-1	8	31	8	52	48	46	28
⇥	37	0	31	64	7	-13	36	29	-19
Ke								-25	

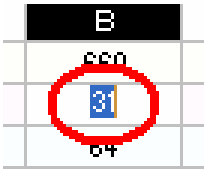
The Metrics Panel includes the following information for every glyph in the editing field: name, width, left and right sidebearing and a pair kerning value with the next glyph.

You may control the appearance of the Metrics Panel using the Panel command in the Options local menu (when the local command area is at the bottom) or with the Panel button on the Metrics window toolbar: ▤.

Click on this button in the top-right area of the panel to move it top or bottom:



If you click on any cell in the Panel you may change the value:

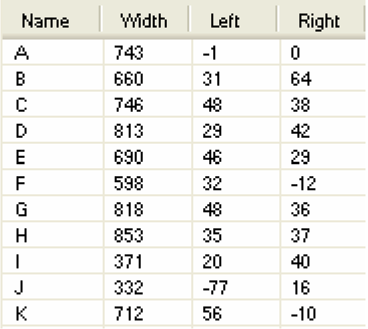


Use the up and down arrow keys to navigate between different values for the same glyph. Use the Tab and Shift+Tab keys to navigate between glyphs.

When the Metrics Panel is visible, the properties area of the command area (if it is at the top) disappears.

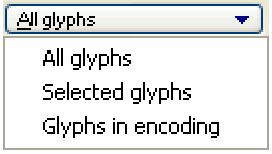
Metrics Table

Use this button in the bottom control area or the Table button of the Metrics Window toolbar to open the Table:



Name	Width	Left	Right
A	743	-1	0
B	660	31	64
C	746	48	38
D	813	29	42
E	690	46	29
F	598	32	-12
G	818	48	36
H	853	35	37
I	371	20	40
J	332	-77	16
K	712	56	-10

This table contains metrics or kerning information for all the glyphs in the font. Actually you can decrease the number of glyphs (or kerning pairs) that appear in the table using the filter control that is located below it.



When the Metrics window is in metrics mode, every row in the table contains the name of the glyph, the glyph width and left and right sidebearings.

In kerning mode every row contains the names of the first and second glyphs in the pair and a kerning value. Sometimes cells may contain additional marks that help to manage class-based kerning but we will discuss that later.

Context Menu

As in all other windows of FontLab Studio, if you right-click the editing area, you will see a context menu which contains commands that are related to the current mode of the Metrics window. We will describe the contents of each menu when we talk about the different modes.

Metrics Window Toolbar

This is a simple list of all the buttons available on the toolbar:

ABCD	Opens a metrics file (PFM, AFM or MMM format)
ABCD	Saves a metrics file
	Quick Save – saves the current metrics files to a temporary file
	Opens the metrics from a temporary file saved by Quick Save
▾	Opens a command menu (see below).
AV ▾	Opens the class kerning menu. Discussed in the Editing Kerning section.
M	Activates support for the measurement line. When it is active, all metrics are measured along the line
RTL	Changes the preview panel to the right-to-left reading mode
	Activates the flip mode in which all glyphs appear flipped vertically.
	Opens the Panel
	Opens the Table
	Opens the Ruler

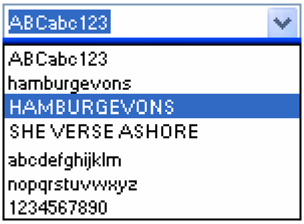
The Command menu contains the following commands:

	Opens the Automatic Metrics or Automatic Kerning generation dialog boxes.
AV+	Opens the Add pairs dialog box where you can define new pairs the easy way,
✕	Opens the Reset Kerning dialog box
	Opens the Kerning Editor dialog box
	Opens the Assistance dialog box, which may be Metrics Assistance or Kerning Assistance, depending on the current mode.

Selecting a String for Previewing or Editing

To prepare text for editing you have the following options:

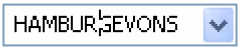
1. Select one of the predefined sample strings in the sample text combo-box:



ABCabc123

ABCabc123
hamburgevons
HAMBURGEVONS
SHE VERSE ASHORE
abcdefghijklm
nopqrstuvwxyz
1234567890

2. Enter the text in the sample text field of the control area (top or bottom located):



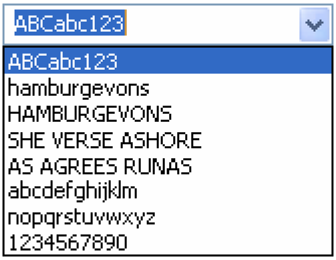
HAMBURGEVONS

3. Enter the Text mode and type sample text directly in the Editing area.

4. Append glyphs to the sample text by dragging them from other windows.

Selecting a Predefined Sample String

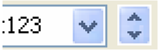
Click on the button to the right of the sample text field and select the string for editing:



ABCabc123

ABCabc123
hamburgevons
HAMBURGEVONS
SHE VERSE ASHORE
AS AGREES RUNAS
abcdefghijklm
nopqrstuvwxyz
1234567890

Or use the spin buttons to the right of the field to select the next or previous string:



You can also use the **Ctrl+PgUp** and **Ctrl+PgDn** keyboard shortcuts to navigate the list of sample strings up and down.

Editing a Sample String

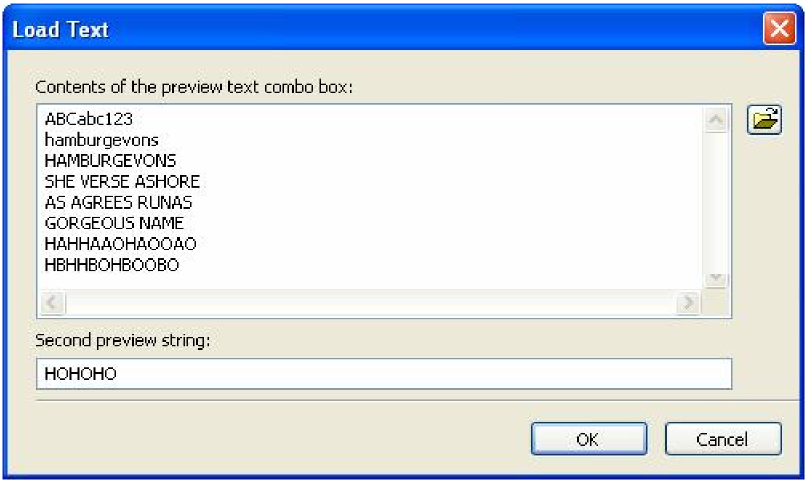
Just click the sample string text field and modify it as you want. You may type text into it or you may use FontLab glyph-access notation to access glyphs that have no characters mapped to the current keyboard layout.

FontLab Sample Text Notation:

Character	Meaning of the following text
/	Glyph name follows the slash: /A Follow the name with another '/' to continue entering glyph names or enter a *space* after the glyph name to continue entering ANSI characters: /Acaron/Adieresis BCDEF You may enter the code of the character according to the currently active encoding or a codepage: /128/130 In this case the code number must contain only digits.
//	'/'
/#	Unicode index of the glyph in hex format /#0446
\	Unicode index of the glyph in hex format may be preceded with 'u' \0445\0448\u0446 BCDE
\\	'\'
\n	Line break in the preview

Customizing the Sample Stri ng List

If you click on the button … to the right of the sample list control, you will see the following dialog box:



Load Text

Contents of the preview text combo box:

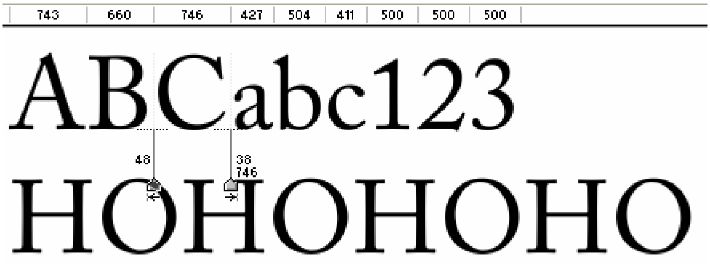
```
ABCabc123
hamburgevons
HAMBURGEVONS
SHE VERSE ASHORE
AS AGREES RUNAS
GORGEOUS NAME
HAHHAAOHAOOAO
HBHHBOHBOOBO
```

Second preview string: HOHOHO

As you can see, there is a big multiline editing field that contains all the strings in the sample list. Change it as you want or click on the 📂 button to fill it from a text file.

You may use special characters as described in the previous section to enter glyph codes, names or Unicode indexes. Type **\n** to force a line break in the sample text.

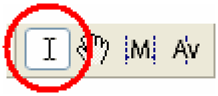
The *Second preview string* textbox contains text that will appear as an additional line below the editable sample text. It’s very useful for comparing spacing and kerning to some "standard" string that is representative for your font.



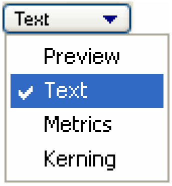
Enter some text, close the dialog box and then use the sample string scroll buttons or the **CTRL+PGUP** and **CTRL+PGDN** keyboard shortcuts to see how it works. Do not forget to click on the editing area before using any shortcuts.

Entering Text in Text Mode

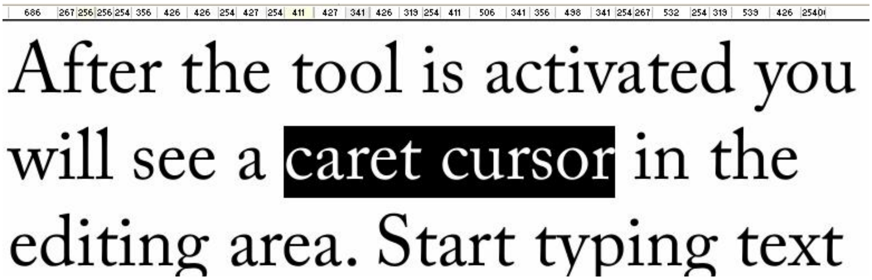
You may edit text in the editing area similarly to how you do it in any text editor. Just activate the Text tool on the Metrics Tools toolbar:



You can also select Text in the mode selection menu in the local command area docked to the bottom:



After the tool is activated you will see a caret cursor in the editing area. Start typing text. You may also drag-select text and use the Edit > Copy and Edit > Paste commands to move blocks of text inside the Metrics window or from external applications.



After the tool is activated you will see a caret cursor in the editing area. Start typing text

The Copy-paste feature of the text tool is compatible with Unicode so if you paste some Unicode text, it will appear unchanged (if characters of that text are present in this font).

Check the sample string editing field, you will notice that it automatically creates FontLab notation for all non-ANSI characters.

Using Drag-Drop

The easiest way to fill a sample string is **using the drag-drop method**. You can simply drag any glyph from the Font Window and drop it in the Metrics Window and it will be inserted in a position highlighted by the caret. If you want to *add* glyphs to the string, hold the **SHIFT** key. If you want to *replace* the sample string with the dropped glyphs, hold down the **CTRL** and **SHIFT** keys.

You can also drag glyphs from the Classes panel - glyphs or classes. If you drag a class from the class list, only the key glyph of the class will be inserted. If you want to insert all glyphs of the class, hold down the **ALT** key.

Navigating in the Sample String

You can also use the **PAGE UP** and **PAGE DOWN** keys on the keyboard to navigate within the sample string. The **HOME** and **END** keys will jump to the beginning and end of the current line of text.

To scroll the window you can press the space bar and scroll the Metrics window with the hand tool.

If the sample text is really long, switch the Metrics window into Preview mode and use the hand tool **to scroll the editing area**.

Activating and Browsing Glyphs

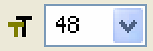
Click on any glyph in the Editing area and it will be selected for further editing. In metrics mode you will see the right and left handles that allow you to change the sidebearings and in kerning mode you'll see a pair handle that highlights a position between the first and second glyphs in the pair.

After you activate a glyph you can browse the glyph collection in the current font. Use the "previous glyph" and "next glyph" shortcuts. By default they are **Ctrl + [** and **Ctrl +]** respectively.

In Metrics and Kerning modes you can **change a glyph in the string** just by clicking the related key on the keyboards or by quickly entering its name.

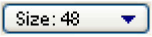
Selecting Preview Size

If the local command area is in the top part of the Metrics window, type the desired point size in the **String Size** combo box:

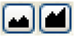


or select one of the predefined sizes from the list.

If the local command area is at the bottom, you will get a size menu:



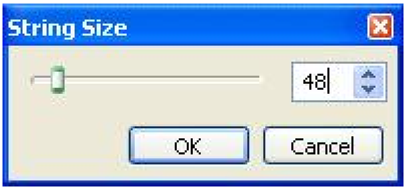
and two buttons to the right of it:



Use these buttons **to decrease or increase the size** of the sample string.

Both the combo box and the Size menu contain an Auto command. Select it and the size of the sample text will be automatically selected to fit one line of text (or two lines if the second sample string is not empty) into the current vertical size of the editing area.

The **Size** menu (available when the local command area is at the bottom) also has the **Custom...** command. Select it and you will see the following dialog box:

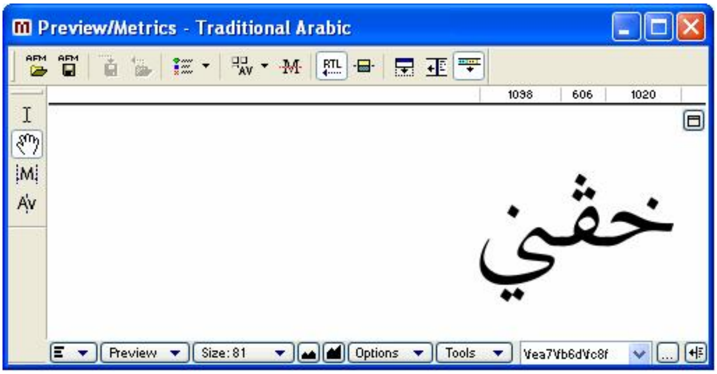


Type in the desired point size in the text field at the right or use the slider to adjust the size. You will see the result immediately in the Metrics window.

If the sample text becomes too large to fit in the window, a vertical scroll bar will appear allowing you to view all the editing areas of the Metrics Window.

Right-to-Left Mode

If you are working on a font that requires right-to-left reading, like Arabic or Hebrew, you can change the Metrics window to the right-to-left mode. Click on the RTL button on the toolbar and you will see that the preview string is written from right to left:

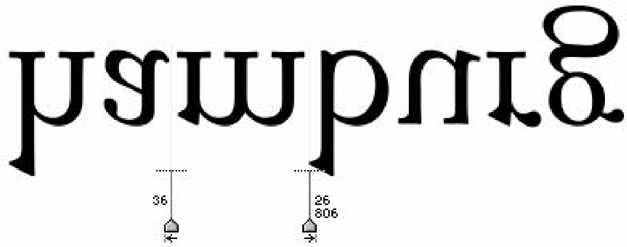


Note: The Metrics window in FontLab Studio does **not** support OpenType Layout features, so Arabic shaping is not automatically performed. You need to explicitly enter the glyph names or Unicode codepoints of the presentational forms to display the text.

Flipped Mode

Sometimes it is useful to see your font without being able to read the text. It may help you to better visualize the even placement of the stems and to recognize the rhythm of the black and white features.

Click on the Flip button to flip all the glyphs around their horizontal axis:



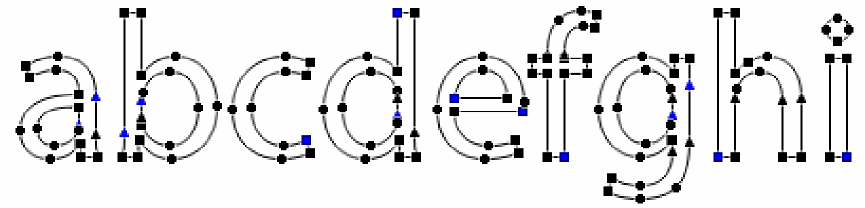
The text remains editable and all the tools will work with the flipped text.

Previewing Outline and Nodes

Some commands in the View > Show Layers menu work when the Metrics window is active:

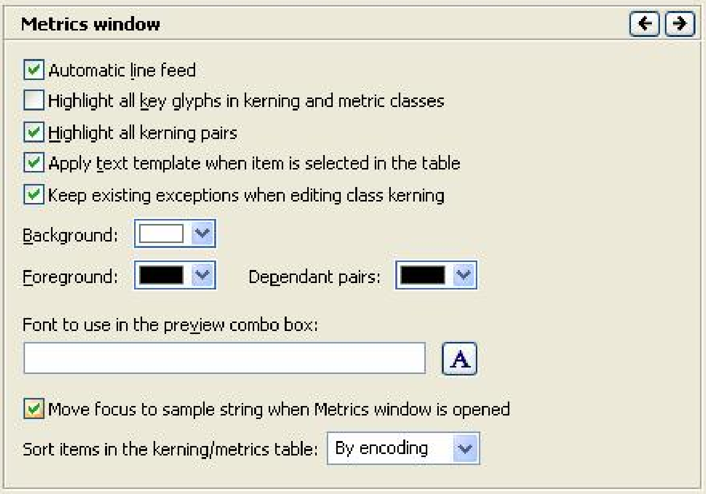
	Guidelines	Global guidelines are visible in the current line
	Glyph metrics	Baseline is visible
	Vertical metrics	Font vertical metrics are visible in the current line
	Nodes	Nodes are visible
	Preview	Outlines are filled

This means that it is not necessary to have the glyph outlines always filled while you are working with font metrics. For example you may need to switch off the fill and switch on the nodes to visually compare placement of nodes in some glyphs:



Customizing Colors

You are not restricted to black text on a white background. Open the Metrics options page (Tools > Options > Metrics Window):



Metrics window

☑ Automatic line feed
□ Highlight all key glyphs in kerning and metric classes
☑ Highlight all kerning pairs
☑ Apply text template when item is selected in the table
☑ Keep existing exceptions when editing class kerning

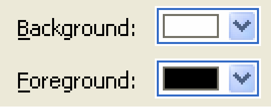
Background: □
Foreground: ■   Dependant pairs: ■

Font to use in the preview combo box:

☑ Move focus to sample string when Metrics window is opened

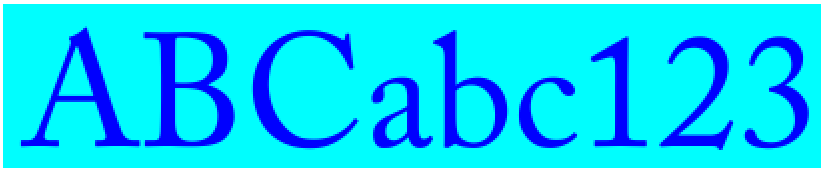
Sort items in the kerning/metrics table: By encoding

Use these controls to customize the foreground and background colors:



Background: □
Foreground: ■

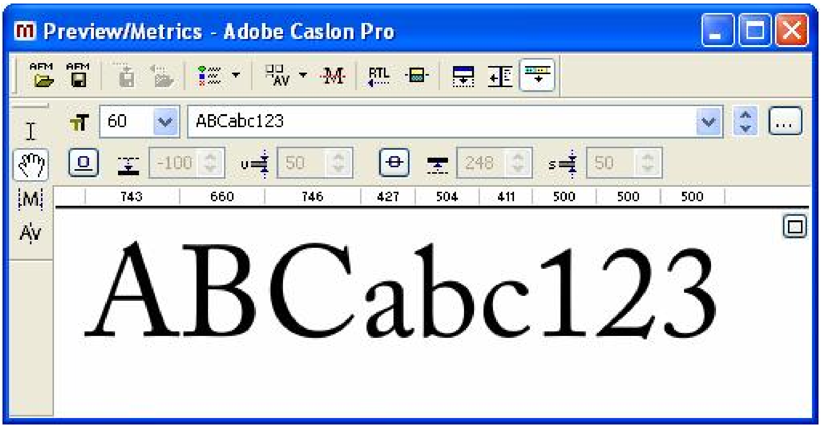
As a result, you can get custom colors in the Metrics window:



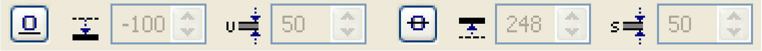
Editing Underline and Strikethrough

To edit the position and width of the underline and strikethrough line switch the Metrics window to the Preview mode. You can do this by clicking on the Preview Mode button of the Metrics Tools toolbar or by selecting Preview in the mode-selection menu of the bottom command area or by selecting the same command in the context menu that appears when you right-click the editing field.

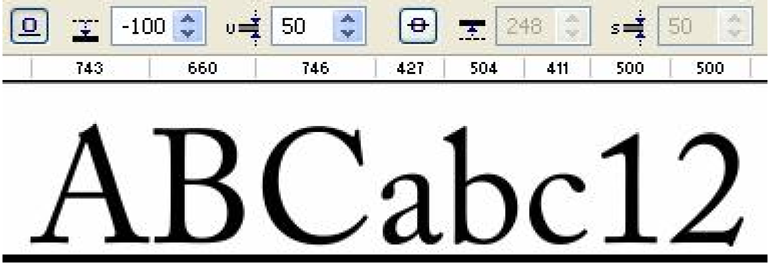
To get access to the controls for adjusting the properties of the lines, switch the local command area to the top using this button: (located in the top-right corner of the editing area). This is how the Metrics window should look:



Just above the ruler you can see the lines controls:

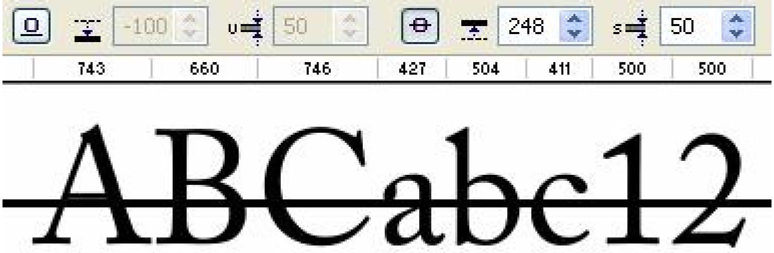


There are two buttons and four editing boxes. Click on the Underline button to show the underline:



As you can see, underline controls are now enabled so you can use this control: -100 to change the underline position. Use this control: 50 to change the underline thickness.

Use the Strikethrough button to show the strikethrough line and enable the related controls:



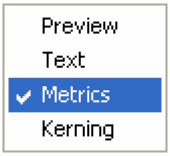
Strikethrough may appear together with underline or separately (as pictured).

Editing Metrics

This section discusses **horizontal glyph metrics** (the advance width and the sidebearings, jointly referred to as just *metrics*), and **kerning**. In FontLab you can modify this information either manually or automatically.

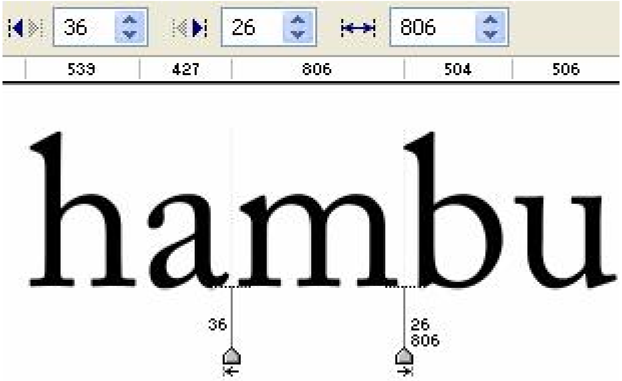
Horizontal glyph metrics can be modified manually in the Glyph window by dragging on the sidebearing lines. However, this does not give you an accurate presentation of the glyphs in context. The process of letterspacing (devising of glyph metrics and kerning) should not be done for each individual character separately. Inter-glyph whitespace should be designed based on words and strings of text. You can do this in the Metrics Window.

To modify glyph metrics, switch the Metrics Window to the Metrics mode: Click on the Metrics Mode button M in the Metrics Tools toolbar or select the **Metrics** command in mode-selection menu on the bottom command area:



You can also right-click the editing area and select the Metrics Mode command in the context menu.

The easiest way to see the metrics of a glyph is to use the Property area:



By default, the Property area is empty. To make the metrics editing controls visible, click the left mouse button on a glyph in the editing field. The metrics editing controls will appear and the sidebearings lines with editing handles will appear at the sides of the glyph.

The numbers at the bottom of the glyph are the left and right sidebearing values and the glyph's advance width.

Manual Metrics Editing

To modify a glyph's metrics you can use several methods:

1. Drag the sidebearings lines.
2. Drag the glyph within the editing area.
3. Edit the values in the property area of the Metrics Window.
4. Use the Metrics Panel.
5. Use the Metrics Table.

To drag the sidebearings lines just position the mouse cursor on the line, press the left mouse button and drag the mouse. Release the mouse button when you are done.

To drag a glyph within the editing area, position the mouse cursor on the glyphs' image; press the left mouse button and drag the mouse to position the glyph inside its width. Press the right mouse button while dragging the mouse to modify the glyph's width.

You can also **modify the vertical position of the glyph** relative to its baseline. Just press and hold the **SHIFT** key on the keyboard while dragging the glyph.

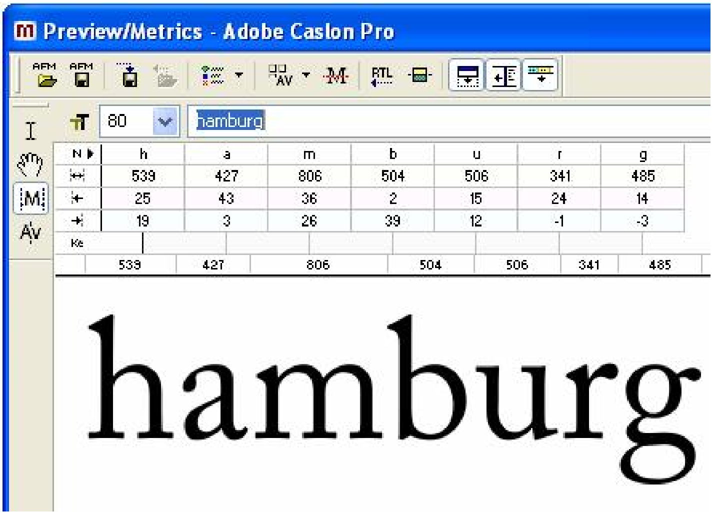
Using the Keyboard

When the glyph is active you can use the keyboard to adjust the metrics:

Left and right arrow keys	Moves the glyph by one font unit inside the sidebearings without changing the advance width. Hold the SHIFT key to move the glyph by 10 font units
Ctrl+left and right arrow keys	Moves the glyph together with the right sidebearing. This changes the left sidebearing and the advance width. Hold the SHIFT key to move by 10 font units at each key click
Page Up	Moves to the previous glyph in the sample line
Page Down	Moves to the next glyph in the sample line
Any character or digit	Selects the character you have clicked as the current character for editing. You can also enter the glyph name if you want to access glyphs that are not assigned to any key combination
Ctrl+] and Ctrl+[	Moves to the next and previous glyphs in the font.

Using the Metrics Panel

Click on the button to show the Metrics Panel:



N ▸	h	a	m	b	u	r	g
↔	539	427	806	504	506	341	485
⇤	25	43	36	2	15	24	14
⇥	19	3	26	39	12	-1	-3
Ke							
	539	427	806	504	506	341	485

The Panel always consists of four lines:

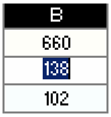
Error! Objects cannot be created from editing field codes.

Click on any number in the panel to enter an exact value. Just use the keyboard to adjust the number and press the **Enter** key when you are done. The **Esc** key or a left click outside the cell you are editing will cancel the changes.

Use the **up** and **down** arrow keys on the keyboard to move up and down in the panel. Use **Tab** key to move right and **Shift+Tab** to move left.

Referencing Metrics

In the Metrics Panel, you can use glyphnames as a reference instead of the real numeric values. For example, if you want to set the left sidebearing of the glyph 'B' to be equal to the left sidebearing of the glyph 'D', click on the cell located at the intersection of the B column and the third row:



B
660
138
102

and, instead of the numeric value for the metric, enter "=D". When you click **Enter** key to accept changes, the data will be copied from the source glyph.

Using the Calculator

FontLab Studio has very simple calculator embedded in most editing fields that allow you to enter formulas. Instead of entering a value you can enter an equation:

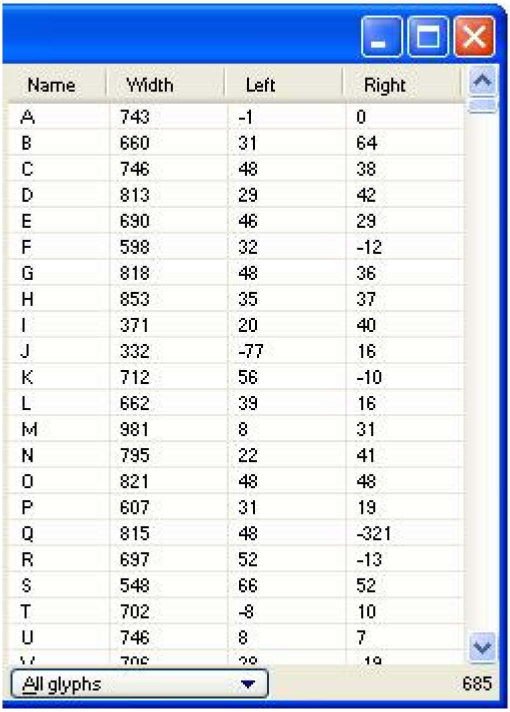
650/2

Which will produce 325 - the value that appears in the editing field. This calculator works in the Metrics Panel.

The standard 4 operations: + - / and * are accepted.

Using the Metrics Table

Click on this button on the Metrics Window toolbar or this button on the bottom bar to open the table:



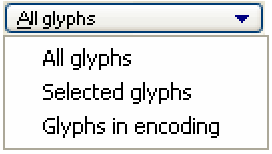
Name	Width	Left	Right
A	743	-1	0
B	660	31	64
C	746	48	38
D	813	29	42
E	690	46	29
F	598	32	-12
G	818	48	36
H	853	35	37
I	371	20	40
J	332	-77	16
K	712	56	-10
L	662	39	16
M	981	8	31
N	795	22	41
O	821	48	48
P	607	31	19
Q	815	48	-321
R	697	52	-13
S	548	66	52
T	702	-8	10
U	746	8	7

In metrics-editing mode this table has four columns: Name (contains the glyph name), Width, Left (left sidebearing) and Right (right sidebearing).

You can click on the header of each column to sort table rows according to the related value (name, width, left or right sidebearing). This is very useful in finding glyphs whose metrics have particular properties.

To edit any of the metrics values, click on the table cell and enter the new value. Click Enter to accept it or Esc to cancel.

You can filter the glyphs that are listed in the table. To do so, use the **Filter** selector control below the table:

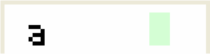


If you choose **Selected glyphs**, only the glyphs that are selected in the Font window will appear in the table. Similarly, if you select Glyphs in encoding, only glyphs that are in the current "yellow zone" of the Font window will go into the table.

Metrics in the table are calculated according to the current state of the measurement line - if it is active, all metrics are based on its position. Refer to the next section for more information about the measurement line.

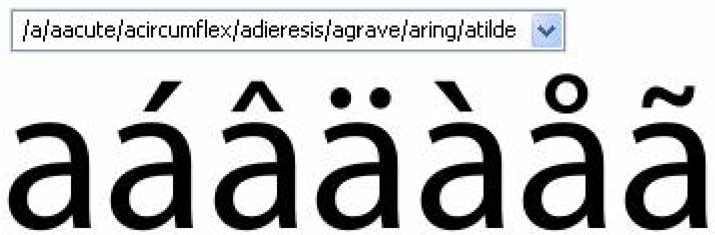
Previewing Dependent Composites

Some of the glyph names in the Metrics table have a light-green mark at their right:



This means that this glyph works as a base glyph in one or more composite glyphs. For example, if you have an 'a' glyph and 'adieresis', 'acaron' and 'agrave' composites, the 'a' will get this mark.

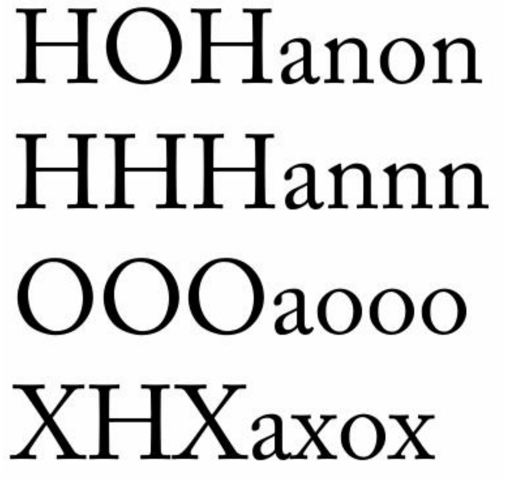
If you click on the mark while no glyph is currently selected for metrics editing in the main panel, Fontlab Studio will automatically generate a sample string which has the "base" glyph first and all "dependent" glyphs following:


/a/aacute/acircumflex/adieresis/agrave/aring/atilde

Use this feature to check that the metrics of the base glyph and dependent glyphs are compatible.

Generating Context

If no glyph is selected for metrics adjustment and you click on a row in the table, Fontlab Studio will automatically generate some text around your glyph to help with metrics editing:

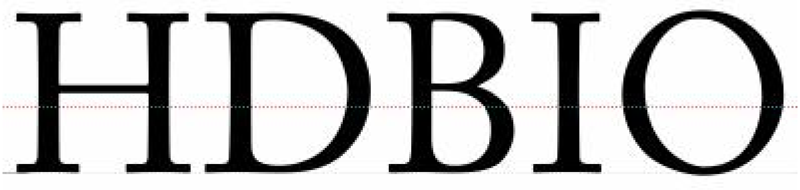


HOHanon
HHHannn
OOOaooo
XHXaxox

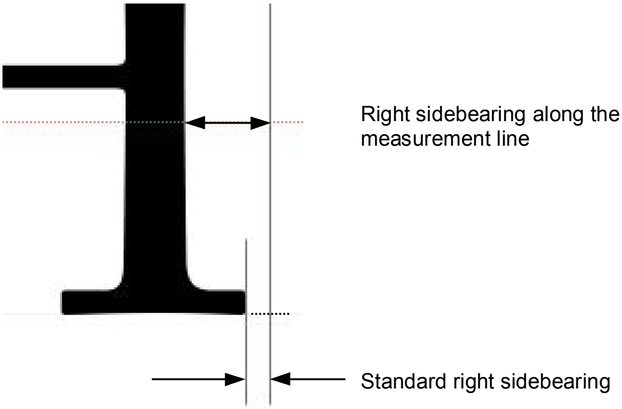
The content of this context depends on the type of the glyph: an uppercase glyph will have more uppercase "neighbors" while a lowercase will get lowercase context on the right side.

The Measurement Line

To activate the measurement line, click on this button: M. You will see a red line appear in the editing area:



When the measurement line is active (and visible), the glyph sidebearings are measured not from the extreme points of the character (i.e. from the bounding box), but from the point of intersection of the measurement line and the contour:


Right sidebearing along the measurement line
Standard right sidebearing

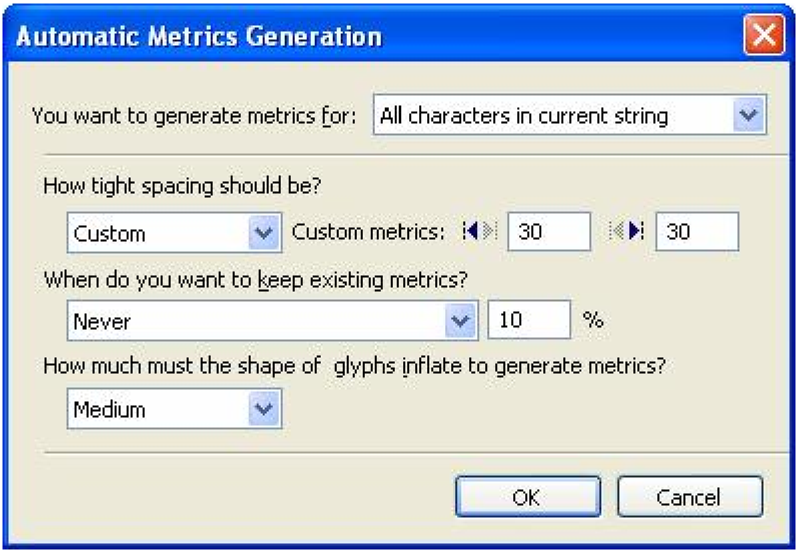
The measurement line is very useful when you are setting metrics in a serif font – usually the designer would like to ignore serifs when calculating sidebearings and the measurement line gives you a natural way to do that.

Automatic Metrics Generation

FontLab can automatically define glyph metrics using a special algorithm. This algorithm usually produces good results but we recommend manual editing for the best results.

To automatically generate glyph metrics click on the button on the Metrics Window toolbar, select the **Auto** command in the **Tools** local menu of the Metrics Window or select the **Auto Metrics** command in the popup menu.

The **Automatic Metrics Generation** dialog box appears:



Automatic Metrics Generation

You want to generate metrics for: All characters in current string

How tight spacing should be?

Custom Custom metrics: 30 30

When do you want to keep existing metrics?

Never 10 %

How much must the shape of glyphs inflate to generate metrics?

Medium

This dialog box includes two areas: **Area of application** and **Parameters**. In the first area you select the glyph(s) to which the automatic algorithm will be applied.

The possible choices are:

Current character only	This option is the default if any glyph is selected in the editing area
All glyphs in the current string	This option generates metrics for all glyphs in the current string in the editing area
Whole font	This forces FontLab to generate metrics for all glyphs in the font and is not generally recommended. This operation is not undoable. FontLab prompts you and asks that you save the current metrics information in a special file from which it may be easily restored if you are not satisfied with the results that the autometrics algorithm produced.

You can choose the parameters for the algorithm in the **Parameters** area of the Autometrics dialog box. All the parameters are displayed. We recommend that you experiment with various parameters using the autometrics application.

Quick Save and Quick Open

You can use these commands to temporarily save the current state of the metrics and kerning information. To quick save a metrics file, ~SAVE.AFM in the FontLab directory, press the 💾 button on the toolbar.

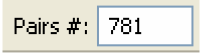
To open a previously saved file, press the 📂 button. The Warning dialog box appears prompting you to save the current (modified) state of metrics into the same temporary file.

Editing Kerning

To edit kerning data switch the Metrics Window to Kerning mode by pushing the AV button on the Metrics Tools toolbar.

or, select the **Kerning** command in the popup menu that appears if you press the right mouse button in the editing area of the Metrics Window.

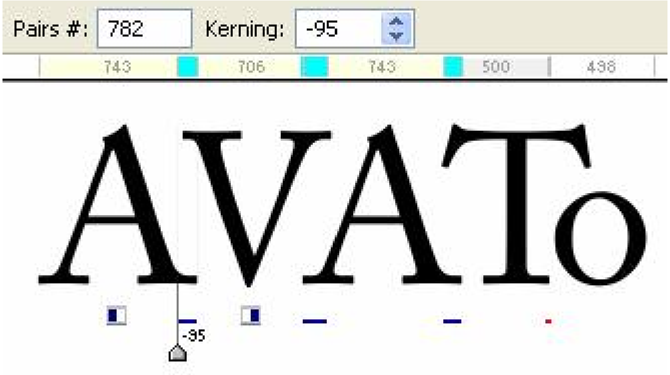
When you switch to the kerning mode and the metrics property panel is visible you will see the total number of defined kerning pairs for the current font appear in the property area of the Metrics Window:



Pairs #: 781

To make the Kerning Editing controls visible you must select the pair that you want to edit. Position the mouse cursor on the right glyph of the pair and click the left mouse button.

You will see the Kerning Editing controls appear in the property area and the kerning line and handle appear in the editing area:



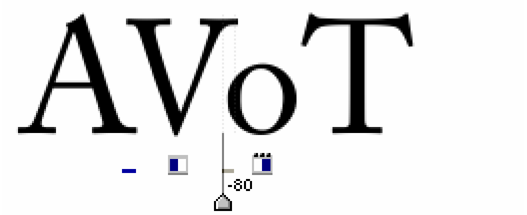
Pairs #: 782 Kerning: -95

There is now a blue area in the metrics ruler. This means that negative kerning exists for that pair in the current preview string. If that area is bright yellow, it means that kerning between the two glyphs is positive.

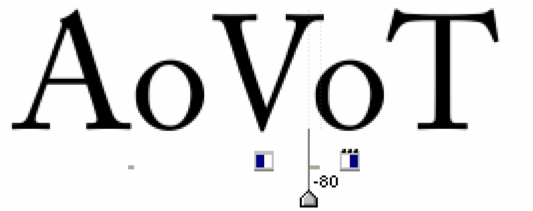
Manual Kerning Editing

To edit kerning manually, drag the kerning line (or right glyph of the kerning pair) using the left mouse button. If you click the right mouse button while holding the left mouse button on the glyph or on the kerning line, that **kerning pair will be removed**. You will see that the total number of kerning pairs decreases.

Tip: if you hold Alt key and double-click the right glyph of the pair, it will be copied to the left of the left glyph:



before Alt-double click to 'o'



after Alt-double-click

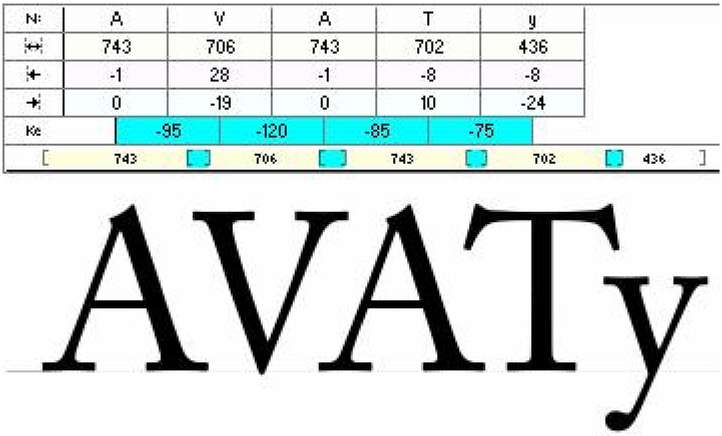
Using the Keyboard

When a glyph is selected in the sample string you can use the left and right arrow keys to change the kerning by one font unit at each key click. Hold the **Shift** key to change the kerning by 10 font units.

Use the **Ctrl+[** and **Ctrl+]** keys to change the glyph in the string and **Page Up** and **Page Down** keys to move to the previous and next glyph in the string.

Using the Metrics Panel

When the properties area is expanded and kerning editing mode is activated you can see all the glyph metrics and pair kerning information in the editing field:



N:	A	V	A	T	y
↔	743	706	743	702	436
⇤	-1	28	-1	-8	-8
⇥	0	-19	0	10	-24
Ke	-95	-120	-85	-75	

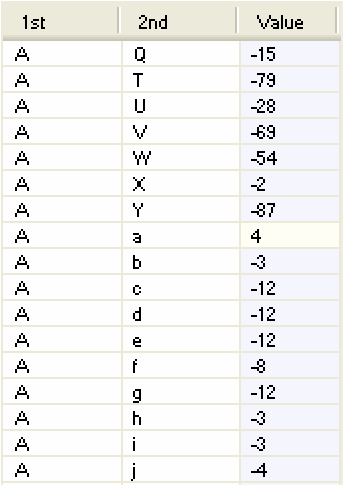
[743 □ 706 □ 743 □ 702 □ 436]

Kerning is displayed on the fifth row in the Metrics Panel and each value is positioned between the glyphs that form the kerning pair. The background color for the kerning value is white when there is no kerning, light blue if kerning is negative (glyphs are shifted toward each other) and yellow if kerning is positive.

To change the kerning value, click on the kerning row in the table and enter the new value. Click **ENTER** key on the keyboard to accept the changes or **ESC** to cancel. Use the **TAB** and **SHIFT+TAB** keys to select a pair in the sample string.

Using the Metrics Table

If the metrics table is visible (if not, use the button on the toolbar or the button on the bottom panel to show it) in kerning mode it will have three columns:



1st	2nd	Value
A	Q	-15
A	T	-79
A	U	-28
A	V	-69
A	W	-54
A	X	-2
A	Y	-87
A	a	4
A	b	-3
A	c	-12
A	d	-12
A	e	-12
A	f	-8
A	g	-12
A	h	-3
A	i	-3
A	j	-4

The first two columns contain the names of the first and second glyphs of the pair. The third column contains the kerning value. If the kerning value is on a light-blue background it means that it is negative. Positive kerning is on a light-yellow background.

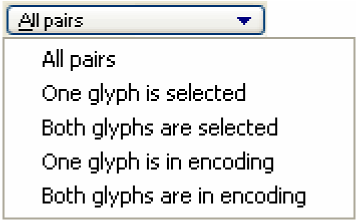
If the digits are red-colored it means that this pair is a class kerning exception (see below for more information about class kerning and exceptions).

You can easily change the kerning for a pair - click the number in the right column and enter the new value. Click **Enter** to accept or **Esc** to cancel.

Filtering Pairs in the Table

The number of kerning pairs in a big font can be huge and navigating a kerning table with a thousand rows may be difficult.

Use the filter control below the table to limit the number of pairs that are put into the table:



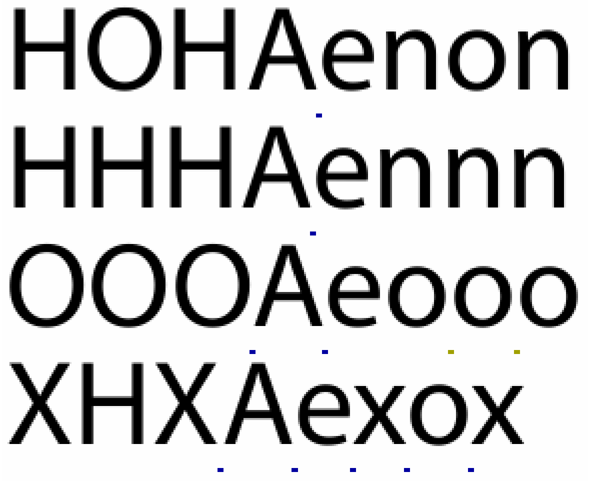
If you select **All pairs**, it will list all available pairs. The other options will show only the pairs that follow the selected rule.

For example, to show all pairs that have 'A' on the left or right side, choose **One glyph is selected** and select 'A' in the Font window.

If you select **Both glyphs are selected** and select 'A' and 'V', you will see only two lines: A V and V A.

Generating Context

If no pair is selected in the editing field and you click on a pair in the Metrics table, Fontlab Studio will automatically generate sample text that "highlights" the selected pair and allows you to see how the kerning in this pair works in a real-life situation:



HOHAenon
HHHAennn
OOOAeooo
XHXAexox

The selected pair appears in the middle of each string with some optically unique glyphs on the left and on the right. Selection of these glyphs depends on the case of the first and second glyphs of the pair: uppercase glyphs will get uppercase neighbors.

You can customize the context by editing the metrics.txt file located in the Fontlab Studio user files folder.

Deleting Pairs

Select a pair in the Metrics table and click on the **Delete** key on the keyboard. The pair will be removed.

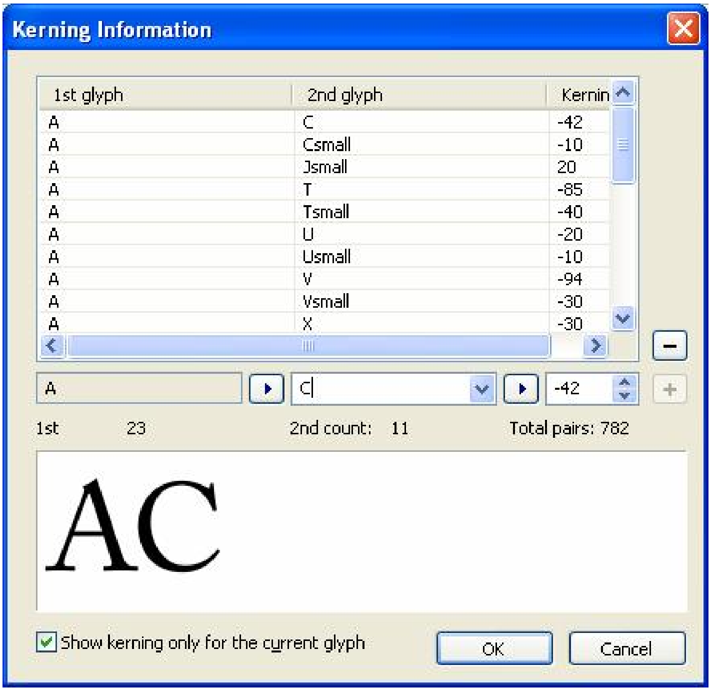
Of course, you can use the **Edit > Undo** command to get your pair back.

Using the Kerning Dialog

You may add or delete kerning pairs linked to a selected glyph and enter precise kerning values using the Kerning Information dialog box.

To open this dialog box press the button on the Metrics window toolbar and select the **Edit Kerning** command from the menu or select the **Edit Kerning** command in the context menu of the main editing area. This command is also available in the **Tools** menu on the bottom panel.

You will see the following dialog box:



1st glyph	2nd glyph	Kernin
A	C	-42
A	Csmall	-10
A	Jsmall	20
A	T	-85
A	Tsmall	-40
A	U	-20
A	Usmall	-10
A	V	-94
A	Vsmall	-30
A	X	-30

A C -42

1st 23 2nd count: 11 Total pairs: 782

☑ Show kerning only for the current glyph

In the top half of the dialog box you see a table that has information about all the kerning pairs in which the current glyph is on the left. Each row of this table includes the name of the paired glyph on the right and the kerning value.

You can sort this list by the names of the “right” glyphs or by the kerning value. **To sort the list**, click on the header of the column that you want to use as the sort key.

You can **edit a kerning value** or **change the right glyph of the pair us**ing the edit controls below the list. The sample window in the bottom part of the dialog box previews the selected kerning pair. You will immediately see the result of the changes in the Metrics window.

To add a new kerning pair press the **Add** button. The currently selected pair will be duplicated and you can change it. This is very useful when you want to add a kerning pair that has a value equal to an existing pair but the right glyph is different, as in the “Ta” and “Tà” pairs.

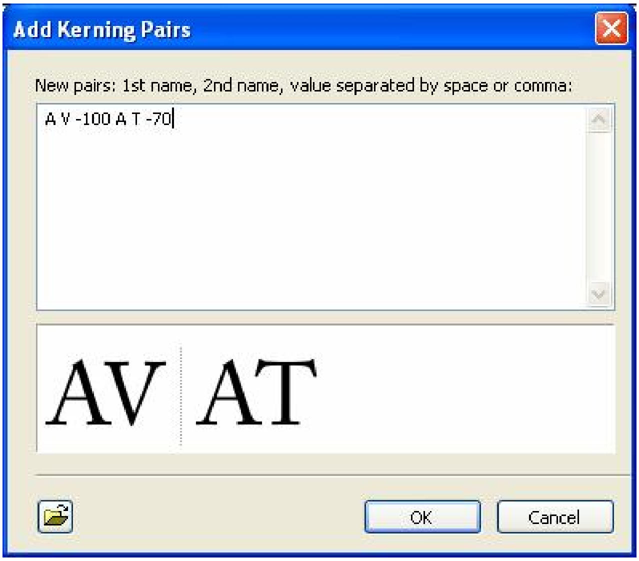
To remove a kerning pair select it and press the **Del** button.

You may also remove all kerning pairs associated with the current glyph by pressing the **Reset** button.

Adding Kerning Pairs

To quickly add many new kerning pairs you can use the **Add Pairs** command which is available in the context menu at the bottom, **Tools** menu or in the menu that appears if you click on the button in the Metrics window toolbar.

Enter kerning pairs followed by a kerning value in the editing box in the top. You will see a preview of the kerning in the panel below:



Add Kerning Pairs

New pairs: 1st name, 2nd name, value separated by space or comma:

A V -100 A T -70

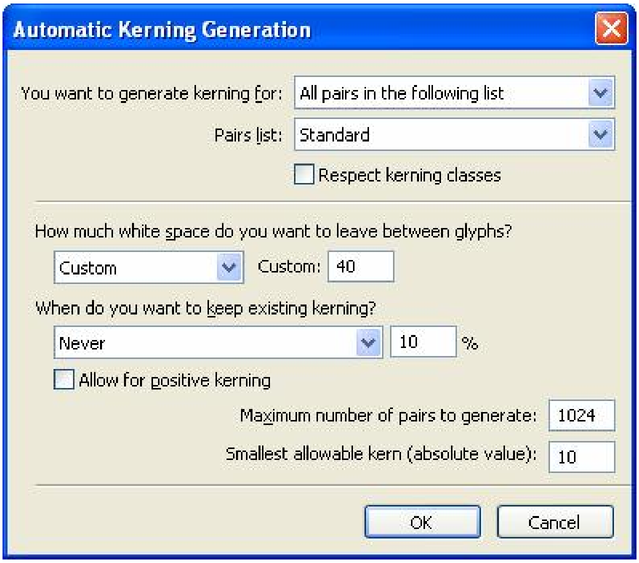
You can paste kerning data from a text editor or table application or click on the button to read kerning data from a text file.

Automatic Kerning Generation

The easiest way to apply kerning to a font is to use FontLab Studio's autokerning algorithm. This algorithm analyzes the shape of the glyphs in the given pairs and automatically kerns them. You can control the pairs list that the autokerning algorithm processes as well as other parameters.

To define kerning automatically press the 💎 button on the toolbar, or select the **Auto Kerning** command in the popup menu.

The **Automatic Kerning Generation** dialog box appears:



Automatic Kerning Generation

You want to generate kerning for: All pairs in the following list

Pairs list: Standard

☐ Respect kerning classes

How much white space do you want to leave between glyphs?

Custom Custom: 40

When do you want to keep existing kerning?

Never 10 %

☐ Allow for positive kerning

Maximum number of pairs to generate: 1024

Smallest allowable kern (absolute value): 10

This dialog box consists of two areas: the **Area of application** and **Parameters**.

In the first area you select the pairs for which the algorithm will compute kerning values. You can choose between **Current pair only** (available if one of the pairs is selected in the editing area), **All Pairs in the current string,** or **All Pairs in the following list**.

The second area allows you to generate kerning for all the pairs located in a special list file. The list files are stored in a Kerning subdirectory of FontLab's installation directory. You can create your own kerning pair files or use one of the files placed there at the time of FontLab's installation.

If the **Respect kerning classes** button is checked, then the autokerning algorithm will be applied only to key glyphs of the kerning classes and to glyphs that do not belong to any kerning class.

The **Parameters** option lets you customise the autokerning algorithm. The most used option is: **How much white space do you want to leave between glyphs?** This controls how close the glyphs will be moved together while computing kerning in the pair.

The **Allow for positive kerning** check box lets the autokerning algorithm produce positive kerning in pairs. Positive kerning moves glyphs apart from each other. Positive kerning is usually not recommended but there may be occasional circumstances where it is needed.

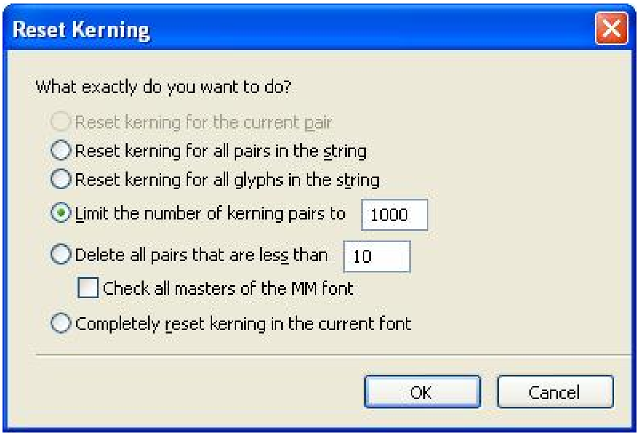
If you want to save the existing kerning the combo box lets you control the disposition of the existing (imported or manually created) kerning pairs. You can replace existing pairs by automatically generating new ones, keep them unchanged, or select the condition mode.

The **Maximum number of generated pairs** and **Maximum absolute value for generated kerning** options control the possible number of automatically created pairs and the maximum normal (negative or positive) kerning value.

Resetting Kerning

To remove the kerning information for some glyphs or for the entire font you must use the *Reset Kerning* feature. To open the Reset Kerning dialog box press on the ✕ or select the **Reset Kerning** command in the popup menu.

The **Reset Kerning** dialog box appears:



What exactly do you want to do?

○ Reset kerning for the current pair
○ Reset kerning for all pairs in the string
○ Reset kerning for all glyphs in the string
● Limit the number of kerning pairs to 1000
○ Delete all pairs that are less than 10
□ Check all masters of the MM font
○ Completely reset kerning in the current font

This dialog box includes options that control kerning removal.

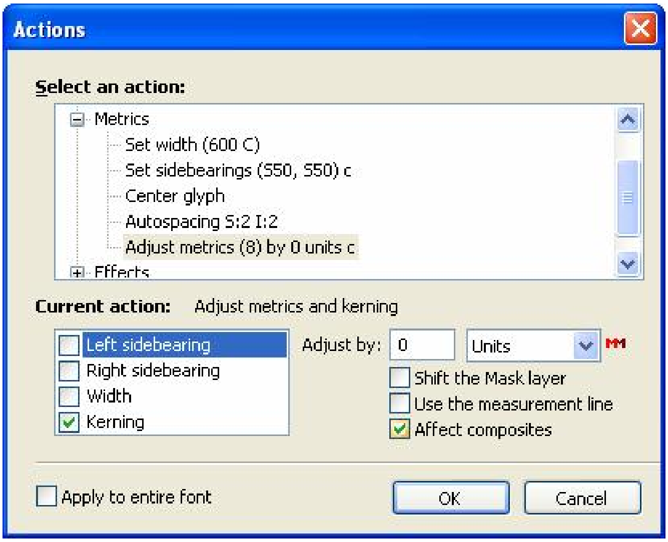
Available options are:

Reset kerning for the current pair	This is the default if a pair is selected. Removes kerning for that pair only. You can get the same result by clicking the right mouse button while editing kerning in the current pair
Reset kerning for all pairs in the string	Default if no pairs are selected. Removes kerning in all pairs that exist in the current string
Reset kerning for all glyphs in the string	Removes kerning in all pairs that include glyphs in the current string
Limit number of kerning pairs to…	Kerns only the given number of pairs with the largest absolute kerning value
Delete all pairs that are less than…	Removes all pairs that have a kerning value less than the given value. The absolute value of kerning is compared
Completely reset kerning in the current font	Removes all the kerning pairs available in the font. Because this is not an undoable operation, the warning dialog asks you to save the current metrics and kerning data in the temporary file.

Adjusting Metrics and Kerning

If you want to change metrics or kerning by some fixed value and the manual process will take too much time, you can use the Transform dialog box.

1. Switch to the Font window.
2. Select the glyphs that you want to process.
3. Open the Actions dialog box using the **Tools > Actions** command.
4. In the dialog box select the **Metrics > Adjust metrics** action:



⊟ Metrics
- Set width (600 C)
- Set sidebearings (550, 550) c
- Center glyph
- Autospacing S:2 I:2
- Adjust metrics (8) by 0 units c

⊞ Effects

Current action: Adjust metrics and kerning

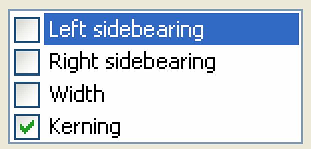
□ Left sidebearing
□ Right sidebearing
□ Width
☑ Kerning

Adjust by: 0 Units

□ Shift the Mask layer
□ Use the measurement line
☑ Affect composites

□ Apply to entire font

5. In the options area select the metrics that you want to change:



□ Left sidebearing
□ Right sidebearing
□ Width
☑ Kerning

6. Enter the amount by which you want to adjust the values and select the units (which can be font units or a percentage of the source value). Enter a positive number to increase metrics distances or kerning or a negative value – to decrease.

   Normally metrics are measured from the bounding box. You can change this, however, if you want, to measurement from a measurement line by using the check box.

   The **Affect composites** option lets you choose what will happen with composite glyphs that reference glyphs whose metrics you adjust using this action. If the checkbox is on (which is the default) the position of the components in composites will be adjusted to compensate for the change of the left sidebearing of the referenced glyph, so the shape of the composite is not changed. If you want to avoid this effect, uncheck this option.

   The measurement line is a horizontal line (defined in the Glyph Window) that defines a “slice” which is used to measure the distance from outline to sidebearings. Please refer to the “Glyph Window” chapter for more detail.

Class-Based Kerning

Some glyphs in a font may have a similar shape and may be kerned equally. For example, “A” and “Acaron” will have the same kerning value if kerned with “T” or “Tcaron”. With the standard kerning system this will require 4 kerning pairs. If the number of similar glyphs in the group increases, the number of necessary pairs will rise dramatically.

A better way to handle the kerning of similar glyphs is to define glyph groups or classes. In our example the first class will contain the glyphs “A” and “Acaron” and the second “T” and “Tcaron”. Then we will need to define only one pair and all glyphs in both classes will be covered.

Kerning classes may save a lot of time if you need to kern a font that contains a lot of similar glyphs. The typical number of class kerning pairs (which define kerning between classes) is a few hundred. Compare this to several thousand pairs that are necessary to define the same kerning data using traditional methods.

Classes are also actively used to define OpenType features that are applicable to a set of glyphs, so we will return to this subject in the “OpenType Fonts” chapter.

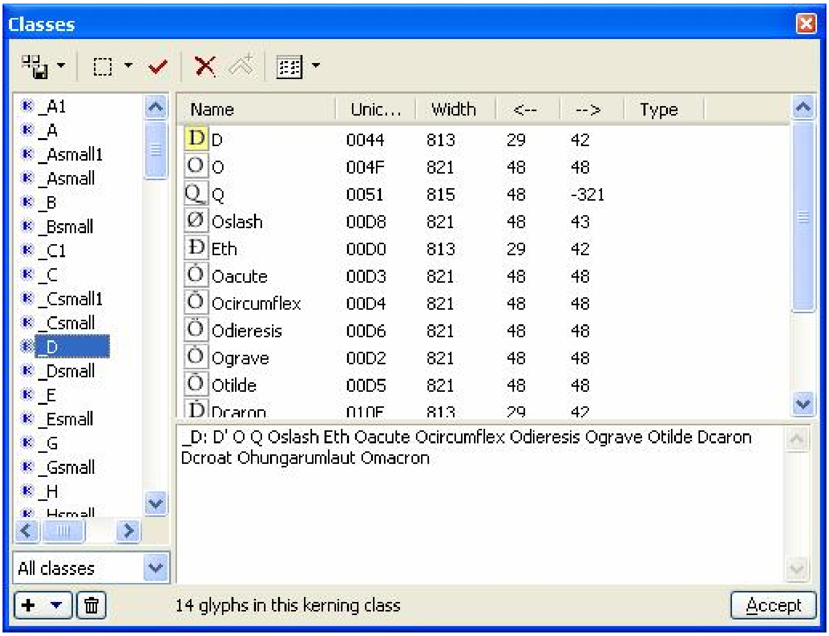
Class-Based Kerning and OpenType Fonts

By default, FontLab will keep a class-based kerning structure when you open an OpenType font that has it. For each kerning class FontLab will automatically generate a class name and mark the first glyph in the class as the key glyph. This feature allows you to work with the huge kerning tables of some OpenType fonts in a comfortable environment that excludes most repetitive pairs.

When you finish edit kerning pair values in the Metrics window you need to create a "kern" feature that will build kerning into the final OpenType font. You can use the special macro program available in the **Macros** submenu of the Metrics window context menu or you can simply remove the kern feature and FontLab will automatically generate a new one on export of the OpenType font.

Classes Panel

To define glyph classes in FontLab you need to use the Classes panel. Open the panel using the **Panels > Classes** command from the **Window** menu.



_A1
_A
_Asmall1
_Asmall
_B
_Bsmall
_C1
_C
_Csmall1
_Csmall
_D
_Dsmall
_E
_Esmall
_G
_Gsmall
_H
_Hsmall

Name	Unic...	Width	<--	-->	Type
D	0044	813	29	42	
O	004F	821	48	48	
Q	0051	815	48	-321	
Oslash	00D8	821	48	43	
Eth	00D0	813	29	42	
Oacute	00D3	821	48	48	
Ocircumflex	00D4	821	48	48	
Odieresis	00D6	821	48	48	
Ograve	00D2	821	48	48	
Otilde	00D5	821	48	48	
Dcaron	010F	813	29	42	

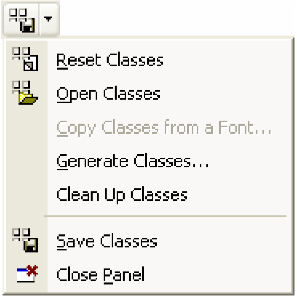
_D: D' O Q Oslash Eth Oacute Ocircumflex Odieresis Ograve Otilde Dcaron Dcroat Ohungarumlaut Omacron

14 glyphs in this kerning class

This panel contains a toolbar, a list of classes, a class preview panel, a class definition panel and a status bar that tells you how many glyphs are defined for the current class.

On the toolbar there are several buttons:

File operations

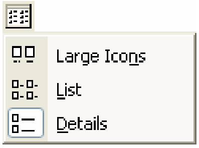


Reset classes – removes all classes
Open classes – opens the class information from the text file
Copy classes from a Font -- copies all classes from another opened font
Generate Classes... -- automatically generates kerning and metrics classes using advanced optical algorithms
Clean Up Classes -- checks all glyphs in all classes and allows you to remove nonexistent glyphs or tries to automatically create them
Save classes – saves information about the font classes to a text file
Close panel – closes the Classes panel

We will discuss all these commands below.

Choose view mode

Use this button to select one of the class preview modes in the drop-down menu:



Select class

Selects all glyphs that belong to the current class in the Font window

Mark class

Marks all class glyphs in red

Remove glyph

Removes the glyphs selected in the class preview panel from the class

Add as Component

Adds the glyph selected in the class preview panel to the current glyph window as a component.

Three additional buttons are in the status bar:

+ ▾	**Add class**	Defines a new class
🗑	**Remove class**	Removes the current class
	Accept	Click this button to accept the changes made to the class definition code.

Class Definition

Every class is defined as a list of glyph names preceded by the class name:

```
_s3: s' scircumflex scaron
```

The class name may only include uppercase and lowercase English letters, digits as well as underscore (_) and period (.). Spaces and special characters are not permitted in class names!

There are three types of classes:

Kerning classes. These are used to group together glyphs that will share the same kerning value. If a kerning pair is defined or changed for one of the glyphs in the class, the remaining glyphs will automatically share the same kerning value. The name of a kerning class must start with an underscore (e.g. _a).

Metrics classes. These are used to group together glyphs that will share the same metrics (advanced width and sidebearings). If metrics are changed for one of the glyphs, the user can quickly propagate the change to other glyphs using Metrics Assistance. Note that unlike with kerning classes, the changes made to one of the glyphs in a metrics class are not automatically reflected in the other glyphs. The name of a metrics class must start with a period (e.g. .n).

OpenType classes. These are used in OpenType Layout feature definitions. For example, the layout feature for old style figures (“onum”) may replace a class of lining figures with a class of old-style figures. The name of an OpenType class must start with an uppercase or a lowercase letter (e.g. smcp2).

Each kerning class and each metrics class must have exactly one **key glyph** defined – this is done by following one of the glyph names in the glyph definition by the quotesingle (') character. The key glyph acts as a “representative” of the class. The user defines the metrics or kerning for the key glyph and then – automatically or semi-automatically – the changes are propagated to the remaining glyphs in the class. A metrics or kerning class may not contain more than one key glyph. All non-key glyphs are called *dependent glyphs* or *child glyphs*.

The class definition appears in the bottom part of the panel and you can edit it to add or remove glyphs.

Defining the Class

Click on the + ▾ button **to define a new class**. From the flyout menu select **New Kerning Class**, **New Metrics Class** or **New OpenType Class**. Choose New Kerning Class. You will see a default class name appear in the list of classes and in the class definition panel:

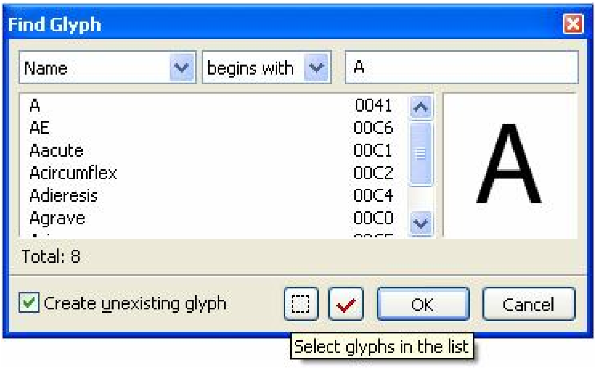
_kern1:

You **can manually enter glyph names** that you want to add to the class after a colon glyph:

_kern1: A Acaron

or you **can drag-drop glyphs** from the Font Window to append their names to the class.

➲ **Tip:** Use the Edit > Find command to quickly find all glyphs which have names begin with 'A'.



Find Glyph

Name ▾ begins with ▾ A

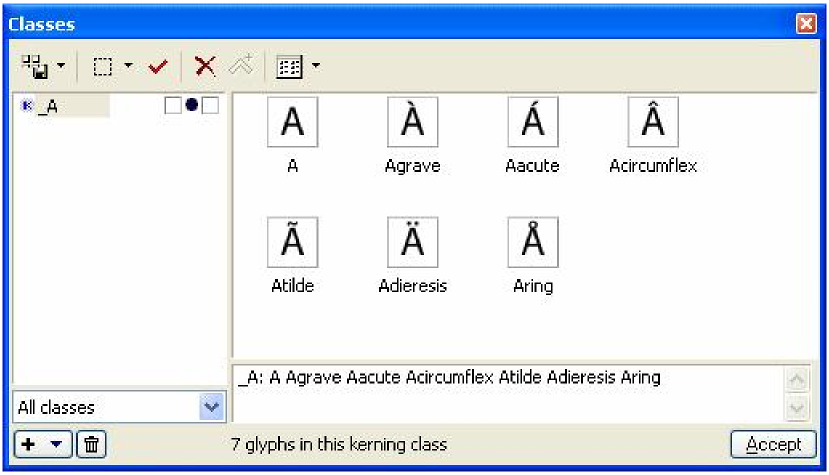
A	0041
AE	00C6
Aacute	00C1
Acircumflex	00C2
Adieresis	00C4
Agrave	00C0

Total: 8

☑ Create unexisting glyph

Click on the Select button to select all the glyphs found.

It’s time to **rename the class**. Use the class definition panel and change “_kern1” to “_A”. Click on the Accept button. Your Classes panel should now look something like this:



_A: A Agrave Aacute Acircumflex Atilde Adieresis Aring

7 glyphs in this kerning class

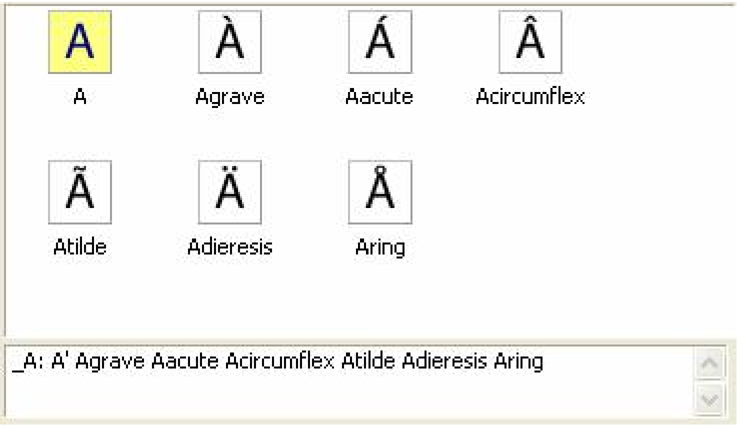
Repeat the procedure to define a class for “T”-like glyphs.

Important: After making any changes to a class definition, click the Enter key on the keyboard or the **Accept** button on the Classes panel.

Key Glyph

Kerning classes must include a declaration of the key glyph that is used as a kerning master for other glyphs in the class.

To define a key glyph, add a single quote (') after its name in the class definition text:



_A: A' Agrave Aacute Acircumflex Atilde Adieresis Aring

After you accept the changes made in the class definition string, the key glyph will get a yellow background in the preview panel.

Rearranging Classes and Glyphs

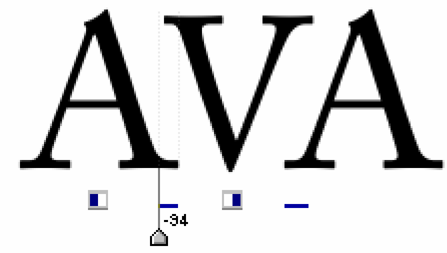
You can easily rearrange classes in the class list by dragging them to a new place. Also, you can copy glyphs from one class to another using the drag-drop method:

1. Select the glyphs in the source class.
2. Drag them to the class list.
3. Drag over the classes list until the destination class is selected.
4. Move the mouse cursor to the glyph palette and release the button - you will see that the glyphs are added to the destination class.

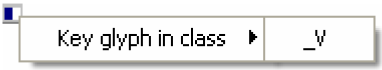
Editing Class-Based Kerning

To define kerning for a class you need to define the kerning for the key glyph of the class using the standard tools of the Metrics panel in kerning mode.

When you enter glyphs that are used as key glyphs into the kerning-editing string and select a pair of them for kerning editing you will see two buttons appear below the glyph images:

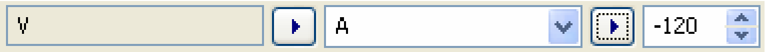


If you click on one of these buttons you will see a popup menu that lists all classes where the glyph acts as a key glyph:



Select the class name and it opens for preview in the Classes panel.

Similar buttons appear when you edit kerning using the Kerning Editor dialog box:

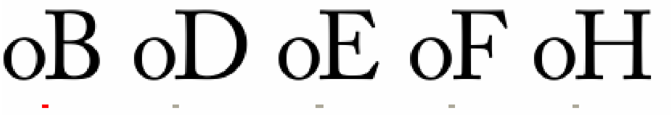


Their purpose is the same – to preview classes in which the currently selected glyph serves as a key glyph.

➲ **Tip:** hold down the Ctrl key and click on the "class menu" icon. If a glyph is a member of the class, it will be replaced by the key glyph of that class.

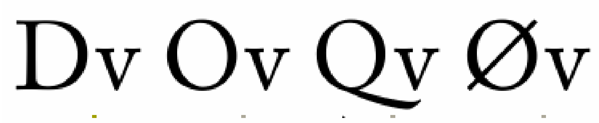
Side of the Class

When kerning for the key glyphs is defined, you may apply the kerning value to other glyphs of the class. To do that you need to specify if the class contains glyphs that must have the same kerning on the left or on the right side. For example, the B D E F H glyphs all have the same shape on the left side, so in many cases the kerning pairs where they are the second glyphs will be the same:



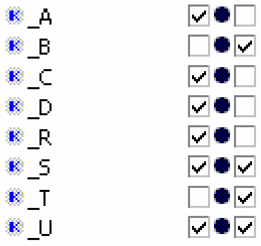
This means that in this case 'B' is the key glyph of the "right" or "second" class - its members are the second glyphs in a pair (which is "right" in the case of left-to-right writing scripts).

From the other side, such glyphs as D O Q and Oslash have roughly the same shape on the right side, so they can work as the first glyph in a pair:



Some glyphs may have the same shape on both sides, which may mean that they can be used as first or second glyphs in a pair.

To specify the "side" of a kerning class, you may use the Kerning Assistance panel or the checkboxes in the class list:



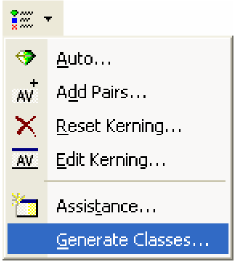
_A ☑ ● □
_B □ ● ☑
_C ☑ ● □
_D ☑ ● □
_R ☑ ● □
_S ☑ ● ☑
_T □ ● ☑
_U ☑ ● ☑

A check box to the right of the central dot means that a glyph in this class may act as a second glyph of a pair (as in our first example above). A check box to the left means that the class contains first glyphs of pairs.

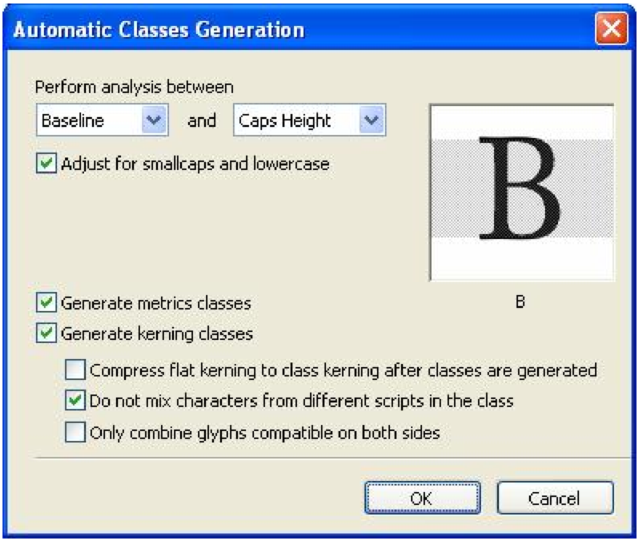
Generating Kerning Classes Automatically

Fontlab Studio 5 has a very smart algorithm that can automatically generate kerning and metrics classes.

Click on the command menu button in the Metrics window toolbar to open the menu:



Select the **Generate Classes** command. You will see a dialog box:



Automatic Classes Generation

Perform analysis between Baseline and Caps Height

☑ Adjust for smallcaps and lowercase

☑ Generate metrics classes

☑ Generate kerning classes

□ Compress flat kerning to class kerning after classes are generated

☑ Do not mix characters from different scripts in the class

□ Only combine glyphs compatible on both sides

To generate metrics and kerning classes Fontlab Studio analyzes the shape of the glyphs. Those glyphs that have similar shapes on the left or right side are combined into a kerning class. If both sides are similar then a metrics class can be generated.

The first group of controls defines the area that is used to analyze glyph shape. The preview to the right shows this area. It could be from baseline to Caps height or from descender to ascender or any combination.

If the **Adjust for smallcaps and lowercase** option is active, then it will automatically lower the top line of the area if lowercase or small caps glyphs are analyzed.

The controls in the bottom allow you to choose what kind of classes you want to generate. These could be metrics or kerning classes or both.

If you want to generate kerning classes, you will get a few more options:

Compress flat kerning to class kerning after classes are generated

If this option is on, then Fontlab Studio will not only generate kerning classes but also convert plain pair kerning into class-based kerning. This is the fastest way to convert plain TrueType or Type 1 kerning to modern OpenType-based kerning.

Do not mix characters from different scripts in the class

If this option is active (which is recommended) then Fontlab Studio will check the Unicode index (or some other properties if Unicode is not defined yet) to check that glyphs that belong to different scripts will not go into the same class. In other words, even if Latin 'A' and Cyrillic 'A' are identical, they will not go into the same class.

Only combine glyphs compatible on both sides

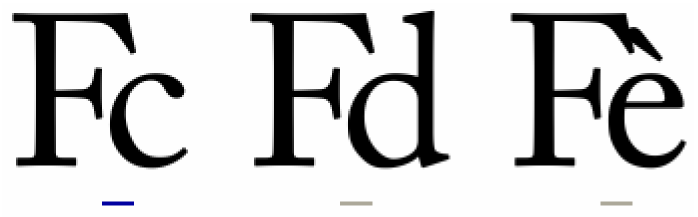
Activate this option if you want to get smaller classes with much more similar glyphs. Usually if this option is on, only base glyphs and composite glyphs that reference the base will be combined into a class.

Generate Classes

This command is also available in the **File** menu of the Classes panel.

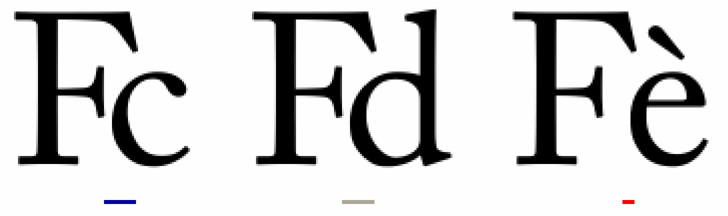
Kerning Exceptions

Suppose you have two kerning classes and some kerning is defined between their key glyphs. The "Side" properties are set correctly so all glyphs from both classes are kerned:



As you can see, last pair in the sample above has an obvious conflict – the right glyph overlaps the left glyph.

To fix this situation we can use class kerning exceptions - individually kerned pairs that correct class-based kerning. In the example above, we will define a new kerning pair between F and egrave:



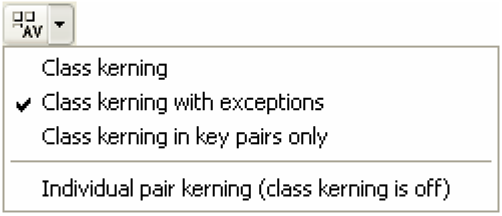
Notice that the bar below the kerning pair has a different color: "real" kerning of the key glyphs is black, a "virtual" kerning pair which is a result of class-based kerning is gray and an exception is red.

Similarly, in the kerning table the kerning value for exception is colored red.

Class Kerning Modes

To control how class-based kerning and exceptions work in the Metrics window, choose one of the class kerning modes.

Click on this button in the Metrics window toolbar:


AV
Class kerning
✓ Class kerning with exceptions
Class kerning in key pairs only
Individual pair kerning (class kerning is off)

Class kerning

If this option is active, only class kerning is editable and no exceptions are allowed. So if you have kerning defined between "left" _A class and "right" _T class, then if you change the kerning between any two members of the class, it will be the same as if you had changed the kerning between the two key glyphs.

Class kerning with exceptions

In this case if you modify the kerning between two members of a class that are not key glyphs, you will define an exception.

Class kerning in key pairs only

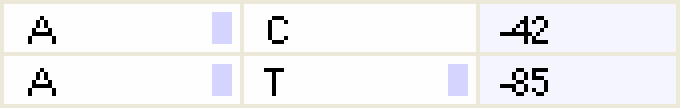
This option allows you to modify kerning only in key glyphs, all other members of the class are "locked".

Individual pair kerning

If this mode is active, class kerning is completely ignored.

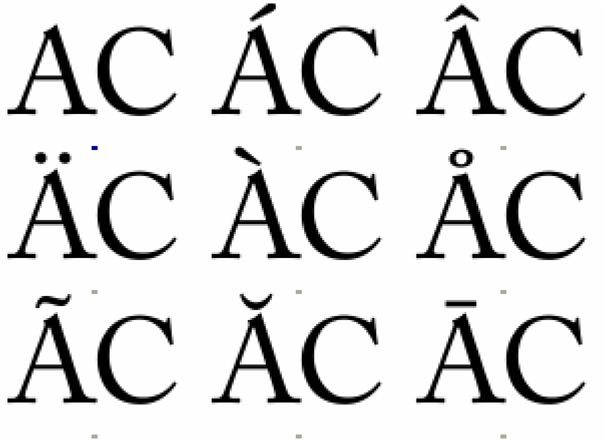
Previewing Class-based Kerning

In the Metrics table key glyphs of the classes have a light-blue area to the right of the glyph name:



A	C	-42
A	T	-85

If you click on this area, Fontlab Studio will automatically generate a sample string that contains the second glyph of the pair kerned with all glyphs of the class:



AC ÁC ÂC
ÄC ÀC ÅC
ÃC ĂC ĀC

If you press the **Alt** key and click on the class area of the pair of two key glyphs, it will generate a sample string that contains all combinations of all glyphs of the two classes.

Instead of clicking on the class area, you can press **Control** and click on the glyph name.

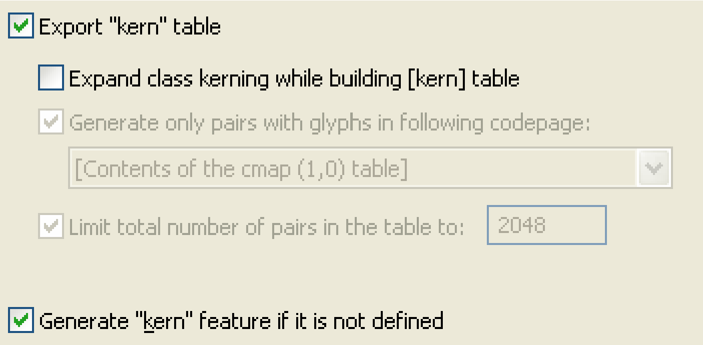
Kerning Classes and OpenType Kerning

OpenType fonts (TrueType or PostScript flavored) may have kerning in two places: the kern table and the kern positioning feature.

The kern table may contain only plain kerning, not dependent on any classes. It is used by applications that don't know how to use OpenType positioning features.

The kern feature allows you to define very complicated kerning, which includes class-based kerning and even more complex things like three-glyph kerning or context-dependent kerning.

Fontlab Studio 5 allows you to generate both types of kerning data blocks in the exported OpenType font file. This is controlled in Tools > Options > Generating OpenType and TrueType > Kerning:



☑ Export "kern" table

□ Expand class kerning while building [kern] table

☑ Generate only pairs with glyphs in following codepage:

[Contents of the cmap (1,0) table]

☑ Limit total number of pairs in the table to: 2048

☑ Generate "kern" feature if it is not defined

As you can see, there are two check boxes: Export "kern" table and Generate "kern" feature if it is not defined.

The first check box also has some options that control kerning expansion - conversion of class-based kerning to plain kerning supported by the table. We will discuss kerning expansion in the next section.

Is important to understand that the only way to put class-based kerning into the final font file (and keep it as class kerning, without expanding it to plain table) is to build the "kern" feature. You can do it manually, using the OpenType editor described on page 841 or you can use the automation tools provided by Fontlab Studio.

Please note that if you have the kern feature already defined, all changes that you make in kerning or in classes or in class kerning properties will have no effect until you re-generate the kern feature.

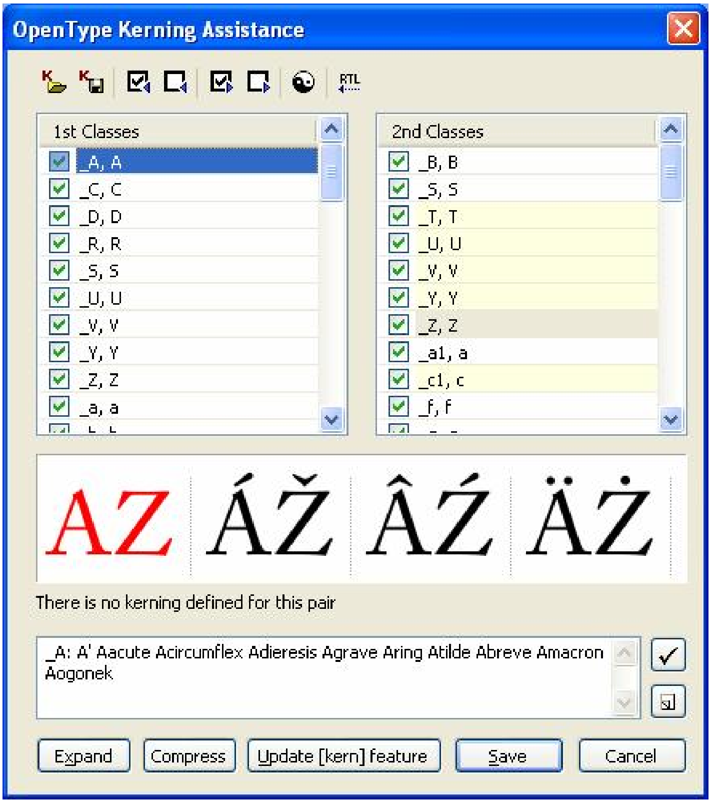
There are three ways to update the kern feature:

1. Use the "Generate Kern feature" command from the Metrics window context menu (in Kerning mode).
2. Use the same command located in the file menu of the OpenType panel.
3. Use the Kerning Assistance dialog box that is described below.

Kerning Assistance

FontLab has a special dialog box that can simplify the creation of class-based kerning. Before you start using it, define some kerning classes (which have their name preceded by an underscore and one of the glyphs in the class is selected as a key glyph).

To open the Kerning Assistance dialog box use the **Tools > Kerning Assistance** command:



There is no kerning defined for this pair

_A: A' Aacute Acircumflex Adieresis Agrave Aring Atilde Abreve Amacron Aogonek

The dialog box has a toolbar at the top, two lists of kerning classes (for left and right glyphs in the pair) and a sample panel that shows the result of kerning of the pair.

The left and right lists contain all the kerning classes of your font. The classes on the left contain the first glyph of a pair. The right list contains second glyphs of pairs. Check the classes that may act as a first glyph (see previous section for explanation of the class side). Those classes which are kerned with the key glyph of the "left" class will be highlighted with a yellow background and the sample panel below the lists will preview combinations of glyphs from the first and second class that are currently selected.

The actual kerning positioning and the exact kerning value come from the kerning of the key glyphs of each of the kerning classes. This means that if you have an "_A-class" and a "_V-class" which have 'A' and 'V' as key glyphs in each class, respectively, you must define the kerning for the "AV" pair using the Metrics window. If you then checked "_A-class" in the left list and "_V-class" in the right list all glyphs in these classes would be kerned by the same value as the "AV" pair.

A **preview panel** in the bottom of the dialog box can preview the result of the class kerning. Left-drag to scroll the preview panel and see more sample pairs.

Click on the Right-to-left RTL button on a toolbar to show the preview in the right-to-left direction.

Buttons on the **toolbar** for working with the kerning data:

Open data file	Opens the data file with the kerning assistance information. FontLab can open data files saved by itself and kerning assistance files saved from Fontographer®. In the latter case FontLab will automatically generate kerning classes and check them in the list similarly to the Fontographer® Kerning Assistance dialog box.
Save data file	Saves current kerning assistance information to a data file so you can apply it to a different font.
☑ **Select all**	Checks all items in the current list (left or right)
□ **Deselect**	Unchecks all items in the current list

Defining a New Class

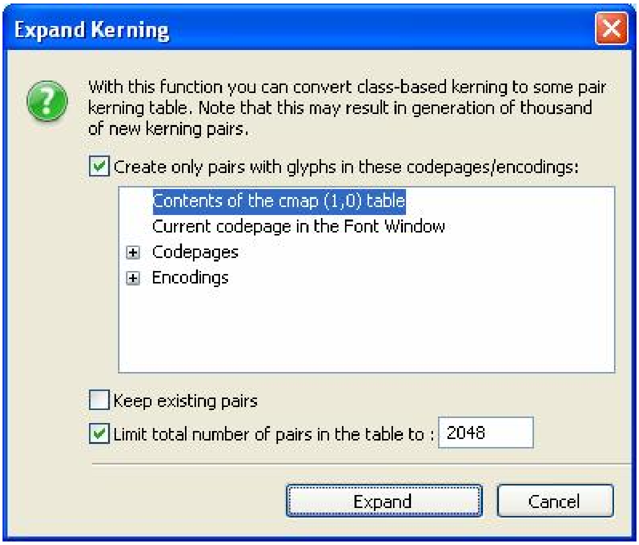
You can define a new kerning class without leaving the Kerning assistance dialog box. Click on the □ button and enter the class name and list of glyphs in the panel that is below the preview panel. Click the accept ✓ button to add the new class to the lists. Do not forget to mark the key glyph of the class with the single quote character: "_kern1: A' Agrave"

Editing the Class Code

Use the class panel (located below the preview) to change the class - remove or add glyphs. Click on the accept button to put the changes into effect.

Expanding Kerning

Sometimes you may need to convert class-based kerning into a plain kerning table. To do so click the **Expand Kerning** button. You will see a dialog box that lets you customize the expanding process:



With this function you can convert class-based kerning to some pair kerning table. Note that this may result in generation of thousand of new kerning pairs.

☑ Create only pairs with glyphs in these codepages/encodings:

- Contents of the cmap (1,0) table
- Current codepage in the Font Window
- ⊞ Codepages
- ⊞ Encodings

☐ Keep existing pairs

☑ Limit total number of pairs in the table to : 2048

Expanding class kerning may generate a lot of new kerning pairs: if you have two classes kerned and each has 10 glyphs expanding will create 99 new kerning pairs. To let you control this process we introduced filtering options.

The first option, **Create only pairs with glyphs in these codepages/encodings,** lets you select the languages that you want to support by the new expanded pairs. Select one or more codepages or encodings and Fontlab Studio will generate only those pairs that have both glyphs in one of the selected codepages or encodings.

The second option, **Keep existing pairs,** allows you to control the preference of existing kerning pairs over the new automatically generated pairs.

The third option, **Limit total number of pairs...,** allows you to limit the total number of newly generated pairs. Filtering is based on the absolute value of the pair - pairs with bigger values (positive or negative) have a better chance of being generated.

After you select your options and click the Expand button Fontlab Studio will calculate the number of new and modified pairs and issue a warning. Click Yes to continue and No to cancel.

Compressing Kerning

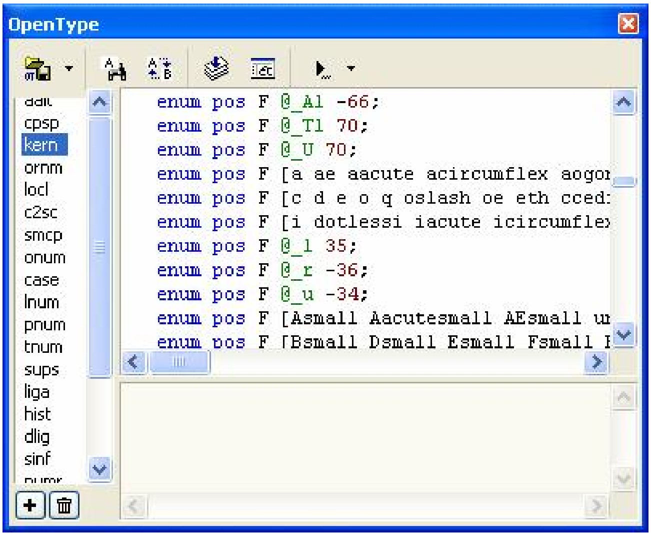
Fontlab Studio can perform an operation that is the opposite of expanding class-based kerning. It is called kerning compression. If you have some plain kerning in your font and have defined some kerning classes (manually or automatically), you can convert plain kerning to class kerning. Click on the Compress button. You will see a warning message and if you press on the Compress kerning table button Fontlab Studio will analyze the kerning table and classes and try to remove plain kerning pairs that are unnecessary if class kerning is correctly defined for the font.

Updating the "kern" Feature

If you change some properties of the kerning classes in the Metrics window, Classes panel or Kerning assistance dialog box, this updated information will be stored in the font (and saved in the VFB file) but will have no effect on the exported OpenType font. To put class kerning into effect you need to store it in the form of a "kern" feature that is compiled into a binary glyph positioning table.

To update the kern feature click on this button:

You may open the OpenType panel (**Window > Panels > OpenType**) to see the new kern feature:

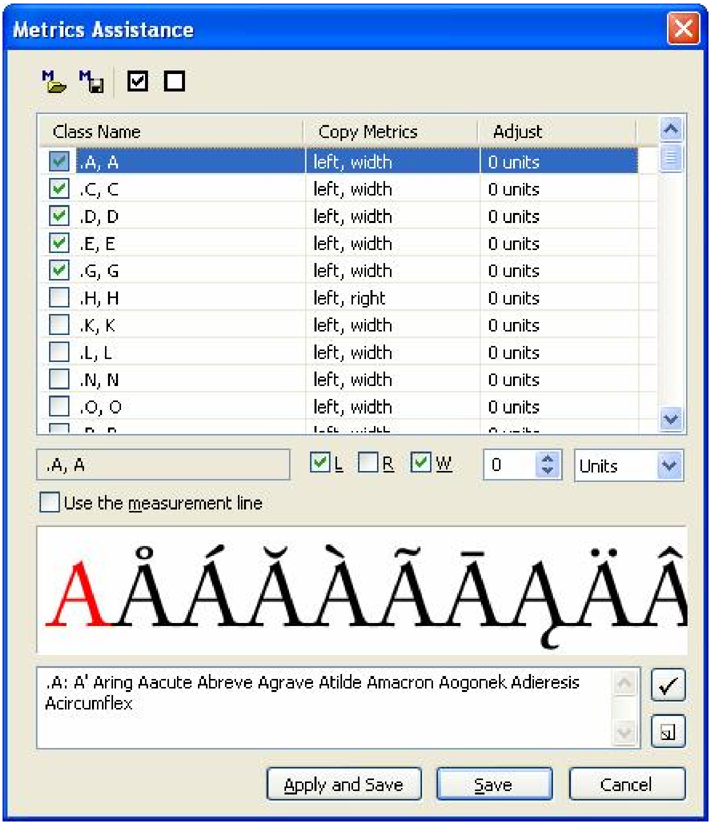


```
    enum pos F @_Al -66;
    enum pos F @_Tl 70;
    enum pos F @_U 70;
    enum pos F [a ae aacute acircumflex aogo
    enum pos F [c d e o q oslash oe eth cced
    enum pos F [i dotlessi iacute icircumfle
    enum pos F @_l 35;
    enum pos F @_r -36;
    enum pos F @_u -34;
    enum pos F [Asmall Aacutesmall AEsmall u
    enum pos F [Bsmall Dsmall Esmall Fsmall
```

If you want to understand what this means, please refer to the “OpenType Fonts” chapter on page 815.

Metrics Assistance

Another way to use a kerning class is to adjust the metrics (advance width and left and right sidebearings) in the glyphs that belong to the class. Use the **Tools > Metrics assistance** command to open the Metrics assistance dialog box:



Class Name	Copy Metrics	Adjust
☑ .A, A	left, width	0 units
☑ .C, C	left, width	0 units
☑ .D, D	left, width	0 units
☑ .E, E	left, width	0 units
☑ .G, G	left, width	0 units
☐ .H, H	left, right	0 units
☐ .K, K	left, width	0 units
☐ .L, L	left, width	0 units
☐ .N, N	left, width	0 units
☐ .O, O	left, width	0 units

.A, A ☑ L ☐ R ☑ W 0 Units

☐ Use the measurement line

AÅÁĂÀÃĀĄÄÂ

.A: A' Aring Aacute Abreve Agrave Atilde Amacron Aogonek Adieresis Acircumflex

It has a toolbar, a list of the metrics classes, a command area, a preview panel and a class information panel that lets you change class definitions and define new classes.

Before you start using class metrics, define some metrics classes (their names must start with a period). You can do that inside the Metrics assistance dialog box, but adding classes with the Classes panel is much easier.

The typical procedure to define class-based metrics:

1. Select the class in the list.
2. Check the checkbox to the left of the class name to indicate that that the class must be processed.
3. In the control area below the list check the metrics you want to copy from the key glyph of the class to the rest of the glyphs. It could be **L** for the left sidebearing, **R** for the right sidebearing and **W** for the advance width.
4. If you want, you can use the **Adjust** field at the right of the control area to change the metrics when they are copied from the key glyph of the class. Enter a positive or negative value and select the units - font units or percent of the original value.

Of course, you can generate some metrics classes automatically using the Generate Classes feature described on page 593.

Optionally you can measure sidebearings along the measurement line, which may be very useful if you are working with a serif font.

Use the preview panel to see the effect of your actions. To apply the new metrics click the **Apply and Save** button. Click on the **Save** button to store the metrics assistance information without actually changing the glyph metrics.

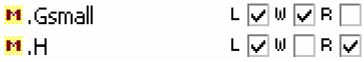
The editing field below the preview panel lets you change the class definition. Click on the ✓ button to accept changes. To create a new class, press the ▣ button.

Use the toolbar buttons to perform additional operations in the Metrics Assistance dialog box:

📂	**Open data file**	Opens the data file with the metrics assistance information. FontLab Studio can open data files saved by itself and metrics assistance files saved from Fontographer®. In the latter case FontLab will automatically generate classes and import all information that is compatible with the FontLab metrics assistance feature
💾	**Save data file**	Saves current metrics assistance information to the data file so you can apply it to different fonts
☑	**Select all**	Checks all classes in the list
□	**Deselect**	Unchecks all classes in the list.

Editing Metrics Class Properties in Classes Panel

You can define "left", "right" and "width" properties of the metrics class without opening the Metrics Assistance dialog box. If you look at the metrics class in the Classes panel you will see that it has some controls to the right of the name:



.Gsmall L ☑ W ☑ R □
.H L ☑ W □ R ☑

These check boxes mean the same as the L, R and W controls in Metrics assistance. Use them to declare the properties of the metrics class.

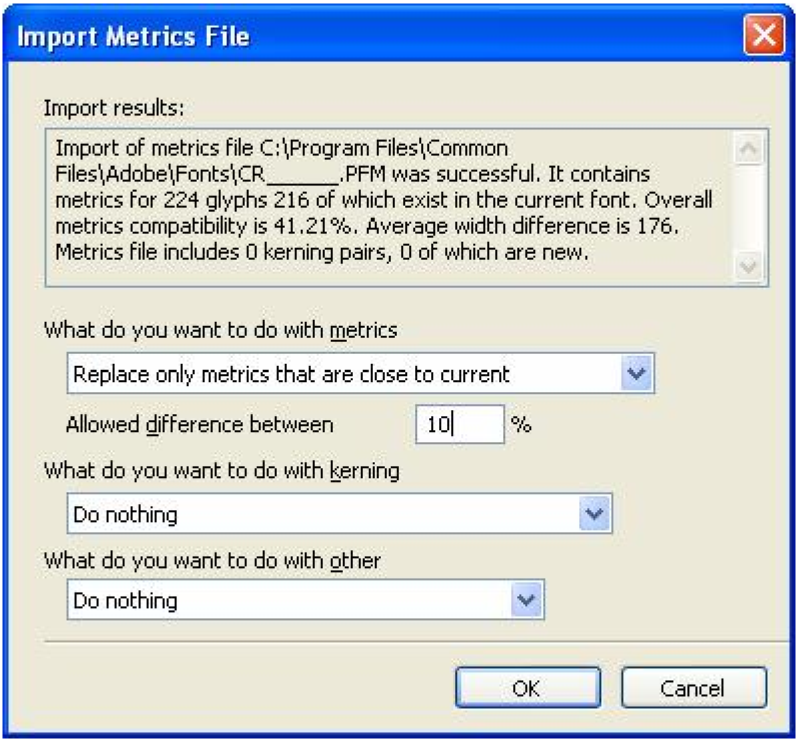
You will have to open the Metrics assistance dialog box to apply metrics class relations and adjust metrics accordingly.

Opening Metrics Files

FontLab allows you to import metrics and/or kerning information into the current font. Using this feature, you can create metric and kerning information once and use it in several similar fonts.

To import a metrics file into FontLab click the button on the toolbar. You will see the standard Windows Open File dialog box. Select the metrics file that you want to import (in PFM or AFM format) and press the **OK** button.

The **Import Metrics** dialog box appears:



Import Metrics File

Import results:

Import of metrics file C:\Program Files\Common Files\Adobe\Fonts\CR______.PFM was successful. It contains metrics for 224 glyphs 216 of which exist in the current font. Overall metrics compatibility is 41.21%. Average width difference is 176. Metrics file includes 0 kerning pairs, 0 of which are new.

What do you want to do with metrics: Replace only metrics that are close to current

Allowed difference between: 10 %

What do you want to do with kerning: Do nothing

What do you want to do with other: Do nothing

The topmost control contains a legend describing the metrics file that you are importing and its compatibility with the current font.

The options in the **Parameters** area let you select various metrics importing options:

What do you want to do with the metrics data:

Do nothing	Do not import metrics data from this file
Replace all metrics in the current font	Import all metrics data (glyphs' widths and sidebearings) and replace the metrics data in the current font. We recommend that you use this option only if your font is very similar to the metrics file that you are importing
Replace all metrics that are close to current	Replace only those metrics records that are similar to the imported metrics. The **Possible difference between metrics** option controls the allowed difference
Replace metrics that are thinner than in the current font	These options are obvious.
Replace metrics that are wider than in the current font	

What do you want to do with the kerning data:

Do nothing	Do not import kerning data from the metrics file
Completely replace kerning data in the current font	Remove all existing kerning pairs and replace them with pairs imported from the metrics file
Add imported kerning data to the current font	Leave the existing kerning pairs unchanged but add new kerning pairs from the metrics file
Add new kerning pairs but autokern them	Import information about the glyphs that form each kerning pair in the metrics file and apply an autokerning algorithm to these pairs.

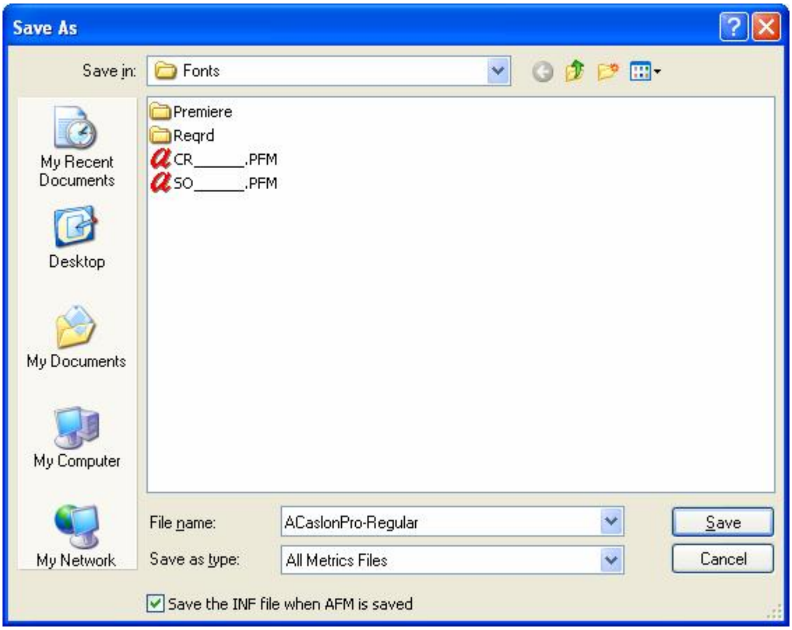
The **What do you want to do with other data?** option controls the font header importing option. FontLab can import the Font Info data from the metrics file and replace the current font info data if the **Replace this data in the current font** option is selected.

Note that when you open a metrics file while editing the metrics of a Multiple Master font only the metrics and kerning of the currently selected master will be replaced. Be careful.

Saving Metrics Files

When you export a font file in Type 1 font format the metrics files (in AFM and PFM formats) are automatically written. The TrueType font format includes all metrics information so it is not necessary to export additional files.

However, if you want **to export a metrics file alone**, you can always do so by using the Metrics Window. Just press the button on the Metrics Window toolbar. The Standard Save File dialog box appears.



File name: ACaslonPro-Regular

Save as type: All Metrics Files

☑ Save the INF file when AFM is saved

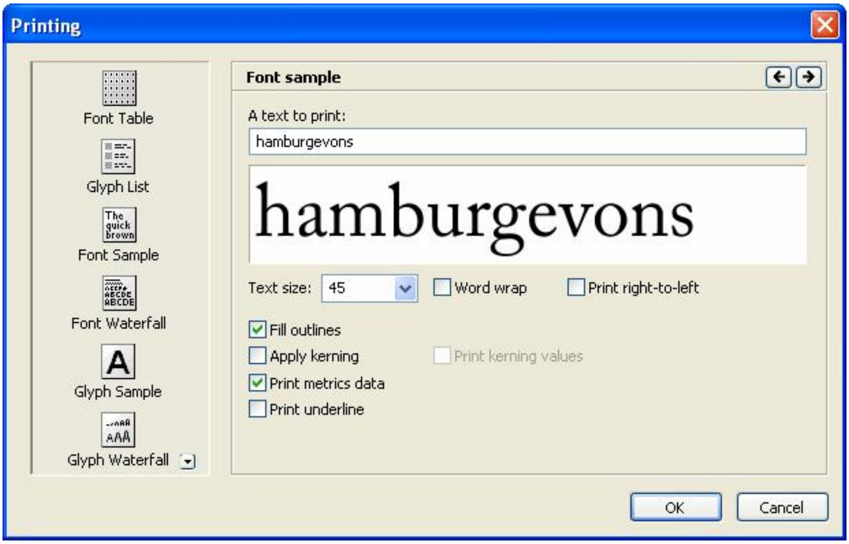
Select the destination format (AFM or PFM for single master fonts and AMM or MMM for Multiple Master fonts), and the destination directory. Enter the file name and press the **Save** button to save the metrics file.

You may choose whether to save the font information (.inf) file along with the .afm metrics file or not.

Printing

While you are in the Metrics Window you can print sample strings with or without metrics and kerning information. To do so select the **Print** command in the **File** menu.

Choose the Font Sample page:



A text to print: hamburgevons

Text size: 45 □ Word wrap □ Print right-to-left

☑ Fill outlines

□ Apply kerning □ Print kerning values

☑ Print metrics data

□ Print underline

You will see that the "A text to print" field is populated with the sample string from the metrics window. Select other appropriate options and click **OK** to print the sample.

Check the “Printing and Proofing Fonts” chapter on page 277 for more printing options.

Actions

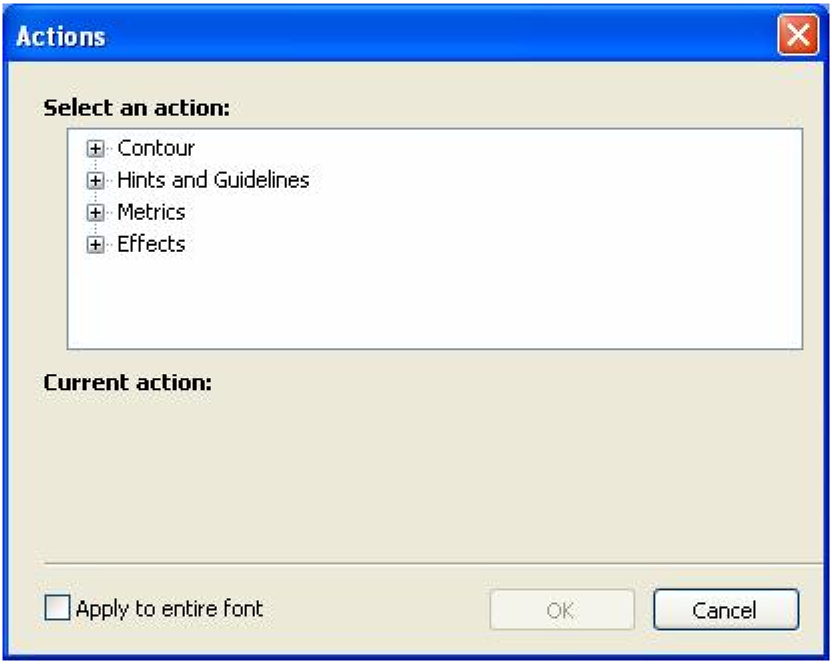
In FontLab Studio you can transform glyphs in many ways. You can edit glyphs and glyphs' metrics manually using the Glyph and Metrics windows described in previous chapters. Or you can use FontLab Studio's actions to edit glyphs or metrics automatically. Actions may be applied to one glyph, to a range of glyphs selected in the Font window, to a special set of glyphs (only to letters or only to digits, for example) or to a whole font. All actions are carefully designed and often produce high-quality results that do not require manual control or correction.

In this chapter we will show you how to use the actions and give a detailed description of each available action.

8

The Actions Dialog Box

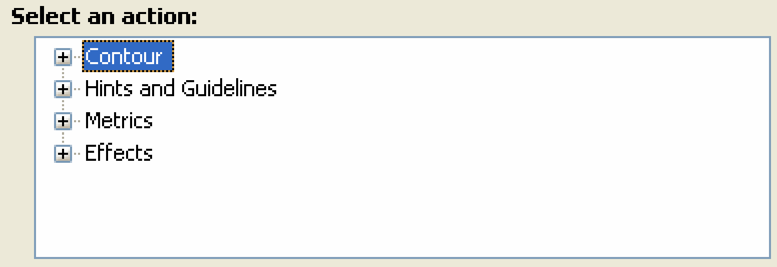
The easiest way to apply actions is to use the Actions dialog box. It is accessible from the **Tools** menu while the Font or Glyph window is active. Select the **Action** command from the **Tools** menu and you will see a dialog box:



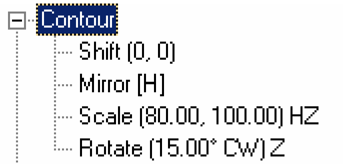
Note: in previous versions of FontLab, this dialog box was called Transformation. By default the box is empty.

If you open this dialog while the Glyph window is active the action will be applied only to the glyph currently open. If you open it while the Font window is active then the action will be applied to all selected glyphs.

To choose an action to run use the list of actions:

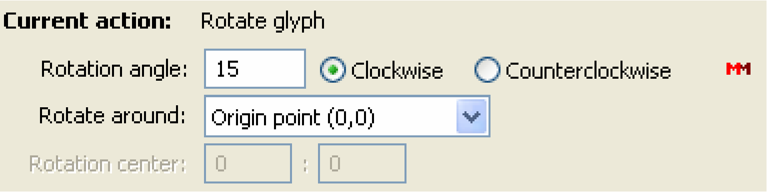


Expand one of the categories to see all the actions:



Some action names are followed by their parameters in brackets.

Select an action and you will see a parameter panel appear below the list:



Current action: Rotate glyph

Rotation angle: 15 ● Clockwise ○ Counterclockwise MM

Rotate around: Origin point (0,0)

Rotation center: 0 : 0

The contents of the parameter panel depend on the action selected. Note the red MM mark in the right top corner of some parameter panels. This mark means that the currently selected action may be applied to a single master of a Multiple Master font. All actions that do not have this mark are not compatible with MM fonts. You can use them, but all the masters will stick together and you will lose the "multiple-masterness" of your font.

After you select an action and set its options, press the **OK** button to run the action. If you are applying the action to a lot of glyphs a warning message will appear telling you how many glyphs you will modify and asking you for confirmation. Action applied to many glyphs is not undoable, so it’s a good idea to save your font before running this action.

You can repeat the last action by choosing the **Tools > Repeat Action** command or by pressing the button in the Transformation panel.

Below you will find a detailed description of each available action. A description of the more sophisticated **Action Set** dialog box, where you can build an Action Set that can include many actions, finishes up this chapter.

Actions

There are four groups of actions:

Contour	The outline of a glyph is transformed
Hints and Guidelines	Actions that are concerned with hints and links
Metrics	Metrics information is transformed (includes automatic metrics generation)
Effects	A set of effects that can be applied to glyphs.

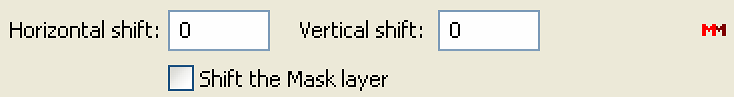
The actions in the Actions and Action Set panels can be applied to entire glyphs only, not to parts of glyphs. If you wish to scale, rotate or mirror a selected portion of a glyph rather than the entire glyph, please use the Transformation panel (**Windows** menu) or the Free Transform feature (context menu of an outline selection).

Contour Transformation

Here is a list of all the outline transformation actions:

Shift	Shifts the glyph's outline
Mirror	Mirrors the glyph vertically or horizontally
Scale	Scales the glyph proportionally or non-proportionally
Rotate	Rotates the glyph
Slant	Slants the glyph
Decompose	Decomposes a composite glyph
Curves to PostScript	Converts an outline to the Type 1 (3rd-order curves) format
Curves to TrueType	Converts an outline to the TrueType (2nd-order curves) format
Contour Direction	Sets the direction of contours to PostScript or TrueType or reverses all contours
Connections	Automatically detects the connection types between the contour segments
Extremes	Automatically inserts points at extreme points on curves
Remove Overlap	Removes overlapping parts of the glyphs' outline
Make Master	Automatically calculates the 4th master when 3 other masters are known
Optimize	Optimizes the glyph outline with a custom set of options
Blend	Blends the outline and mask layers.

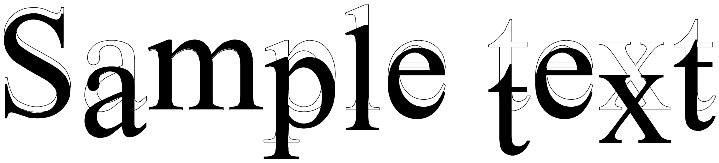
Shift



Horizontal shift: 0 Vertical shift: 0

□ Shift the Mask layer

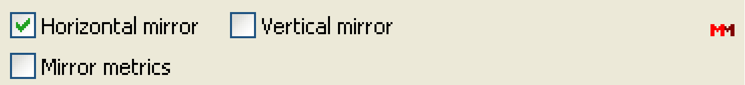
This action shifts the outline of the glyph in the vertical and/or horizontal direction. Here is a sample of a font with some glyphs shifted in the vertical direction:



You can also shift glyphs in the vertical direction in the metrics mode of the Metrics window: hold the Shift key and drag the glyph.

Use the **Shift the Mask Layer** control to shift the mask layer together with the outline or to leave it untouched.

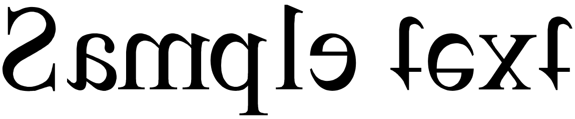
Mirror



☑ Horizontal mirror □ Vertical mirror

□ Mirror metrics

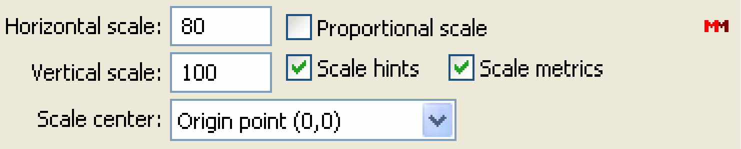
Here is the result of this simple transformation:



The letters in the word “Sample” were mirrored horizontally and the letters in the word “text” – vertically.

Use the **Mirror Metrics** control to swap left and right sidebearings of a glyph.

Scale



Horizontal scale: 80 ☐ Proportional scale

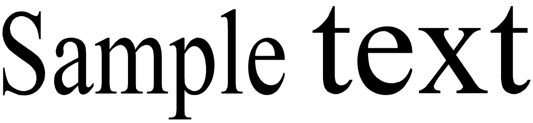
Vertical scale: 100 ☑ Scale hints ☑ Scale metrics

Scale center: Origin point (0,0)

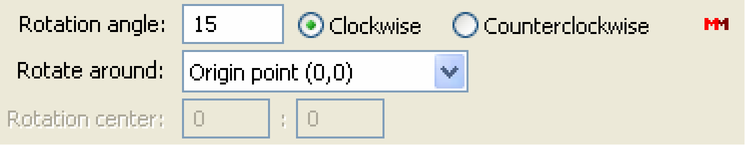
This action lets you scale your glyphs proportionally or non-proportionally. Enter your desired vertical and horizontal scale factors in the edit fields. Switch on the **Proportional scale** option to keep the vertical and horizontal scale factors the same.

Switch off the **Scale hints** option to avoid scaling hints along with the glyph's outline. Scaling hints' width is not always precise so if you scale hints with the outline you sometimes find that some hints now miss the nodes that they were supposed to hint. We recommend converting hints to links before this transformation to keep the proper width and position of hints.

Here is an example of this transformation (the letters of the word "Sample" were scaled 80% horizontally and the letters of word "text" were proportionally scaled to 120% of original size):



Rotate



Rotation angle: 15 ● Clockwise ○ Counterclockwise

Rotate around: Origin point (0,0)

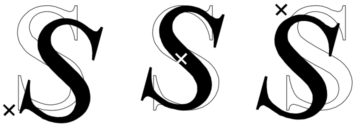
Rotation center: 0 : 0

This transformation action simply rotates glyphs. You can set the rotation angle, the position of the center of rotation and the direction of rotation.

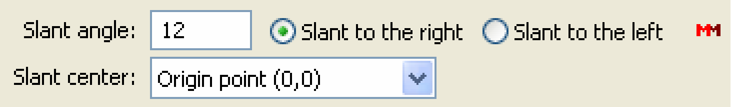
You can rotate glyphs around the origin point, around the reference point, around the center of the glyph’s bounding box or you can specify a point that will be used as the center of rotation.

To specify the reference point, drag the glyph's origin point ☼ in the Glyph window.

Here is an example of the same rotation transformation around different center points:



Slant

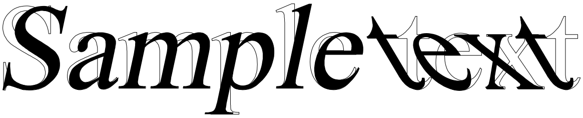


Slant angle: 12 ● Slant to the right ○ Slant to the left

Slant center: Origin point (0,0)

This action slants glyphs. It is the quickest way to make an oblique version of your font. Just apply this transformation to all the font’s glyphs and correct the Font Info settings to let the operating system know that this font is now oblique.

Here is a sample of Slant transformation (“Sample” is slanted 12 degrees to the right and “text” is slanted 30 degrees left):



Decompose

This action is the equivalent of the **Decompose** command from the **Glyph** menu. It replaces references to other glyphs (components) by the respective outlines. If the components were scaled or shifted, this information is retained accordingly. Applied to the whole font, it makes the font free of composites.

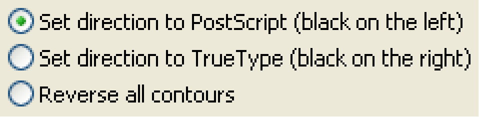
Curves to PostScript

This action converts all TrueType curves (2nd-order, quadratic B-splines) in the selected glyphs into PostScript curves (Type 1 curves, 3rd-order, cubic Bezier curves). TrueType curves are used in TrueType and OpenType TT fonts, PostScript curves are used in Type 1, OpenType PS and MM fonts. Use this command if you want to manually prepare a TrueType font for conversion into Type 1 format, or if you opened a TrueType font but prefer to edit outlines in the Bezier form. This action does not change the contour direction – do not forget to correct the direction of the contours to make the glyphs compatible with the Type 1 or the OpenType PS format requirements.

Curves to TrueType

This action is the reverse of the previous one. It converts PostScript curves into TrueType curves. Usually, it is used to prepare a Type 1 font for manual TrueType hinting. This action does not change the contour direction so you need to correct the direction of the contours in an extra step, using the following action.

Contour Direction



● Set direction to PostScript (black on the left)
○ Set direction to TrueType (black on the right)
○ Reverse all contours

This action automatically detects the direction of contours and corrects them according to the option selected. The **Reverse all contours** option just changes the direction of all contours to the opposite.

Connections

Use this action to reset and recalculate the types of connections between outline segments. For example, if the BCPs of two curve segments are aligned but the connection is sharp, it will be set to a smooth connection. This is useful after major modification of an outline when you want to review how outline segments are connected.

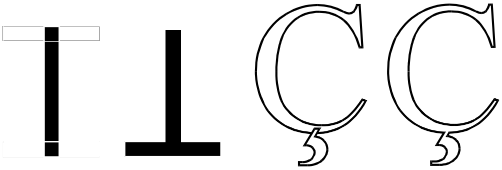
Extremes

This command is the equivalent of the **Nodes at extremes** outline action that was described in the "Glyph Window" chapter. Use it to automatically insert nodes at curves' extreme points as is required by the Type 1 or OpenType PS specification.

Remove Overlap

This action removes overlapping parts of the glyph's outline. It also sets the direction of all the contours to counterclockwise (as it required by the Type 1 specification). Use this transformation as the final step to prepare glyph outlines for hinting or production.

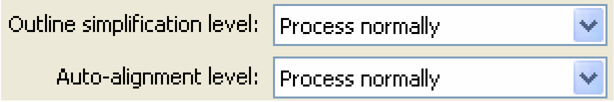
Several examples of this transformation:



Make Master

This transformation takes three known masters of a four-master Multiple Master font and calculates the fourth master. It uses a simple algorithm of linear extrapolation, so the results are not usually precise. But they may give important information about the proportions of the fourth master, so you can get a close approximation of what the fourth master should look like.

Optimize



Outline simplification level: Process normally

Auto-alignment level: Process normally

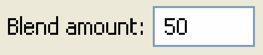
With the Optimize action FontLab Studio tries to automatically adjust the outline to remove unnecessary elements and correct others.

With the action options you can control the optimization process:

Outline Simplification level	Controls the curve removal feature, from “do not simplify outline” to “extreme”. The bigger value you choose the more curves FontLab Studio will try to remove/smooth
Auto-alignment level	Controls the auto-alignment feature in a range from “do not align” to “extreme”.

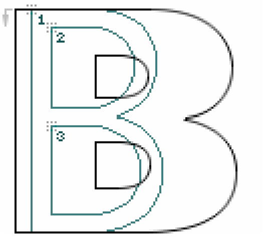
Auto-alignment automatically corrects relative position of lines and curves, for example, if two adjacent curves are almost smoothly connected, but not precisely, auto-alignment will correct that.

Blend



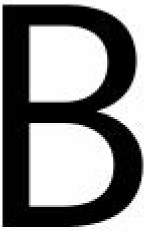
Blend amount: 50

This transformation blends the mask and outline layers, and replaces the outline layer with the result. A single parameter lets you choose the position of the intermediate design between the mask and outline layers:

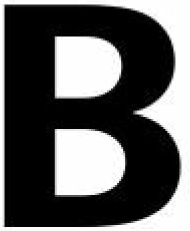


Outline and mask layers

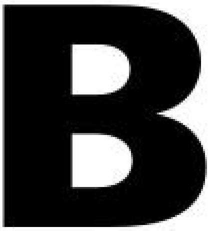
On the example above outline layer is black weight and mask layer is regular. Below are samples of the Blend transformation with different values of the parameter:



10%



50%



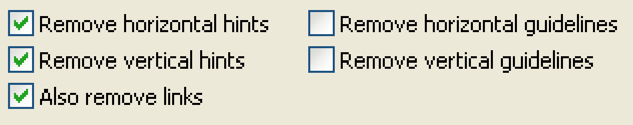
80%

Hints and Guidelines Transformation

Hints transformation actions let you automate some hinting actions:

Remove Hints/Guides	Lets you remove hints and links or guidelines
Autohint	Automatically generates hints
Convert to Instructions	Converts Type 1 hints to editable visual TrueType instructions
Autoreplace	Automatically generates a hint replacement program
Convert to Links	Converts all hints to links
Convert to Hints	Converts all links to hints
Drop TT Hints	Removes all TrueType hints, visual or imported
Reassign Stems	Checks all links in TrueType hinting program and tries to automatically select the best stems for them.

Remove hints/guides



☑ Remove horizontal hints

☑ Remove vertical hints

☑ Also remove links

☐ Remove horizontal guidelines

☐ Remove vertical guidelines

Use this action to remove hints and links or guidelines in selected glyphs. This command is the equivalent of the **Remove Hints** and **Remove Guides** commands that were described in the "Glyph Window" chapter.

Autohint

Analyses a glyph's outline and generates hints for the glyph. This action uses autohinting options that can be set in the **Type 1 Autohinting** page of the Font Info dialog box. Please refer to the page 738 for a description of the autohinting options.

Convert to instructions

Use this action to convert Type 1 hints to the editable TrueType visual instructions. Do not forget to prepare the outlines of the glyphs for TrueType hinting using the Curves to TrueType transformation action. You can find a detailed description of this process in the “Hinting” chapter.

Autoreplace

This action automatically builds a hint replacement program for the overlapping Type 1 hints. Run it after autohinting. Refer to the chapter “Hinting” for more information about hinting and hint replacement.

Convert to links

Use this action to convert Type 1 hints to links. FontLab Studio will analyze the outline of the glyph and try to make links that will replace the hints. Refer to the “Glyph Window” chapter for information about hints and links.

Convert to hints

This action is the reverse of the previous one. It converts all links to hints. Because this operation is always possible (conversion of hints to links is not), you can be sure that it will replace all links by hints.

Drop TT Hints

This action removes all TrueType hints, including visual (manually created) and imported, from the source TrueType font.

Reassign stems

This operation will check all TrueType hinting program for a glyph. If there are some links (single links or double links) that are attached to standard stem, it will try to automatically select the best stems. This operation is useful if you performed some heavy editing of the TrueType standard stems and want to make sure that correct stems are assigned to links.

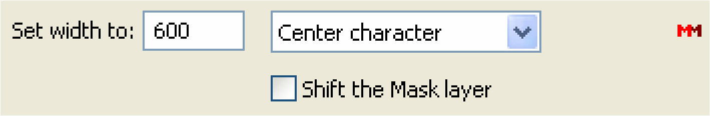
Metrics Transformation

These transformations let you automatically set metrics, calculate metrics in glyphs, increase or decrease a glyph's sidebearings and width, and center glyphs in their advance width.

Available metrics transformations are:

Set Width	Sets a fixed advance width and aligns the glyph within the advance width
Set Sidebearings	Sets or changes sidebearings' values
Center Glyph	Centers a glyph in the advance width
Autospacing	Automatically calculates the glyph's metrics using the same algorithms that are used in the Metrics window
Adjust Metrics	Changes sidebearings and kerning by the given value in font units or in percentage.

Set Width



Set width to: 600

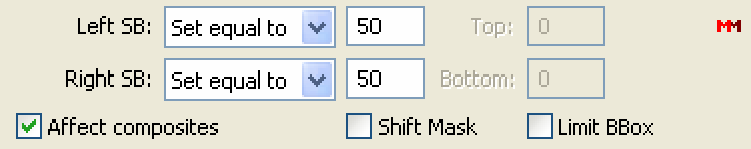
Center character

□ Shift the Mask layer

This action lets you set a fixed width for all glyphs that are selected in the Font window. It is the fastest way to make a monospaced font: select all glyphs, open the Actions dialog, set the desired width and press the **OK** button.

In the parameter panel you can choose what to do with glyphs that are thinner than the requested advanced width. A glyph may be aligned to the left or right margins or it may be centered in the advance width.

Set Sidebearings



Left SB: Set equal to 50 Top: 0

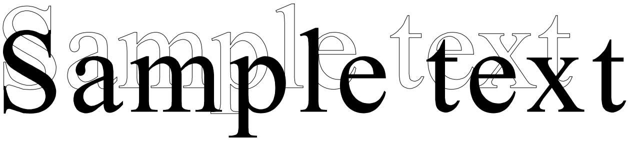
Right SB: Set equal to 50 Bottom: 0

☑ Affect composites ☐ Shift Mask ☐ Limit BBox

Use this action to change the sidebearings' values of the glyphs. You can set new values for the left or right sidebearings or change these values by entering the amount in font units. So if you think that your font needs some more white space, just select this action, choose the **Increase by** option in the list boxes and enter the value by which you want to increase the sidebearings.

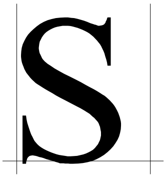
If the **Affect composites** option is off the action will not be applied to composite glyphs.

Here is a sample of increased glyph widths:

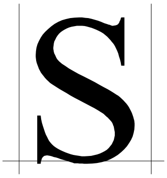


Center glyph

This action simply centers the glyph in the advance width:

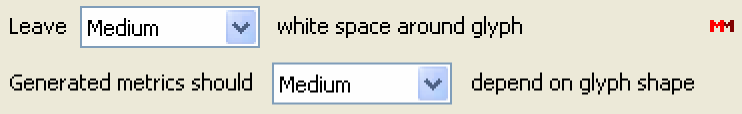


Before centering



After centering

Autospacing

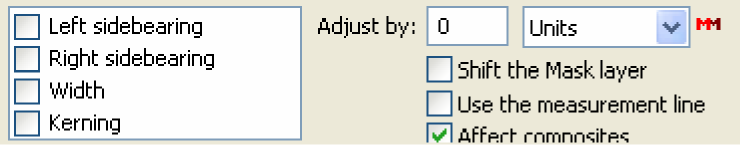


Leave Medium white space around glyph

Generated metrics should Medium depend on glyph shape

This action analyses the glyph’s outline and automatically calculates its sidebearings. It uses the same algorithm that is used to automatically calculate metrics in the Metrics window. Refer to the “Automatic Metrics Generation” section in the “Editing Metrics” chapter for more information about the autospacing algorithm and options.

Adjust Metrics



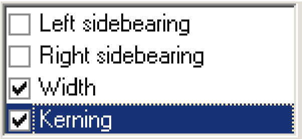
□ Left sidebearing
□ Right sidebearing
□ Width
□ Kerning

Adjust by: 0 Units

□ Shift the Mask layer
□ Use the measurement line
☑ Affect composites

This action lets you to change metrics or kerning by some given value or percentage of the original value.

In the options area select the metrics that you want to change:



□ Left sidebearing
□ Right sidebearing
☑ Width
☑ Kerning

Enter the amount by which you want to adjust the values and select the units (which can be font units or a percentage of the source value). Enter a positive number to increase metrics distances or kerning or a negative value to decrease them.

Normally metrics are measured from the bounding box. You can change this, however, if you want, to measure from a measurement line by using the check box.

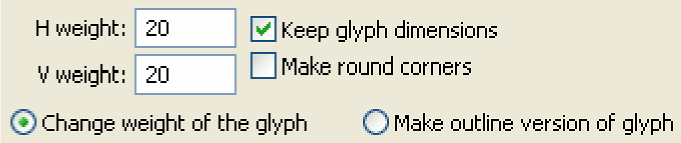
A measurement line is horizontal line (defined in the Glyph Window) that defines a “slice” which is used to measure the distance from outline to sidebearings. Please, refer to page 469 in the “Glyph Window” chapter.

Effects

Increase your font library with this set of professionally designed effects. From outline to 3D-shadow, to gradient fill – these transformation filters always produce good results.

Bold/Outline	Increases the glyph's weight or creates an outline version of the glyph
College	Makes a double outline version of the glyph
Shadow	Generates a drop shadow
3D Extrusion	Makes a "3D" version of the glyph
3D Rotate	Makes an illusion of a glyph rotated in 3D space
Gradient	Generates an illusion of a gradient fill
Random	Randomly moves nodes
Envelope	Applies one of the predefined envelope transformations
Parallel	Creates parallel contour(s)
Expand	Converts contour into a brush path
Add Nodes	Adds more nodes to contours.

Bold/Outline



H weight: 20

V weight: 20

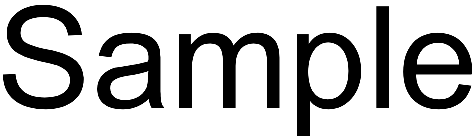
☑ Keep glyph dimensions

□ Make round corners

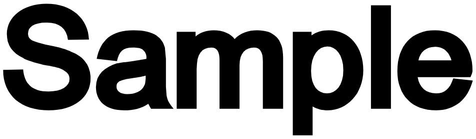
● Change weight of the glyph

○ Make outline version of glyph

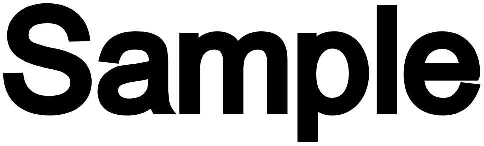
This is one of the most used actions in FontLab Studio. With it you can precisely change the weight of the glyph's stems, make an outline version of the glyph or change the contrast:



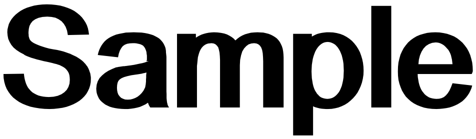
Original glyphs



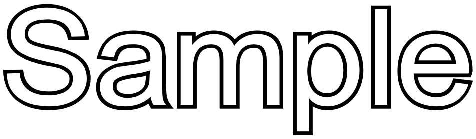
Bold 20 units in both directions Keep glyph's dimensions is ON



Bold 20 units in both directions. Keep glyph's dimensions is OFF
Note that the size of all the glyphs has changed



Bold 20 units in the horizontal direction

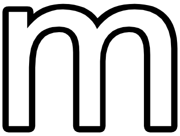


Outline 20 units in both directions. Make round corners is OFF

Enter the horizontal and vertical values that will be used to increase (positive numbers) or decrease (negative numbers) the weight of the outline.

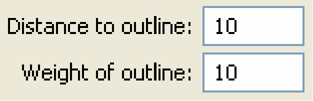
Switch on the **Keep glyph's dimensions** check box to scale the glyph so the weight-increasing effect will be compensated.

Switch on **Make round corners** to make rounded corners in the new outline:



Note that the weight-changing values are in font units, so the visual effects of this action depend on the font's UPM value.

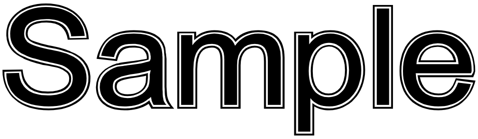
College



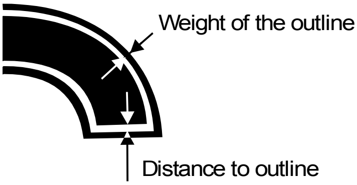
Distance to outline: 10

Weight of outline: 10

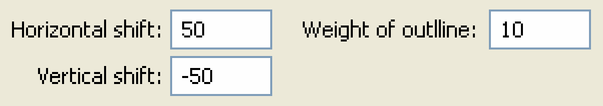
The best way to explain this effect is to see a sample of it:



The parameters of this effect are very simple:

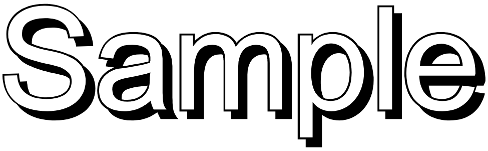


Shadow

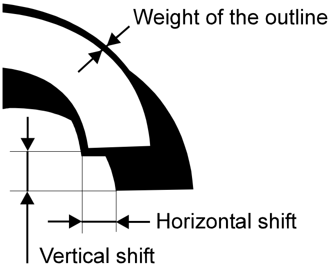


Horizontal shift: 50
Vertical shift: -50
Weight of outline: 10

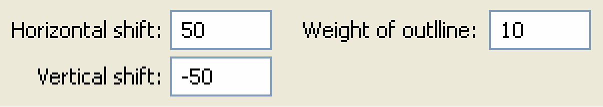
This is a very nice effect that can save you a lot of time. Those who have tried to make a shadow font manually know what a miracle this transformation performs:



The parameters set the shift of the shadow (positive values are to the right and up) and width of the outline:

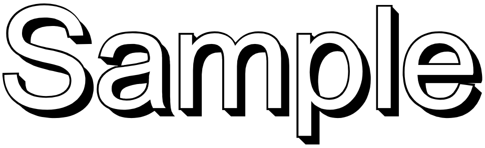


3D Extrusion



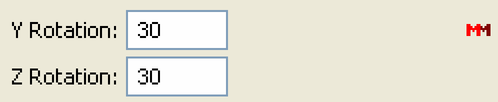
Horizontal shift: 50
Vertical shift: -50
Weight of outline: 10

This action is similar to the Shadow action but it simulates a 3D thickness of the glyphs:



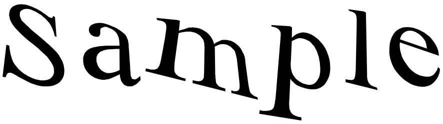
The parameters of this action are the same as in the previous section.

3D Rotate


Y Rotation: 30

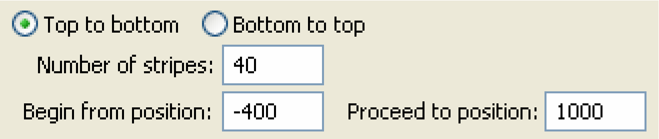
Z Rotation: 30

With this action you can “rotate” your glyphs in “3D” space:



The parameters of this action set angles of rotation for glyphs around imaginary axes. **Z Rotation** means rotation around the vertical axis. **Y Rotation is** around the horizontal axis. The vertical axis goes through the middle of the glyph.

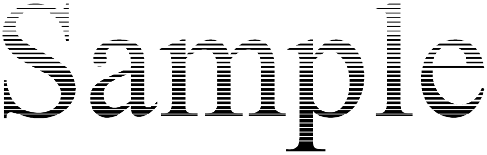
Gradient


● Top to bottom ○ Bottom to top

Number of stripes: 40

Begin from position: -400 Proceed to position: 1000

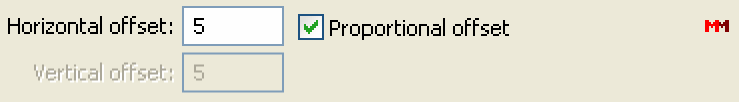
Here’s what you can do with this effect:



As parameters of this effect you can set the number of stripes that appear on your glyphs, the starting and finishing line of the effect and the direction of the gradient.

The starting and finishing lines can be manually set to let you customize this effect and make it look the same in all glyphs. Note that these values are set in font units so they are relative to the font’s UPM value.

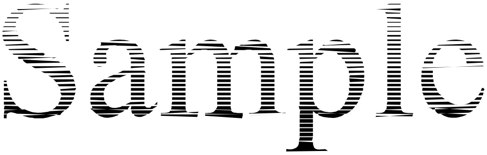
Random



Horizontal offset: 5 ☑ Proportional offset

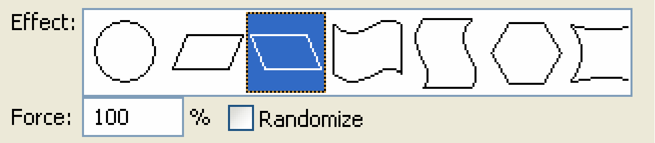
Vertical offset: 5

This effect randomly shifts a glyph's nodes. It is especially interesting when combined with other effects, like Gradient:



You can control how much the nodes are shifted. You can set the same value for both directions if the **Proportional offset** option is on or you can customize the values separately.

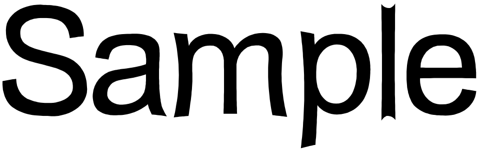
Envelope



Effect:

Force: 100 % □ Randomize

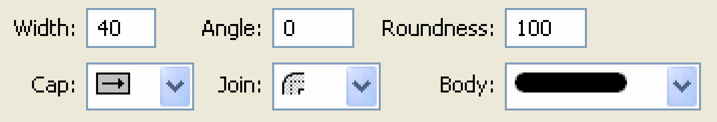
This effect lets you apply one of many predefined transformations to several glyphs at once. Refer to the "Glyph Window" chapter for more information about the Envelope effect. Here is an example of what you can do with this effect:



Arial font after "circle" envelope with -30% Force value

The **Randomize** option applies some random changes to the effect to make an even more interesting result.

Expand

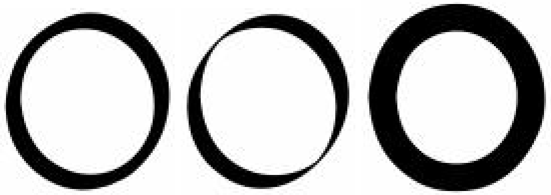


Width: 40 Angle: 0 Roundness: 100

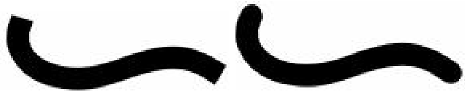
Cap: Join: Body:

The Expand effect will use contours as a trajectory for the paintbrush. It is almost the same as the **Contour > Paths > Expand Path** command.

Specify brush size and shape. **Width** is the width of the brush ellipse at its widest part. **Angle** is the degree of the brush ellipse slant and **Roundness** is the relation (in percent) of the narrow and wide widths of the brush ellipse. Below is a sample of the path expand with different brushes:

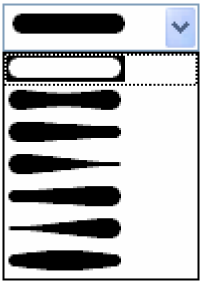


The next line of options specifies the way the expanding algorithm will process the contour corners and the ends of an open contour:

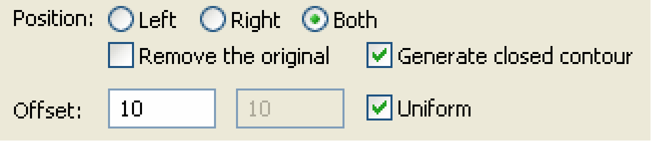


Flat contour ends vs. round ends

The last option **Body** lets you specify the shape of the brush stroke:



Parallel



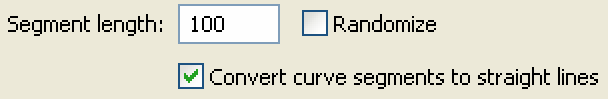
Position: ○ Left ○ Right ● Both

□ Remove the original ☑ Generate closed contour

Offset: 10 10 ☑ Uniform

The Parallel effect creates a contour that is parallel to the existing contour. It is the same as the **Make Parallel Path** command in the **Contour > Paths** menu. Refer to the "Make Parallel Path" section for more information about its algorithm and options.

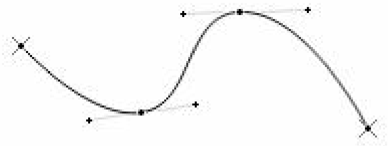
Add nodes



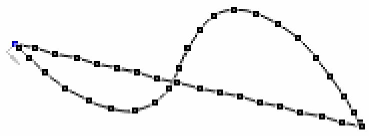
Segment length: 100 □ Randomize

☑ Convert curve segments to straight lines

The Add Nodes effect creates more nodes on the contour. It puts a node every x units, where x is the **segment length** value you entered. For example:



Before adding nodes



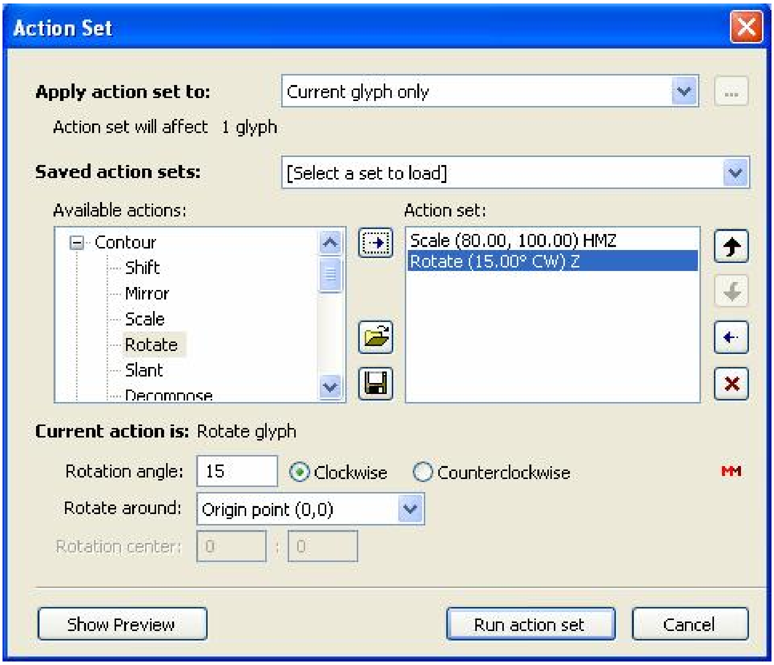
After adding nodes

Note that this action always closes open contours.

Action Set Dialog Box

There is a more advanced method of applying actions to glyphs. With it you can apply many actions at once, transform a subset of a font's glyphs, see an instant preview of a series of actions and even save action sets for future use.

To open the Action Set dialog box select the **Action Set** command in the **Tools** menu. Note that this command is available while any of the windows is open. You will see a rather complex dialog box:



Action Set

Apply action set to: Current glyph only

Action set will affect 1 glyph

Saved action sets: [Select a set to load]

Available actions:

Action set:

Scale (80.00, 100.00) HMZ
Rotate (15.00° CW) Z

Current action is: Rotate glyph

Rotation angle: 15 ● Clockwise ○ Counterclockwise

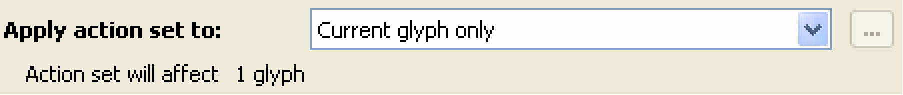
Rotate around: Origin point (0,0)

Rotation center: 0 : 0

This dialog box has several areas that control different options of the action set.

Action Set Range

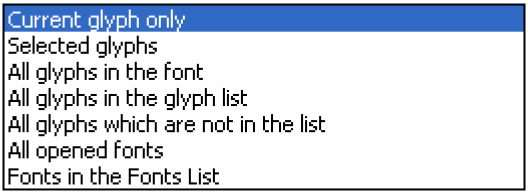
In the top part of the dialog box an **Apply action set to** area is situated:



Apply action set to: Current glyph only

Action set will affect 1 glyph

Controls in this area let you select which glyphs you want to transform. Open the combo box and you will see the available options:



Current glyph only	Actions will be applied only to one current glyph: the "blue" glyph in the Font window or the current glyphs in the Metrics or Glyph windows
Selected glyphs	Actions will be applied to all the glyphs that are selected in the Font window
All glyphs in the font	The whole font will be transformed
All glyphs in the glyph list	Only glyphs that are enumerated in the glyphs' list will be transformed (see below)
All glyphs that are not in the list	Only those glyphs that are not in the list will be transformed. Thus if the list includes all the digits and you select this option, all glyphs except the digits would be transformed
All opened fonts	Action set will be applied to all glyphs in all opened fonts
Fonts in the Fonts List	Action set will be applied to all glyphs in all fonts that are added to the fonts list (see below).

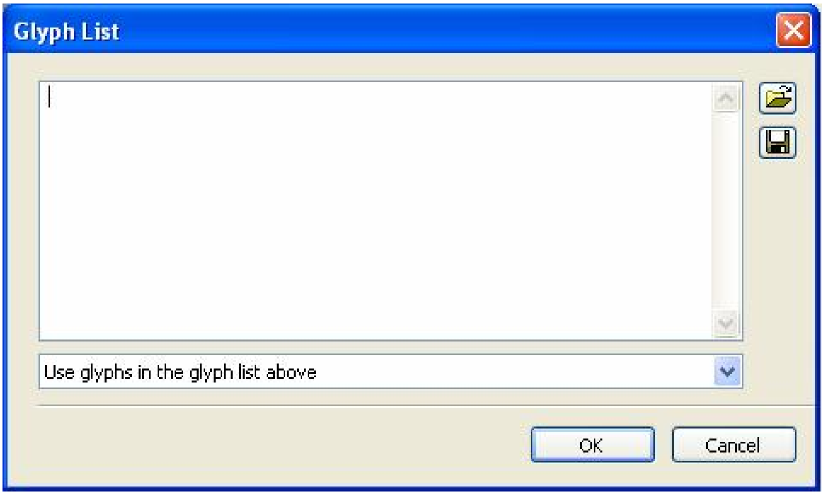
If you are editing a Multiple Master font the master selection combo box will appear below the range list and you can select the master that will be transformed. Note that only transformation actions that have the red MM mark in the right-top corner may transform a selected master. All other actions always transform all masters.

Glyph List

You may select which glyphs will be transformed by entering a list of glyphs. This is handy for repetitive or recurrent transformations.

To create a glyph list select the **All glyphs in the glyph list** or **All glyphs that are not in the list** options in the ranges selection list and press the ... button (which will be enabled).

You will see a dialog box:



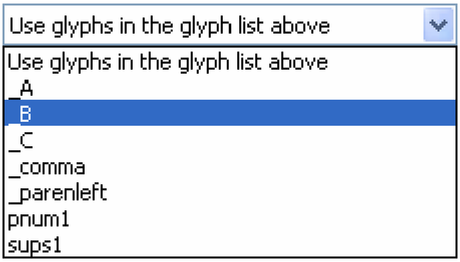
Use glyphs in the glyph list above

Enter all the glyphs that you want to transform into the **Glyph list** editing field. You can use special character commands to enter characters that are not included in the standard Latin 1 character set used in Windows by default. Use a '/' prefix to enter a glyph's name or use a decimal code and a "/#" prefix to enter a glyph's Unicode index.

Use the **Open** button to open any text file and use it as a glyph list and the **Save** button to save the current glyph list in a text file.

Note that if you open the Action Set dialog box while the Metrics window is active the glyph list will be copied from the Metrics window's sample string and the **All glyphs in the glyphs list** option will be automatically selected, so you can instantly apply transformations to the set of glyphs that are previewed in the Metrics window.

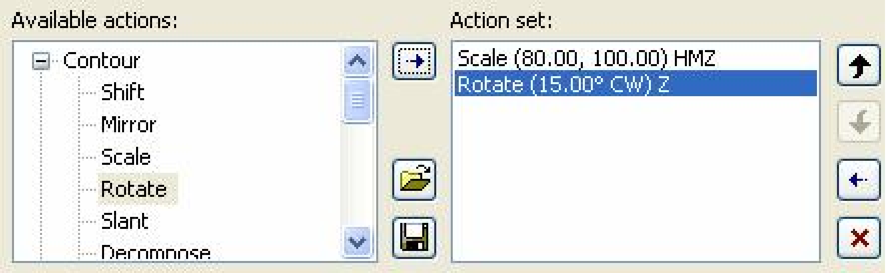
If the font contains glyph classes defined then you can select one of the classes in the list:


Use glyphs in the glyph list above
Use glyphs in the glyph list above
_A
_B
_C
_comma
_parenleft
pnum1
sups1

Choosing the class name will add glyphs of the class to the list above.

Action Set

In the middle of the dialog box there are two list boxes:



Scale (80.00, 100.00) HMZ
Rotate (15.00° CW) Z

The left list box, called **Available actions** includes the names of all available transformation actions. The actions are grouped in categories for easier selection. The right list box previews the current set of actions that will be applied in sequence.

You may add as many actions as you want to the action set; delete actions from the set; or rearrange actions to make them execute in proper sequence.

To add an action to the action set, select the action (use the + and - icons in the **Available actions** list to expand and collapse the action categories) and press the → button, or double-click an action name.

The action will be added to the bottom of the action set (the right list) with its default parameters.

To adjust an action's parameters select the action in the **Action set** list and enter new parameters in the **Current action** area. The actions' parameters panels are described in the previous sections.

To remove an action from the set select the action that you want to remove and press the ← button, or double-click the name of the action in the right list.

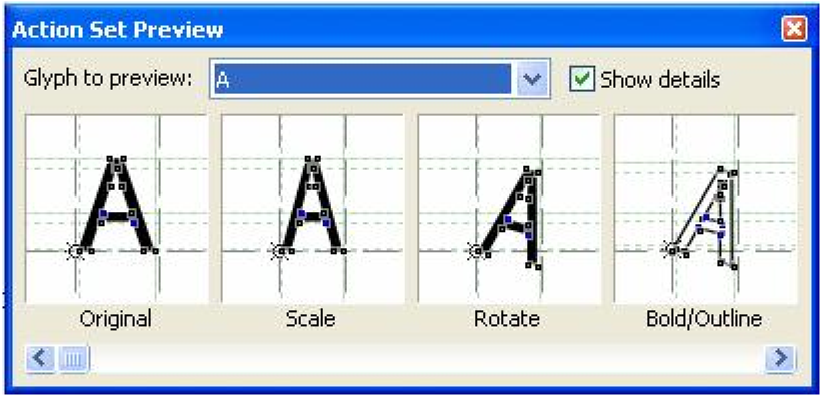
To remove all actions from the action set press the ✕ button.

To move an action one step up in the program select it and press the ↑ button or press the ↓ button to move an action one step down.

Using the Preview Window

When you make a program that includes several actions you can see an instant preview of the transformation program that you have made.

Press the **Show Preview** button to open a preview window:



You see that this panel includes a sample glyph that is incrementally transformed. You can see the results of each action so it’s very easy to control how your action set works.

With the **Glyph to preview** list box you can select the glyph that is used to preview the transformations.

If you switch on the **Show details** option then the nodes, metrics and hints will be visible in preview.

Use the scroll bar at the bottom of the window to see further samples of the transformation actions program.

Press the **Close** button to close this window.

Saving and Opening an Action Set

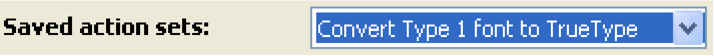
You can save the set of actions that you created and you can open and use previously saved sets.

To save the action set press the 💾 button. You will see a standard dialog box where you can select a directory and enter a file name for the program. If you save an action set in the Programs folder within your FontLab Studio user data folder, the action set will automatically appear in the **Saved action sets** list box the next time you open the Action Set dialog box.

After you press **Save** in the Save File dialog box a new dialog box will ask you to enter a name for the action set. This name will be used to identify the action set and it will appear in the **Saved action sets** list box.

To open a previously saved action set press the 📂 button and select one of the programs in the standard Open File dialog box.

A faster way to open action sets is to use the **Saved action sets** list box. The names of all action sets saved in the FontLab Studio directory will appear in this list:



Saved action sets: Convert Type 1 font to TrueType

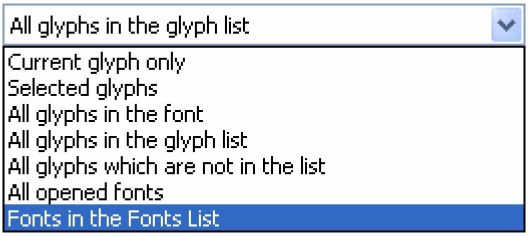
Just select the set that you want to open. You will see the set appear in the **Action set** list box.

Transforming Fonts

With the Action Set dialog box you can apply a set of actions to multiple fonts at once. The easiest way is to apply it to all fonts that are open in FontLab Studio. If that is not enough, you can run the transformation program in “batch mode”, processing multiple fonts that are not open in FontLab Studio.

To select fonts for transformation:

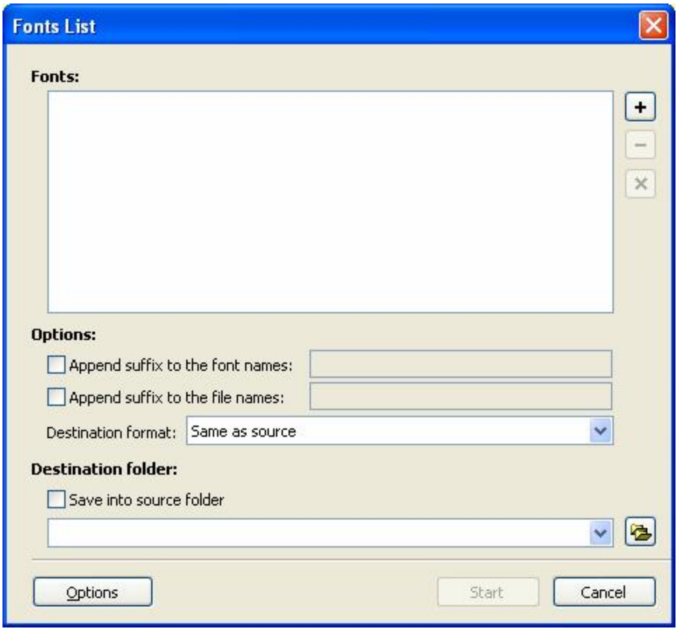
1. Select “Fonts in the Fonts List” as the range:



All glyphs in the glyph list

- Current glyph only
- Selected glyphs
- All glyphs in the font
- All glyphs in the glyph list
- All glyphs which are not in the list
- All opened fonts
- Fonts in the Fonts List

2. Click on the ... button to the right of the Apply action set control to open the Fonts List dialog box:



Fonts List

Fonts:

Options:

☐ Append suffix to the font names:

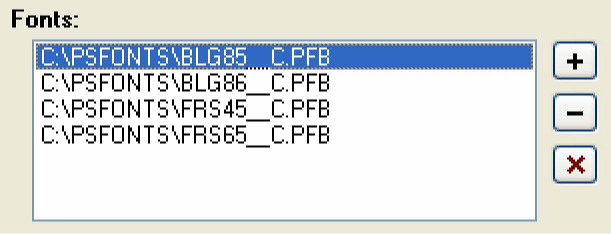
☐ Append suffix to the file names:

Destination format: Same as source

Destination folder:

☐ Save into source folder

3. Click on the + button to add fonts to the list using the standard File Open dialog box. Note that you may select multiple font files to add:

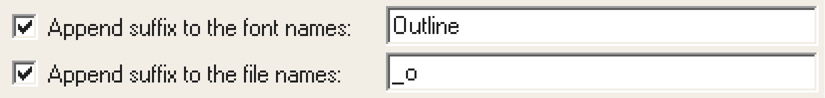


Fonts:

C:\PSFONTS\BLG85__C.PFB
C:\PSFONTS\BLG86__C.PFB
C:\PSFONTS\FRS45__C.PFB
C:\PSFONTS\FRS65__C.PFB

4. To remove a font from the list select it and click on the − button. Click the × button to remove all fonts from the list.

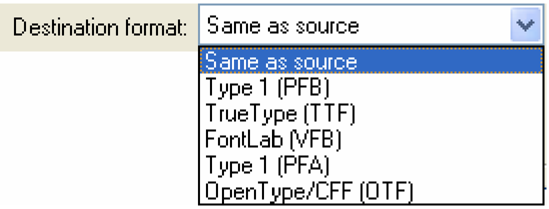
5. Use the Options controls to define the optional suffixes that will be added to the font name and to the file name during transformation:



☑ Append suffix to the font names: Outline

☑ Append suffix to the file names: _o

In the same area you can select the destination format in which the font will be exported:



Destination format: Same as source

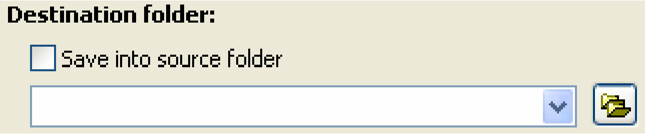
Same as source
Type 1 (PFB)
TrueType (TTF)
FontLab (VFB)
Type 1 (PFA)
OpenType/CFF (OTF)

Use the **Same as source** choice to leave the font's format unchanged.

The font's customized export options (if source fonts are in FontLab Studio format) or the currently selected export options will be used to build the destination font. You may change the current options if you press the **Options** button.

➲ **Tip**: if you do not specify any actions in your action set, you can use this batch transformation feature to convert fonts from one format to another.

6. Enter the path to the destination directory or use the 📂 button to select it from the one of existing directories:



Destination folder:

□ Save into source folder

Use the **Save into source folder** choice to put new fonts to the directory with the source fonts reside.

7. Click **Start** to complete the definition of the list.

After you start the action set FontLab Studio will open fonts from the list; apply the action set; adjust the font and file names if specified; and save the resulting fonts in the selected formats to the selected directory on your disk.

Hinting

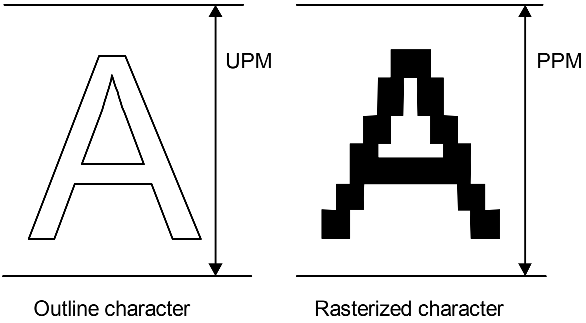
This chapter is about hinting Type 1 and TrueType fonts. Hinting is a rather technical stage of the modern font design process. It is the stage where art truly meets technology. You need a lot of technical information to make well-hinted fonts and this chapter will give it to you.

9

Font Scaling, PPM

One of the most important features of outline fonts is that they can be used on many different output devices – from computer monitors to imagesetters. Because character outline shapes are defined as sequences of lines and curves it is easy to scale outlines to any size and resolution. However, almost all output devices have discrete elements arranged in a regular rectangular raster (grid) and the images that these devices produce are constructed using these discrete cells. Each cell in an output image has integer coordinates and is called a pixel (picture cell). On a computer monitor these are individual fluorescent dots. On a printer they are dots of toner or ink.

To measure scaled outlines in a resolution-independent way, it is convenient to define a quantity called *Pixels Per eM* (*PPM*, sometimes written *ppem*). This is the number of pixels that can fit into the font's height. From the "Glyph Window" chapter you know that font height is a basic font measurement unit equal to the *Units Per eM* (*UPM*). In TrueType / OpenType TT fonts UPM is usually equal to `1000` or 2048 and in Type 1, MM and OpenType PS fonts to 1000.



So, to scale a font to render at a specific point size on a device with a specific resolution we take the resolution and point size to calculate the PPM value. Then we scale all the outline characters by multiplying by the PPM/UPM coefficient.

In PostScript printing, one typographic point (1 pt) is equal to `1/72` inch.

The original Macintosh computer had the screen DPI resolution of 72 DPI (dots per inch) so 1 pt was represented by exactly one pixel. This is a practical fact so font scaling works with this assumption. This means that PPM sizes correspond to point sizes at 72 DPI: to represent 12 pt type on a 72 DPI screen, the font is rasterized at 12 PPM.

Microsoft Windows works at the default resolution of 96 dpi. With such a setting, 12 pt type is rasterized using `12 * 96/72 = 16` PPM.

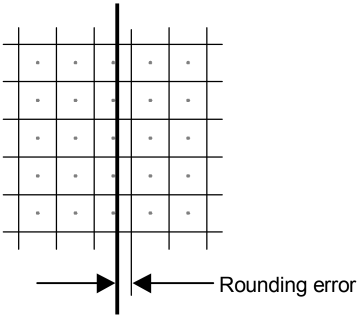
Windows users can specify other dpi resolutions for on their systems in **Control Panel > Display > Settings > Advanced > General > DPI Setting**, e.g 120 or 133 dpi. The general formula for converting between point sizes and PPM sizes is:

<point size> = 72/<dpi> * <PPM size>
<PPM size> = <dpi>/72 * <point size>

Coordinate Rounding, Gridfitting

Output devices take the vector outline of a glyph and “rasterize” it. That is, they calculate from the outline data where they need to place each pixel to get an accurate output representation of the glyph. Since the final output is on a discrete raster (i.e. a grid of numbered pixels), the scaled pixel coordinates need to be rounded somehow to integer values.

For example, if you have an outline point with coordinates (120, 100) and scale it down 7 times,you will get the coordinates (17.1429, 14.2857). After rounding to the closest integer values, the resulting coordinates will be (17, 14) and so the rounding error will be 0.1429 (0.84%) pixels for the horizontal coordinate and 0.2857 (2%) for the vertical coordinate. If we instead scale this point down 13 times, then the scaling errors will be 2.5% for the vertical coordinate and 3.8% for the horizontal coordinate. You can see that the rounding error increases as the size of the final outline is reduced.

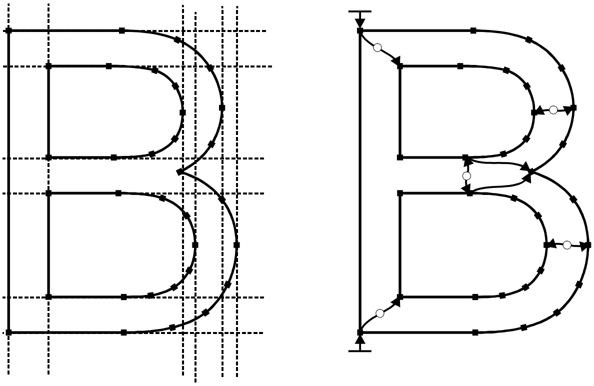


To minimize rounding errors font rasterizers use special algorithms that slightly change the scaled outlines to get better results on devices with low and medium resolution. This process is called *gridfitting*. Algorithms that gridfit outlines use additional information stored with an outline’s definition. These instructions are referred to as *hints*. Hints usually define the most important proportions of characters, the positions of critical elements of characters, and a set of rules for outline modification.

For perfect-looking fonts it’s not enough to define the characters' outlines, you must also provide hints. The process of specifying the hints is quaintly called *hinting*.

TrueType and Type 1 Hints

The two most commonly used font formats are Type 1 and TrueType. However, they use very different hinting instructions and it is not always possible to automatically convert Type 1 hints to TrueType hints.



In Type 1 fonts, hints define the most important dimensions in the characters, like the position and width of the crossbar of the letter ‘H.’

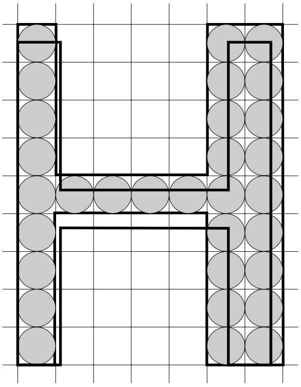
Font hints in TrueType (usually called instructions) directly control the movement of points and the rounding of point coordinates. A TrueType hinting program is written in a special programming language. This makes TrueType hinting very flexible and powerful but also too complex to program directly. Usually a smaller set of higher-level instructions are used to define hints. These instructions are compiled to native TrueType hinting language during font export.

Type 1 Hints

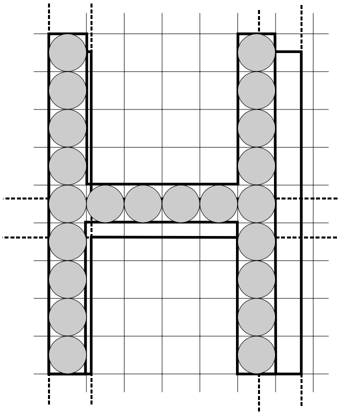
As you know from the “Glyph Window” chapter, there are two kinds of Type 1 Hints – *font level hints* and *character-level hints*.

Font-level hints define important vertical positions in the font, the most commonly used stem widths and some other important data that helps control the hinting process.

Character-level hints are used to declare the position and width of the most important character elements. The most common use for hints is to declare the position and width of character stems. These hints are scaled with the outline in the rendering stage, but due to their independence from the outline, they help to maintain the same stem widths for all stems of a certain width, independent of how it happens to fall on the discrete raster:



Unhinted character



Hinted character

Notice that in the unhinted character the outline falls on the grid such that two rows of pixels would be turned on for the right vertical stem. The hint forces the right stem to become the same width as the left stem in the hinted character.

In the following sections we will discuss font-level hints and the process called *hint programming* that is required at times.

Font-Level Type 1 Hints

Font-level hints are used to keep important character elements similar at all PPM sizes.

There are three types of font-level hints:

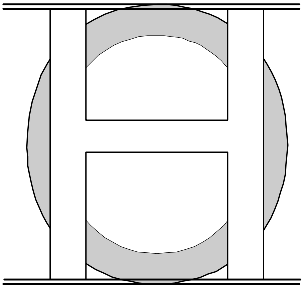
Alignment Zones	Positions and width of important heights
Standard Stem Widths	Widths of the most commonly used stems
Control Data	Controls the hinting process

All font-level hinting is set in the **Alignment** page of the **FontInfo** dialog in FontLab Studio.

Alignment Zones

Alignment zones are typically used to perform a process known as overshoot suppression:

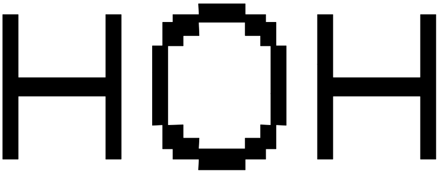
Rounded characters and characters with sharp ends usually are created a little bit larger than “flat characters”:



Notice that the top and bottom of the O extend just a little beyond the top and bottom of the H. This is called overshoot. It is necessary to compensate for a visual effect that makes rounded characters look slightly smaller. Usually the overshoot height is set to 3-4% of character height. However, at small PPM size, this value may be rounded to one pixel.

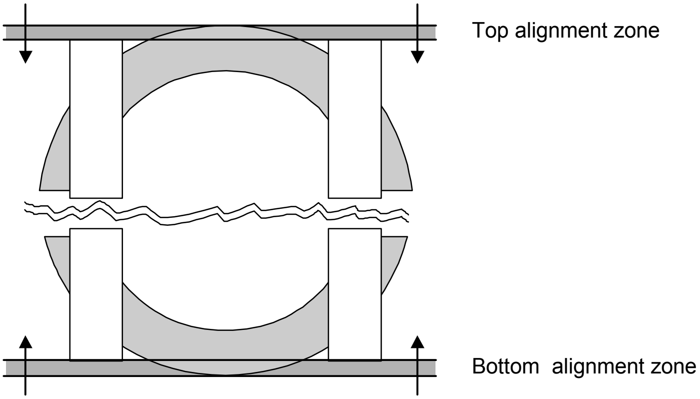
When the PPM is small, one pixel may be 15% of the character height or even more. Here’s how it happens:

Assume that the topmost position of the H character is 700 units and the top position of the O is 715. At 12 PPM (1000 font units scaled to 12 pixels), the rounded height of t he H will be 8 pixels. The height of the O will be 9 pixels. One pixel difference at this height means 8%. Much more than the original 2%!



To avoid such an excessive difference between the rasterized heights of the two types of characters, overshoots are suppressed and the size of O is forced equal to the height of H at small PPM.

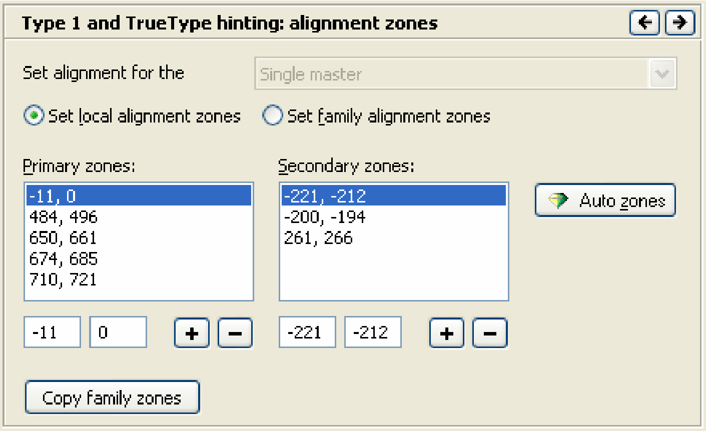
This is done by declaring alignment zones that define the bottom and top positions of the zone (in our example the height of H and O) and the alignment direction (bottom or top):



At small PPMs all points that have vertical positions inside the zone will be aligned to the primary line (i.e. moved in the direction of the alignment zone).

Editing Alignment Zones

To set or edit alignment zones open the **Font Info** dialog box and select the Hinting settings item in the list at the left:



Type 1 and TrueType hinting: alignment zones

Set alignment for the: Single master

● Set local alignment zones ○ Set family alignment zones

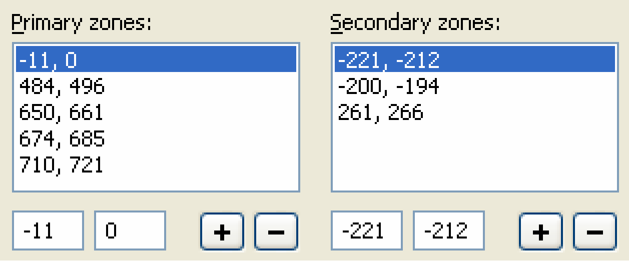
Primary zones:
-11, 0
484, 496
650, 661
674, 685
710, 721

-11 | 0

Secondary zones:
-221, -212
-200, -194
261, 266

-221 | -212

There are two list boxes where alignment zones may be set: the **Primary zones** list and the **Secondary zones** list:



Primary zones:
-11, 0
484, 496
650, 661
674, 685
710, 721

-11 | 0

Secondary zones:
-221, -212
-200, -194
261, 266

-221 | -212

In Type 1 terminology primary zones are called *BlueValues* and secondary zones *OtherBlues*.

BlueValues include one bottom alignment zone, the so-called *baseline zone*, and up to 6 top alignment zones. The baseline zone is used to control bottom overshoots that have to be aligned to the baseline.

OtherBlues includes up to 5 bottom alignment zones.

To add a new alignment zone, press the + button below the list.

To edit the position of the zone, select the zone you want to edit in the list and edit it in the edit fields below the list.

To remove an alignment zone, select the zone you want to remove from the list and press the − button below that list.

You can **see a preview of the zones** by switching on the Alignment Zones layer with the **View > Show Layer > Alignment zones** command.

When zones are visible on screen, you can preview changes you make to the zones by pressing the **Apply** button in the FontInfo dialog box.

You can **edit zones in the Glyph window**, using the edit tool. Make sure they are not locked by the **View > Lock layers > Alignment zones** command.

Press the Auto zones button to automatically calculate alignment zones in the **Primary zones** list box.

How FontLab Studio Calculates Alignment Zones

To calculate alignment zones in the BlueValues list, FontLab Studio finds characters with overshoots and characters that are flat in the position of the overshoot. Then it measures the top and bottom vertical positions of these characters and detects a zone. Examples of such characters are: 'o' and 'x', 'O' and 'H', 'p' and 'g', and so on. FontLab Studio tries to find many different characters from different languages, so it is usually able to locate some examples.

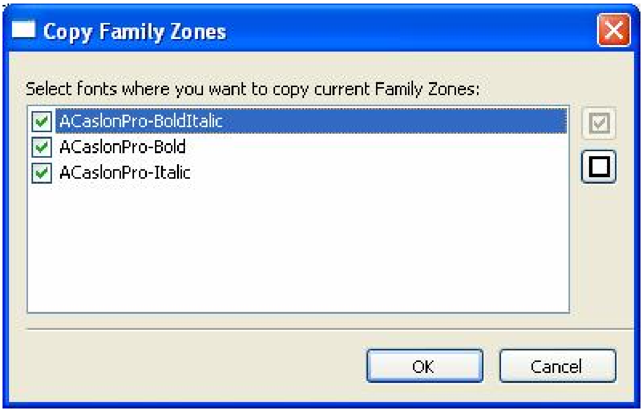
Alignment zones are also used in TrueType manual and automatic hinting.

Family Alignment Zones

To support the common appearance of fonts that belong to the same font family the Type 1 hinting system allows so-called FamilyBlues, alignment zones that are used in the whole font family. Typically the alignment zones of the regular weight are used as Family Blues in all members of the family.

To set family alignment zones switch on the **Set family alignment zones** check box. Then edit the alignment zones as usual. To return to editing “local” alignment zones switch on the **Set local alignment zones** check box.

You also can copy family alignment zones defined for the current font to any other font opened in FontLab Studio. Just press the Copy family zones button and select the destination font in the appeared dialog box:


Copy Family Zones

Select fonts where you want to copy current Family Zones:

☑ ACaslonPro-BoldItalic
☑ ACaslonPro-Bold
☑ ACaslonPro-Italic

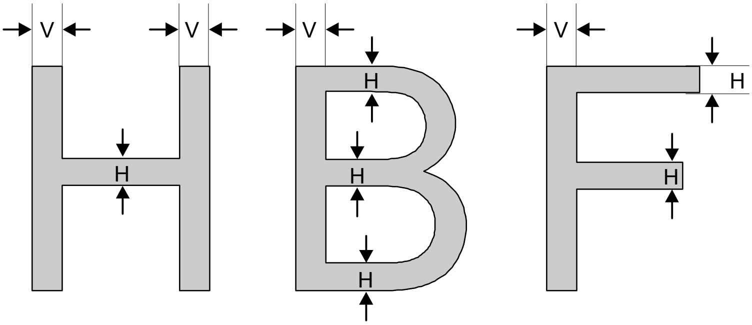
TrueType Alignment Zones

In FontLab Studio 5 you may define different alignment zones for Type 1 or TrueType hinting. TrueType zones have no limitations in their number and allow better control over their scaling. We will discuss them in full detail in TrueType Hinting section.

Note that if some font has some Type 1 zones and no TrueType zones, Type 1 zones will be automatically converted and used in TrueType hinting. So it is a good idea to begin with definition of Type 1 alignment zones, convert them (it will happen automatically in most) to TrueType zones and then adjust them using special tools available in TrueType hinting mode.

Standard Stem Widths

Typically many characters in a font use the same few standard stem widths. As examples, let's take the H, B, and F characters shown below. All of them have the same width for the straight vertical stems and the same width for the horizontal stems:



The most widely used stem widths are stored in the font header in order to force the rasterizer to render these stems at the same width.

This information is used to control at what character size the rounded stem width goes from one to two pixels and from two to three pixels. A step from one to two pixels means a 100% width increase and a step from 2 to 3 pixels a 50% increase. This means that near this value rounding errors will be maximal and control over stem widths will be necessary.

If one stem has a width of 74 units and another a stem width of 76 units and the UPM is 1000 units, then at a PPM of 20 pixels the first stem will be rounded to 1 pixel and the second stem to 2 pixels. Scaled back to the original coordinates, this difference will be 50 units! That is clearly too much for an original difference of only 2 units.

Standard widths work with stem hints. When the width of a hint is close to one of the standard widths, the rounded width of the hint (and the real stem outline) will be forced equal to the width of the rounded standard stem.

Type 1 and TrueType Standard Stems

In FontLab Studio 5 every font may have two sets of stems: Type 1 stems and TrueType stems. They are applied in different hinting modes and have some differences:

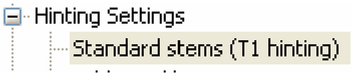
- Number of Type 1 stems is limited by 10 in each direction (vertical and horizontal).
- TrueType stems may have names. Number of TrueType stems is not limited.
- It is possible to define "stem hinting" for TrueType stems, which will control their scaling. We will talk about it in a section dedicated to TrueType hinting.

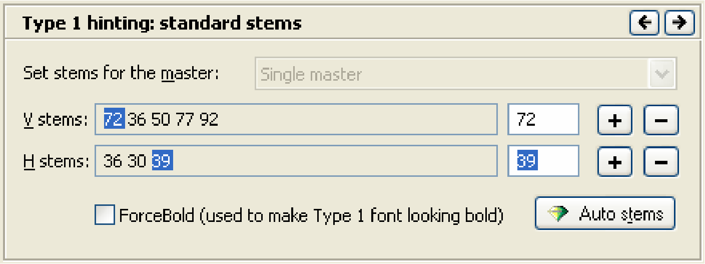
If some font has Type 1 standard stems and no TrueType stems, they will be automatically converted when such font is opened to FontLab studio.

In following paragraphs we will discuss tools to define Type 1 standard stems. TrueType standard stems are described in the TrueType Hinting section.

Editing Type 1 Standard Stems

Standard stem widths are controlled through the Standard Stems page of the **Font Info** dialog box:




Type 1 hinting: standard stems

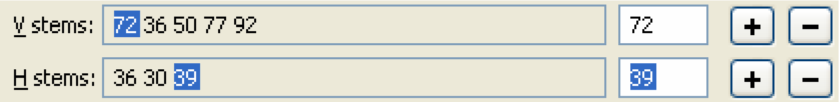
Set stems for the master: Single master

V stems: 72 36 50 77 92 | 72

H stems: 36 30 39 | 39

□ ForceBold (used to make Type 1 font looking bold)

Stem width controls are in the bottom part of this page:


V stems: 72 36 50 77 92 | 72

H stems: 36 30 39 | 39

There are controls for vertical and horizontal standard stem widths. All available stems appear in the horizontal lists. You can select any stem just as you would in normal, vertical list controls.

To add a stem to the list of the standard stems press + at the right side of the stems' list.

To edit a standard stem width, select it using the left mouse button and edit its value in the edit field to the right of the list.

To remove a stem from the list, select it and press the − button.

Note that FontLab Studio will sort stem widths in ascending order when you close the **FontInfo** dialog box.

StdHW, StdVW, StemSnapH and StemSnapV Parameters

From the Type 1 font specification you may know that in Type 1 fonts two types of standard stem widths are used: Standard Width and Stem Snap Width. There is one standard width for each direction and up to 10 stem snap values. In FontLab Studio these values areunited in the stem list. StdHW and StdVW are taken from the first records in the stem lists. StemSnapH and StemSnapV records are the remaining records in the stems' list.

Standard stem widths are also used in TrueType hinting.

FontLab Studio 5 also has a faster way to append stems to the list of standard stem widths. Any vertical or horizontal hint may be used as a source of stem width information. Just point the Edit tool at the hint, press the right mouse button and select the **Define a Stem** command in the popup menu. If this command is not accessible, it means that this stem is already in the list.

To automatically calculate standard stem widths press the

button.

How FontLab Studio Calculates Standard Stems

FontLab Studio can calculate standard stem widths only if some characters in the font have Type 1 hints, so it converts links to hints first (in memory) using the most important glyphs in the font.

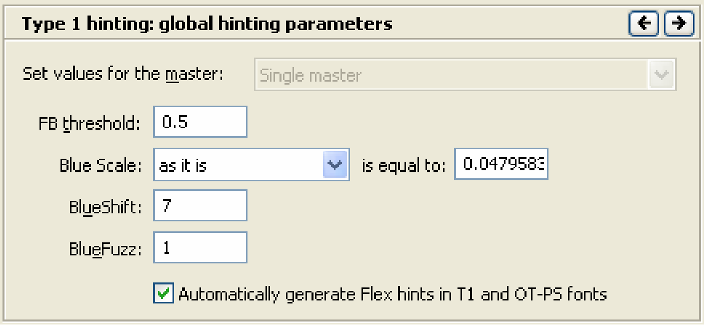
1. It builds a table of all hints that are used in the font, sorts this table by frequency of usage and selects the most frequently used hints.
2. All selected hints are then compared with these most frequently occurring stem widths and hints with widths that are close together are combined into a single record.
3. The list is then sorted again.
4. The most frequently used elements are then selected and used as standard stems.

Additional Control Data

Some additional data may be set to control the hinting process:

BlueScale	Controls PPM when overshoot suppression is switched off
BlueShift	Gives more precise control over overshoot description and flex hints (see below)
BlueFuzz	Expands alignment zones in both directions

You can set all these values on the **Additional Hinting Parameters** page of the Font Info dialog box:



Type 1 hinting: global hinting parameters

Set values for the master: Single master

FB threshold: 0.5

Blue Scale: as it is — is equal to: 0.0479583

BlueShift: 7

BlueFuzz: 1

☑ Automatically generate Flex hints in T1 and OT-PS fonts

BlueScale is the PPM size at which overshoot suppression is switched off. If PPM is less than BlueScale, then overshoot suppression is applied. If it is equal to or exceeds BlueScale, overshoot suppression works only if the distance from the aligned point to the base line of the alignment zone is less than the **BlueShift** value and the scaled distance is less than half of a pixel.

The BlueScale value is stored in Type 1 fonts in a very strange format, but in the Alignment page you can set it using one of three different ways: directly, in the form that the Type 1 specification describes (i.e. it looks like a floating point number), as a PPM size, or as a point size on a device with 300 DPI resolution. Use the **BlueScale:** combo box to select the BlueScale editing method and edit it in the **is equal to:** edit field.

BlueScale Formulas

The "actual" value of the BlueScale value is calculated as:

$$BlueScale = \frac{(PPM - 1.63333)}{800.0}$$

The BlueShift is also used to control Flex hints. Shallow curves that are compatible with other flex requirements (see below) will be hinted by Flex hints only if height of the Flex composition is less than BlueShift.

The **BlueFuzz** value allows you to expand the action range of the alignment zones in both directions. Thus if you have defined a zone like (700-715), and BlueFuzz is equal to 2, then the actual zone used will be (698-717). This is usually used when you are not sure that you correctly set all the alignment zones or when the characters are not all precisely aligned. The normal value of this parameter is 0 but by default it is set to 1. It is not recommended to use the BlueFuzz value other than 0.

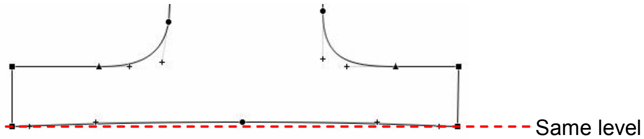
TrueType hinting algorithms do not use BlueScale, BlueFuzz and BlueShift values.

Flex Hints

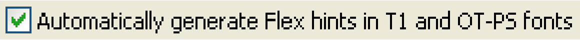
Some glyphs have very shallow curves that are nearly horizontal or nearly vertical. At low resolution and low point size it is better to replace such curves with straight lines.

Flex hint may be applied to a glyph outline segment only if following conditions are completed:

1. Sequence is formed by exactly two curves.
2. Outer endpoints must be at the same position (x or y).
3. The joining endpoint between two curves must be located on the extreme position (vertical or horizontal) of the outline section.
4. The difference (in x or y) coordinates between the joining endpoint and outer endpoint must be less than BlueShift parameter global hinting parameter.



Flex hints in FontLab Studio are set automatically during the font export (in Type 1 or OpenType-PS format). You may only control this feature globally: if you want font to include Flex hints, switch on this check box on the Global hinting parameters section:

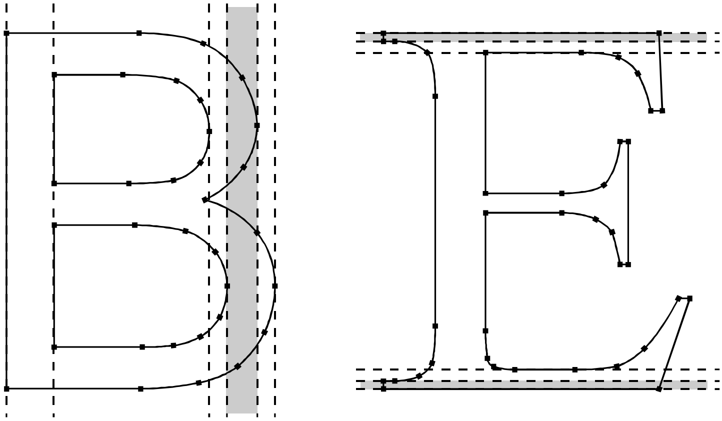

☑ Automatically generate Flex hints in T1 and OT-PS fonts

When you do manual Type 1 hinting programming you can preview Flex hint zones.

Stem Hint Programming

Now that you know everything about font-level hinting and know how to set and edit stem hints (from the "Glyph Window" chapter). It's time to talk about hint programming.

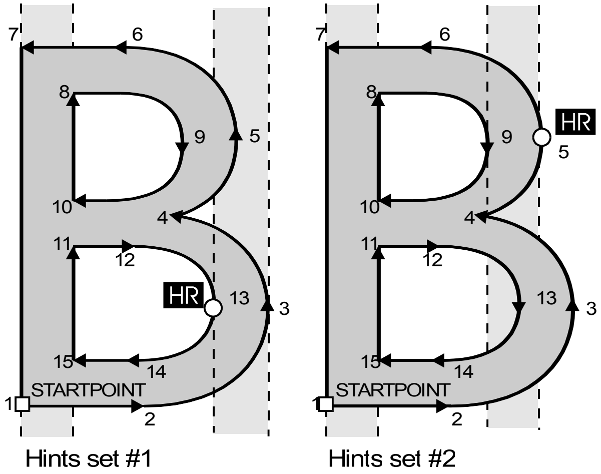
The Type 1 hinting system requires that stem hints not overlap each other. Because stem widths have no length limits and are applied to the whole character, sometimes it is necessary to give special instructions to hints in order to avoid such overlaps:



Overlapped hints

In the left picture we have two vertical overlapping hints and in the right picture two pairs of horizontal overlapping hints.

Each of these hints should, however, work only on part of the outline:



As you can see, we have two hint sets and three outline segments: from point 1 to point 4, from point 5 to point 12 and from point 13 to point 15.

So we must switch active hint sets as the rasterizer proceeds along the contour to match the part of the outline that the hint sets apply to. We need to have some program that will switch off the right hint in segment 2 (after the rasterizer has passed point 3, where the right hint applies and before it gets to point 5 where the left hint applies) and switch it back on in segment 3 (before it gets to point 13 where the right hint applies again). The same program should switch on the left hint in segment 2 and switch it off again in segment 3. This way only one of the two hints is active at any one time.

This program is called a *hint replacement program* and the process that it performs is called *hint replacement*.

FontLab Studio will generate hint replacement programs for every character where necessary but you can also set hint replacement programs manually if necessary to get the best possible results.

You can see the state of the character's hints and hint replacement program instantly in the Font Window. There is a small mark in the left-bottom area of each character cell. If this mark is present, it means that a hint replacement program is present. If the mark is **green** it means that the program is OK, that is, there are no overlapping hints. If this mark is **red** it means that the character has overlapping hints.

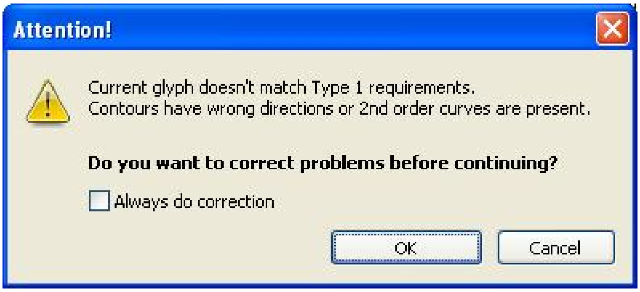
The hint replacement program will be removed if you insert or delete a hint or a node, or apply any transformation operation to the character. Consequently, we recommend that you set advanced hinting information only *after* you finish editing the character’s outlines, at the last stage of font development.

Type 1 Hinting Tool

Use the Type 1 Hinting Tool to create a hint replacement program.

To activate the Type 1 Hinting tool select **Type 1 Hinting** in the **Tools > Hints & Guides** menu. Or just click on the button in the Tools toolbar.

If the glyph that you are hinting contains TrueType curves FontLab Studio will open the **warning dialog box**:



Attention!

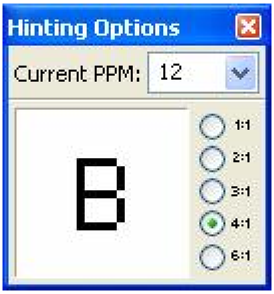
Current glyph doesn't match Type 1 requirements.
Contours have wrong directions or 2nd order curves are present.

Do you want to correct problems before continuing?

□ Always do correction

Click **Cancel** to avoid activating the Type 1 hinting tool or **OK** to convert the glyph to Type 1 curves. Check the **Always do correction** option to convert all glyphs that are opened for Type 1 hinting.

When the Type 1 hinting tool is successfully activated you will see a pixel preview panel:

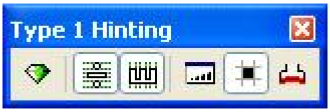


Hinting Options

Current PPM: 12

○ 1:1
○ 2:1
○ 3:1
● 4:1
○ 6:1

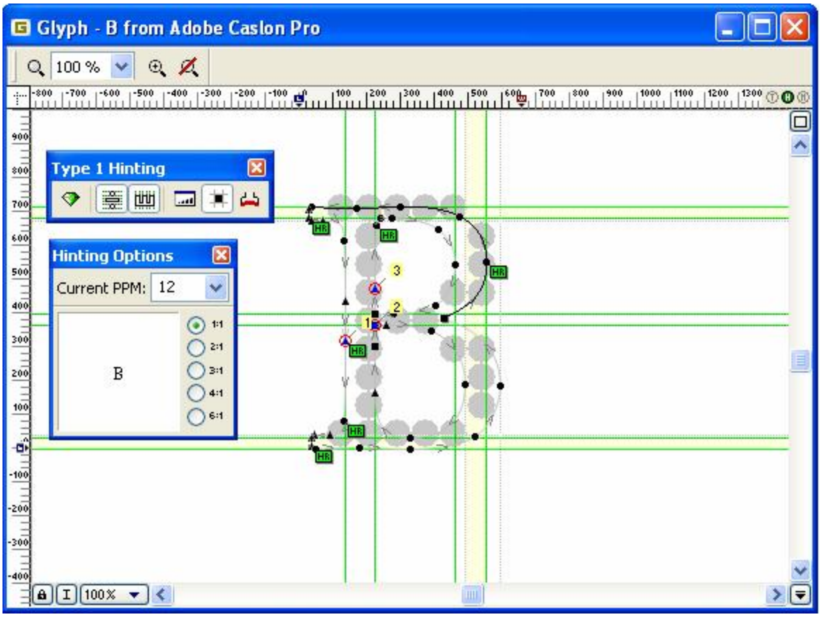
and a small toolbar:



The buttons on the toolbar mean:

Auto	Automatic hinting
3-Hint-H	Allows horizontal triple hints when pressed
3-Hint-V	Allows vertical triple hints when pressed
Preview	Opens the Preview panel
Preview Pixels	Paints rasterized picture of the glyph as a background of the editing area
Preview Flex	Previews Flex hint zones in the current glyph in red color.

When the Type 1 hinting tool is active, the contents of the Glyph window change:



Glyph - B from Adobe Caslon Pro

Current PPM: 12

Here is a brief description of what appears in the editing field:

Thick green lines	Currently active set of stem hints
Thin gray lines	All other hints
Yellow areas	Overlapping zones of hints
Black contour	Active part of contour
Green "HR" marks	Hint-substitution points
Yellow marks	Startpoints of contours with their number
Arrows	Direction of contours.

There are active and inactive contour segments and active and inactive stem hints. Active hints work when the active part of an outline is processed by the rasterizer. The hint replacement points separate contour segments from each other.

You can **select different active parts of the outline** by clicking on the outline segment that you want to make active using the left mouse button. The active segment always appears in black and the hints that apply to that segment appear in green.

Inserting and Removing Replacement Points

The contour segments to which you may assign hints lie between two hint replacement points (green marks). To define a new contour segment you add a new replacement point. Remember that the node where you put the hint replacement mark will be the first node to which the hint set is applied.

To add a hint replacement point:

1. Position the mouse cursor on the node where you want to set the hint replacement mark.
2. Press the right mouse button. You will see the popup menu with two commands: **Cancel** (does nothing) and **Add replace point here** (adds the replacement point). Select the latter command and a new replacement point will appear.

   When you insert a new replacement point FontLab Studio automatically selects the hints that should be set in the new contour segments.

To remove a hint replacement point:

1. Position the cursor on the node that has an “HR” mark.
2. Press the right mouse button and select the **Remove this replace point** command from the popup menu.

   FontLab Studio will combine hints from the two segments, trying to make an optimal hint selection. It will not let hints overlap.

Adding and removing hints

FontLab Studio automatically chooses the hints that should be included in the hint set that belongs to the contour segment beginning from the new hint replacement mark. To modify this hint set you can add or remove hints from it.

To add a hint to the hint set:

1. Position the mouse cursor on the hint that you want to add. The cursor should be between two hint lines.
2. Press the right mouse button. The selected hint will be highlighted and you will see the popup menu with three commands: **Cancel** (closes the menu), Add **this horizontal hint**, and **Add this vertical hint**. Only one of the two latter commands is available depending on which hint you want to add. If the popup menu does not appear, it usually means that you tried to add a hint that will overlap one of the hints that is in the current hint set.

   If the popup menu appears but includes a different set of commands, it means that you missed and selected the wrong hint, or no hint at all.

   "Wrong hints" are hints that overlap any of the hints that are already active in the current segment.

To remove a hint from the hint set:

1. Locate the mouse cursor somewhere between the lines of the hint that you want to remove. Currently active hints are shown in green.
2. Press the right mouse button and select the **Remove this horizontal** (or **vertical**) hint command from the popup menu.

Editing Hints

With the Type 1 hinting tool you can also add, edit and delete Type 1 hints and links.

To add a new hint, hold the CTRL key and drag it from the vertical or horizontal ruler line in the left and top parts of the Glyph Window and position it where you want the hint to be.

To add a new link, select the **Add new vertical/horizontal link** command from the **Tools > Hints & guides** menu or from the popup menu that appears if you press the right mouse button on an empty area of the Glyph Window. Click the mouse cursor on the first node of the pair you want to link and drag it to the second node and then release it.

To edit a hint or link, position the mouse cursor on the hint's or link's line, press the left mouse button and move it to the new position. Refer to the description of the Edit tool on page 476for more information about hint editing.

To remove a hint or link, position the mouse cursor on one of the hint's or link's lines and press the right mouse button. Select the **Delete** command in the popup menu.

Select the **Reverse** command from the same menu to reverse the hint's direction. Correct direction of hints is left-to-right and bottom-to-top. Incorrectly directed Type 1 hints may cause the problems with some older font rasterizers, so FontLab Studio will correct the hint direction automatically during the Type 1 font generation.

Select the **Properties** command to open the hint (or link) properties panel.

There is a faster way **to open the properties panel**: hold the CTRL key and click on one of the hint lines with the left mouse button.

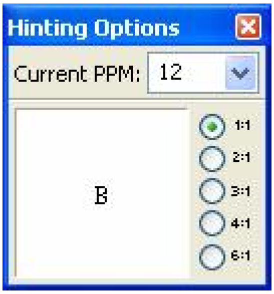
Note that if you delete a hint you will remove it completely, not just the reference to it as in the case of the **Remove** command described in the previous section.

Autoreplacing

The easiest way to build a hint substitution program is to click the button on the command panel. We recommend that you begin from the automatically generated hint substitution program and make adjustments as necessary.

Preview Pixels

While you are editing hinting you can preview your glyph rendered as black-white picture. You have two options: use Pixel Preview panel of the Hinting Options panel:

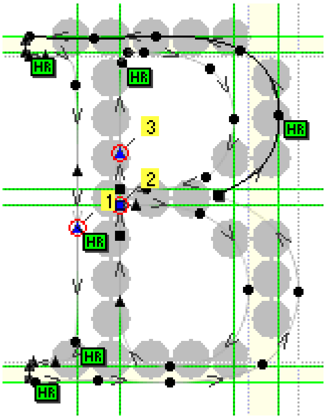


Hinting Options

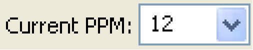
Current PPM: 12

● 1:1
○ 2:1
○ 3:1
○ 4:1
○ 6:1

or you can put a rasterized image of the glyph into the background of the glyph outline:



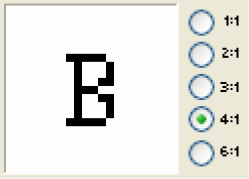
To select the PPM of the rasterized sample use the Current PPM control of the Hinting Options panel:



Current PPM: 12

It is possible to quickly "browse" different PPM sizes using the **Ctrl+PgUp** and **Ctrl+PgDown** keyboard shortcuts.

You can also enlarge sample of the glyph in the Pixel Preview panel using the zoom buttons to the right of it:

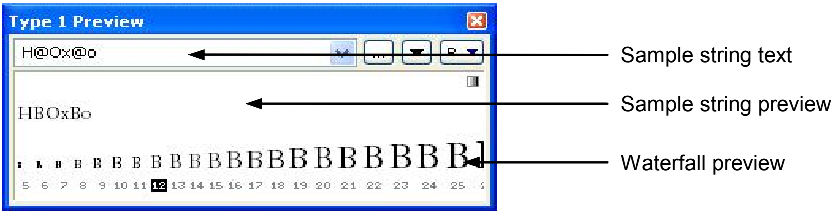


Preview Panel

The Type 1 Hinting Tool has a preview panel that shows how Type 1 hints will affect the character’s appearance. The preview panel uses the Adobe Type Manager rasterizer to preview the font, so you may be assured that in the final font you will get exactly the same look. Of course you need to have some version of Adobe Type Manager (ATM) installed in order to use the Preview panel.

To show the preview panel press the button in the command panel.

The preview panel consists of two fields: a standard edit field where you can enter a sample string, and a preview window, where two types of preview appear:



Type 1 Preview

H@Ox@o

HBOxBo

Sample string text

Sample string preview

Waterfall preview

In the waterfall preview you can see the current character in various PPM sizes. Note, that if grayscale rendering is enabled, you will see grayscale previews at some PPMs.

In the top part of the preview window a sample of any character can appear. We recommend using this sample area to compare the rasterizing results of different characters in a font. You can change the PPM at which the sample string is previewed very easily: position the cursor on the PPM preview in the waterfall range and double-click the left mouse button.

To see a preview of special characters that are not accessible directly from the keyboard use the usual FontLab Studio rules for entering special characters (i.e. enter the character name after a slash '/' character - use two slashes to enter a slash: "//").

FontLab Studio updates the preview panel every time you change something in the hint replacement program. This may be a slow process on some computers, but you can hide the panel; edit the hint replacement program; and then switch the panel back on to see the results of your work.

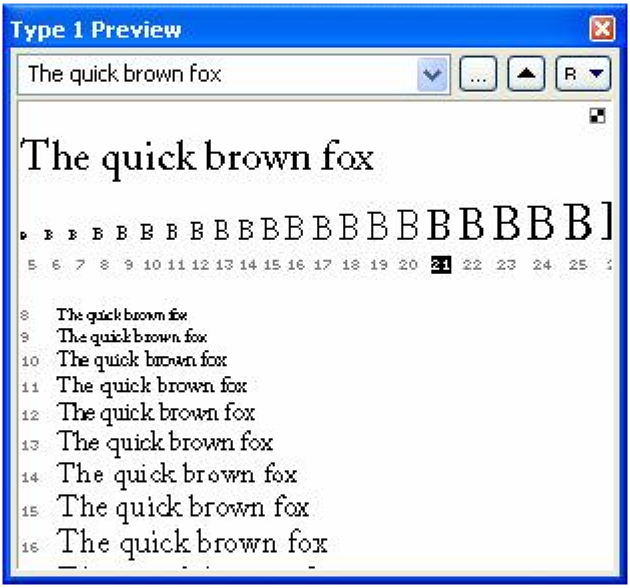
How the Type 1 Preview Panel Works

For Type 1 preview FontLab Studio uses Adobe Type Manager (ATM). When FontLab Studio starts, it makes a connection with ATM and prepares it for work. When the Type 1 preview panel is open and something is changed in the character FontLab Studio performs the following operations:

1. FontLab Studio creates a very small Type 1 font that includes the empty (".notdef") character, the current character and all characters from the sample string.
2. All characters in this font are mapped to codes starting at 20h (32) - the code of the space character. The empty character is not mapped.
3. This font is exported in Type 1 font format and a PFM file is created for it. The font name is set for this font in such a way as to avoid conflict with names of any of the installed fonts.
4. Font and metric files are saved in the Windows TEMP directory with a name beginning with "~FL". The font file has a "PFB" extension and the metrics file has a "PFM" extension.
5. The font is installed in ATM using ATM commands.
6. All previews are made with this font. Previews in the Preview panel can use grayscale output if it is available in the system. To see preview without grayscale switch it off in the system Display Properties panel.
7. When the font is no longer needed it is uninstalled and the font and metric files are removed.

Expanding the Preview Panel

The Preview panel may work in “closed” or “expanded” mode. To open the panel click on the . You will see the preview panel expand:

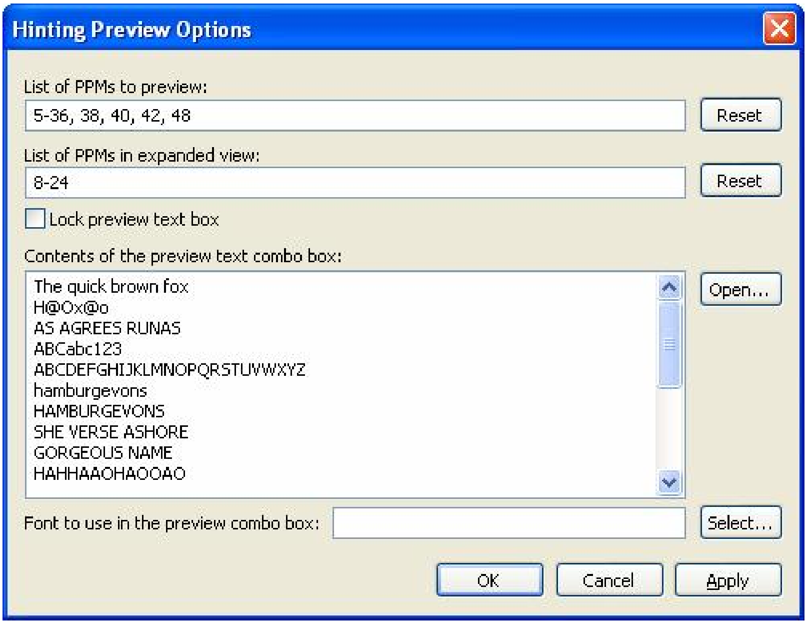


The top part of the panel remains the same, and the bottom part is the sample string rendered at multiple PPMs. You close the panel by clicking the button.

Preview Panel Options

With the Preview panel options dialog box you can customize the PPMs at which the horizontal waterfall and sample string are rendered.

To open the dialog click on the … button to the right of the sample string editing control. You will see the options dialog box:



Hinting Preview Options

List of PPMs to preview: 5-36, 38, 40, 42, 48

List of PPMs in expanded view: 8-24

□ Lock preview text box

Contents of the preview text combo box:

```
The quick brown fox
H@Ox@o
AS AGREES RUNAS
ABCabc123
ABCDEFGHIJKLMNOPQRSTUVWXYZ
hamburgevons
HAMBURGEVONS
SHE VERSE ASHORE
GORGEOUS NAME
HAHHAAOHAOOAO
```

Font to use in the preview combo box:

At the top of the dialog box you will find two editing fields where you can enter the **list of PPMs to preview** in the horizontal waterfall line (top control) and in which to preview the sample string in the expanded mode (bottom line).

Enter the PPMs separated by commas or define ranges of PPMs using the ‘-’:

```
12, 13, 15, 16-24
```

Click on the **Reset** button to the right of the editing fields to reset the list of PPMs to the default values.

Below the PPM selection controls there are two check boxes:

Use font smoothing if allowed by the system
Uncheck this control to force the system rasterizer to preview your font in black-white mode, without any smoothing.

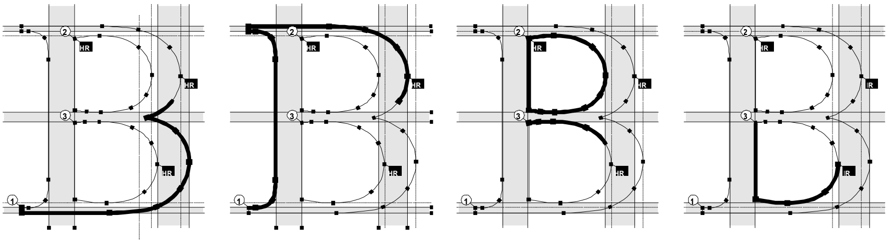
Lock preview text box
When this option is switched on, FontLab Studio will not allow you to change the contents of the sample string edit box. You can, however, select pre-defined strings in the list.

Below the options there is a **list of pre-defined sample stings**. You can freely edit it as text or click the **Open** button to open a text file that will be used as a source of sample strings.

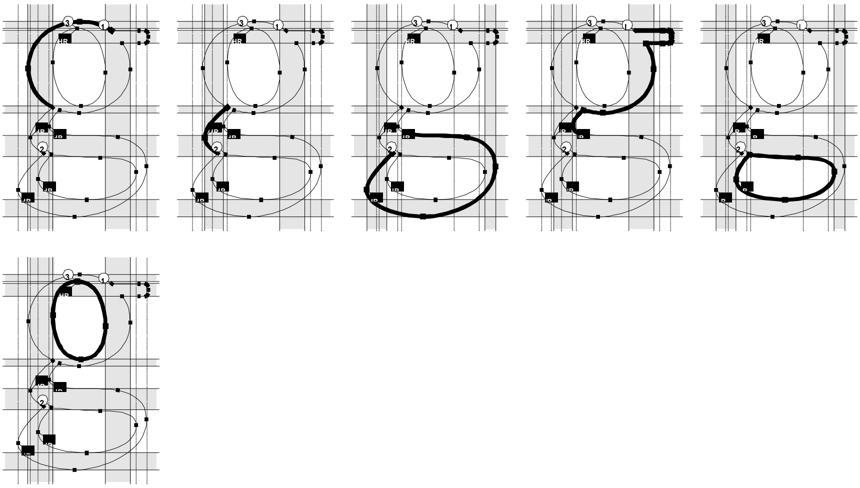
The last option in the dialog box is the **Font to use in the preview combo box**. Enter the font name or click on the **Select** button to choose one of the fonts. The font will be used in the sample selection control – this is very useful when you are working with non-Latin fonts.

Some Examples

Here we want to show you some typical hinting situations and recommended hinting sequences for them:



Example of a hint replacement program for the Times 'B' character



Example of a hint replacement program for the Times 'g' character

TrueType Instructions

In TrueType fonts, the hinting process is very different from the one used in Type 1 fonts. As we said before, in TrueType font format almost all characters have special programs that directly control the movement of outline points at different PPM sizes.

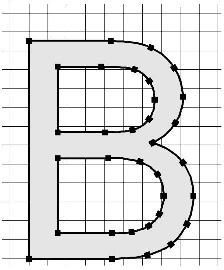
The native TrueType instruction language consists of several dozen commands. All the commands deal with the data stack, a temporary storage place, and the constant definitions that come with a font.

There are 3 different kinds of instructions in each TrueType font file. One global program (called the Font Program) is executed one time when the font is used for the first time. Another global program (called the PPM Program) is executed one time when the font's PPM is changed. Local programs (Glyph Programs) are executed for each glyph when it is scaled.

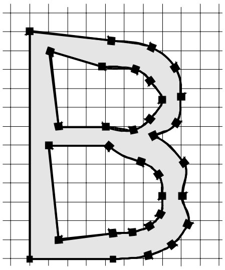
Programs can deal with points, distances, arithmetic values, constants and graphics state parameters. Graphics state parameters set rules that are used as settings for various commands.

Every character outline is scaled according to the selected PPM value. Point coordinates are stored as fixed-point numbers (they are not integers, but have a fixed precision). Then the glyph program is interpreted. The glyph program measures the distances between outline points, uses font-level constants and resets the position of some outline points. These points are called *touched* points.

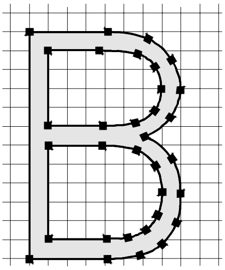
All untouched points usually interpolate (by the last glyph program command) between the new positions of touched points.



Original outline



Hinted outline before interpolation



Hinted outline after final interpolation

There are several special commands that are applied to the glyph outline at specific PPMs. These commands are called *delta instructions* and are used to slightly modify the position of outline points to improve the character's appearance.

We will not include here a complete description of all TrueType instructions. If you are interested we recommend that you read "Technical Specifications for TrueType Font Files" which is available from Microsoft.

Font Parameters

Because within each font it's very important that all characters have a consistent appearance, some font-level information is necessary for hinting. There are two kinds of such information: alignment zones and stem widths.

Alignment zones set the positions of the most important vertical positions, such as the sizes of uppercase characters, the position of middle-lines, and the top and bottom overshoot positions.

To minimize rounding error and to make better baseline alignment you have to suppress overshoots and maintain the same size of overshoot and regular characters at small PPMs. This is very easy to do if you position and size the bottoms and tops of these characters and "stick" the bottom and top points to these values.

Stem widths define the most important stems in the font and control the rounding of these stems. Here you must control the PPM at which the stem width changes from one to two pixels and from two to three pixels.

Refer to page 662 for more information about alignment zones and standard stem widths.

Visual TrueType Hints

In FontLab Studio we use a small set of high-level hinting instructions that are automatically compiled to TrueType instructions during font export. Because these instructions can be set and edited visually we call them *visual TrueType hints* or just *visual hints*.

Visual hints are enough to define TrueType hints even in very complex situations and they are compiled in very compact and effective TrueType instruction code.

The visual hint set includes the following commands:

Align	Aligns (moves) the position of the outline point to the designated position on the grid or to the edge of the alignment zone.
Single Link	Sets the position of the point relative to the position of another point. Distance can be linked with one of the stem widths. Distances also may be rounded or not.
Double Link	Sets the distance between two points to an integer value that may be linked with a stem width
Interpolate	Interpolates the position of a point between two other points
Middle Delta	Slightly shifts a point at a specific PPM. This command works *before* the final interpolation of untouched points.
Final Delta	Slightly shifts a point at a specific PPM. This command works *after* the final interpolation of untouched points. This command is used for the final outline correction.

All commands are available in horizontal and vertical directions. There are no “diagonal” visual instructions.

Sequence of commands

Visual commands may be set in any sequence, but they are interpreted in a very specific order. FontLab Studio automatically detects the logic of the hinting program and does intelligent sorting.

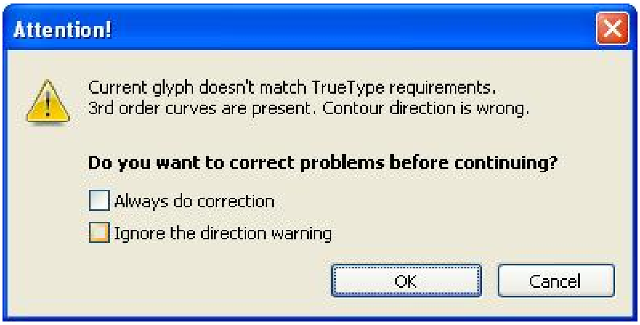
1. Align commands are always interpreted first.
2. Double links are interpreted first also, except that middle delta instructions may set points that are linked by double links.
3. Single links and interpolate commands are interpreted in logical sequence.
4. Middle delta commands are interpreted after commands that set positions of the points for which they are set, but before commands that are based on these points.
5. Final delta commands are interpreted after final interpolation of the untouched points.

TrueType Hinting Tool

With the TrueType hinting tool you can set and modify visual TrueType hints and preview the real resulting TrueType font using the system TrueType rasterizer.

To activate the TrueType Hinting Tool select the **TrueType Hinting** command from the **Tools > Hints & Guides** menu or press the button on the Tools toolbar.

When you select the TT Hinting Tool you may see the message:



Current glyph doesn't match TrueType requirements.
3rd order curves are present. Contour direction is wrong.

Do you want to correct problems before continuing?

☐ Always do correction

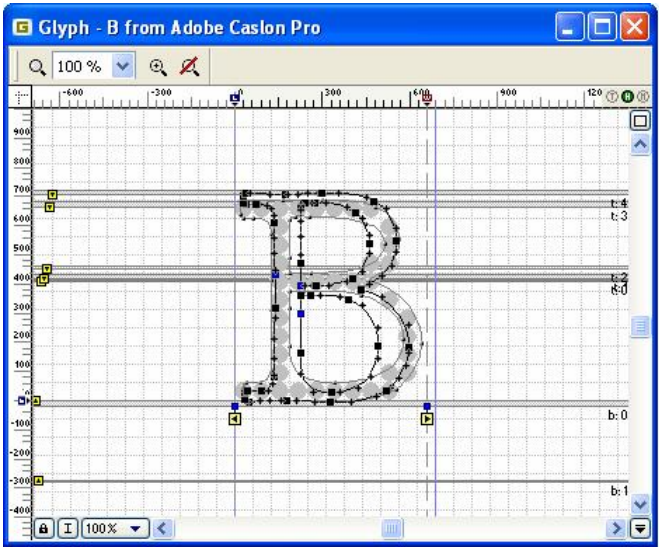
☐ Ignore the direction warning

This message appears if the current character has 3rd-order curves that should be converted to 2nd-order curves to set Visual TrueType hints or if the contour direction is wrong.

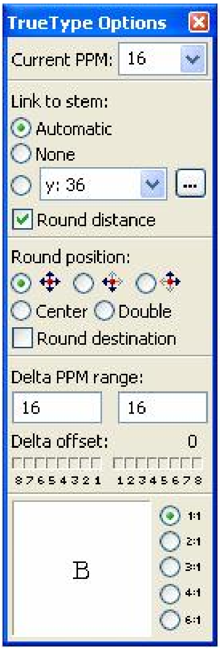
The TrueType specification requires that contours in TrueType fonts to be directed clockwise. Most rasterizers will correctly render TrueType fonts with incorrectly directed contours, but it is not guaranteed so we recommend directing contours according to the specification. If you don't want FontLab Studio to check the contour direction, check the **Ignore the direction warning** option.

Press the **OK** button to continue to work with the tool. Leave the **Always do correction** option checked if you want FontLab Studio to always correct the outline format when opening a character.

When the Hinting Tool becomes active you will see that the editing field of the Glyph Window has changed:



The Toolbar, Options, and Preview may appear on the screen:


TrueType Options

Current PPM: 16

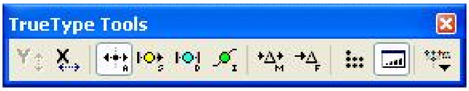
Link to stem:
● Automatic
○ None
○ y: 36

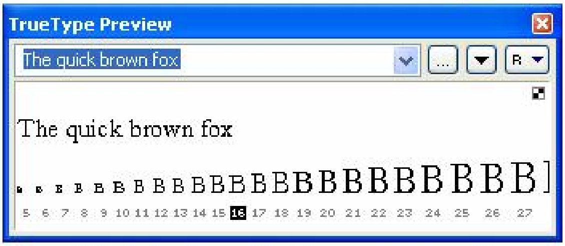
☑ Round distance

Round position:
● ○ ○
○ Center ○ Double
☐ Round destination

Delta PPM range: 16 16

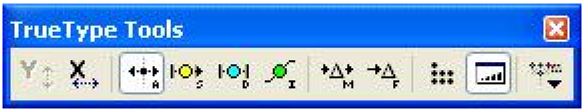
Delta offset: 0




TrueType Preview

The quick brown fox

Toolbar

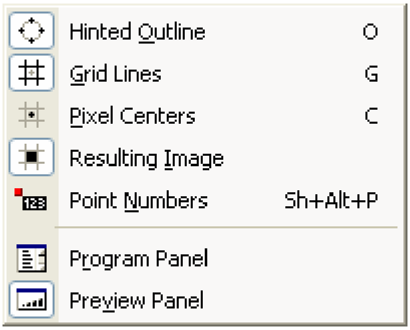


With the Toolbar you can select the hinting direction, the current visual instruction tool, and the layers that appear in the editing field of the Glyph Window. You can also open and close the Preview and Program panels.

Here is a detailed description of the Toolbar buttons:

Y ↕	Set vertical direction. Sets visual instruction tools to work in the vertical direction. I.e. create vertical links, alignment, interpolation and deltas. Instructions in different directions are independent of each other
X ↔	Set horizontal direction
A	Select Align command
S	Select Single Link command
D	Select Double Link command
I	Select Interpolate command
Δ M	Select Middle Delta command
Δ F	Select Final Delta command
⠿	Switch TrueType hinting tool to bitmap mode
▭	Show Preview panel
▾	Open the Options menu.

If you click on the button, you will see the Options menu:

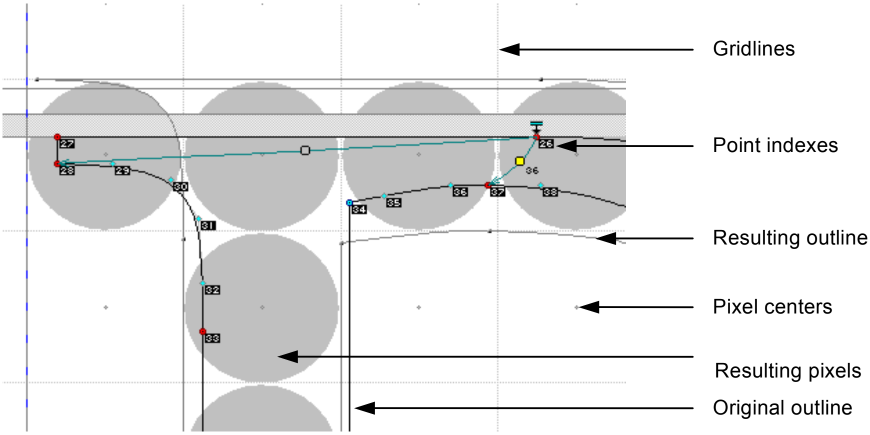


All the commands except the two at the bottom control the appearance of the layers that represent information about the hinting process. The layers are described in the following section.

The two remaining commands let you open the Programs panel that previews the source code of the hinting program and the Preview panel that shows the result of the hinting.

Layers

With the TrueType tool you can see various information layers in the Glyph Window.

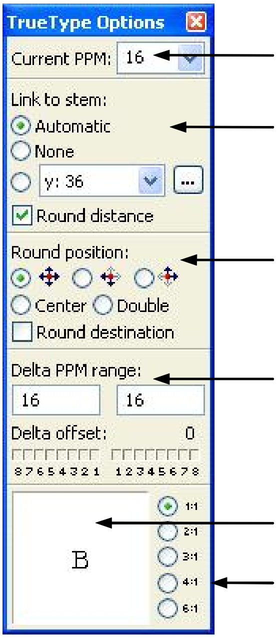


These layers are different from the usual editing layers, so we will explain them here:

Outline	The original, untouched outline of the glyph always appears in the Glyph Window in black. The Resulting outline, which is the result of the interpretation of the instruction program, appears in gray
Grid	Gridlines. Gridlines mark the edges of pixels that will appear in the selected PPM size
Centers	Centers of pixels. When the outline is filled, all pixels whose centers are on the outline or inside the outline are set black. This layer is very useful for delta hinting
Pixels	Resulting pixels. FontLab Studio uses the real Windows TrueType rasterizer to preview a filled glyph at the selected PPM after interpretation of the instruction program
Point indices	Point numbers. There are also two special points that mark the left and right sidebearings of the character. You can apply any commands to any of these points.

Options Panel

The main control center of the TrueType hinting tool is the Options panel:



TrueType Options

Current PPM: 16

Link to stem:
● Automatic
○ None
○ y: 36 ...
☑ Round distance

Round position:
● ○ ○
○ Center ○ Double
□ Round destination

Delta PPM range: 16 16

Delta offset: 0

8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

● 1:1 ○ 2:1 ○ 3:1 ○ 4:1 ○ 6:1

Current PPM size

Alignment of distances

Point alignment options

Delta instruction settigns

Preview of the current glyph

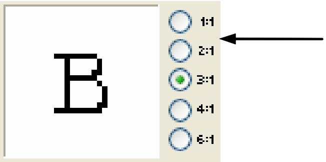
Preview zoom buttons

The main use of this panel is for selection of the current PPM size. Use the drop-down combo box to select one of the predefined values or enter your own value in the edit field:

Current PPM: 16

In the options preview window you can see a sample of the current character. FontLab Studio uses a real Windows TrueType rasterizer to render the character, so this preview is exactly what you will see when you export a TrueType font and use it in an application in a black-white mode.

Use the zoom selection buttons to enlarge the sample character:



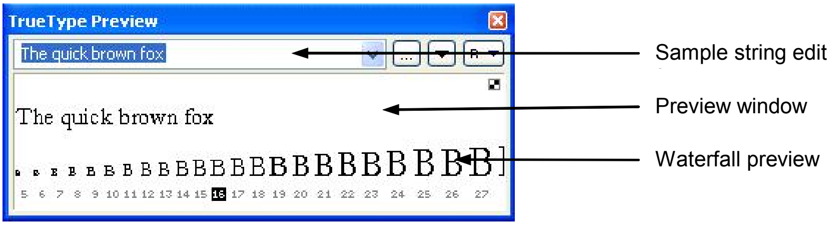
○ 1:1 ○ 2:1 ● 3:1 ○ 4:1 ○ 6:1

Zoom buttons

All other options that can be set in this panel will be described later.

TrueType Preview Panel

In the preview panel you will see a waterfall preview of the current character and a preview of a string at the current PPM size:



The quick brown fox

The quick brown fox

To open the Preview panel (if it’s not already open) press the button on the toolbar.

If you enter any characters in the edit field, you will see these characters appear in the top of the preview window. Use the usual FontLab Studio rules to enter special characters (enter the character name after a slash ‘/’ character or two slashes to enter a slash: “//”).

You may also drag selected characters from the Font Window and drop them in the Preview window.

With the waterfall preview you can quickly select the current PPM. Just move the cursor to the sample PPM you want to select and double-click the left mouse button.

How FontLab Studio Previews TrueType Fonts

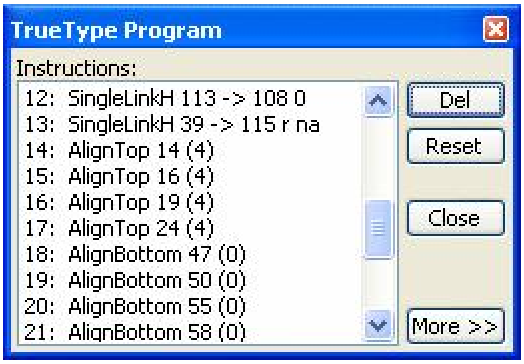
FontLab Studio uses the real Windows TrueType rasterizer to give an exact preview of the TrueType hinting for the Preview panel, the Pixels layer in the Glyph Window and the preview window in the Options panel. To get a preview FontLab Studio implements the following steps:

1. FontLab Studio creates a very small TrueType font that includes the empty (notdef) character, current character and all characters from the sample string of the Preview panel.
2. All characters in this font are mapped to codes starting from the 20h (32) - code of the space character. The empty character is mapped to 0, as usual.
3. This font is exported in TrueType format using all the TrueType export settings, including grayscale settings, maintaining the existing instructions setting and autohinting. A special font name is set for this font to avoid conflict with any installed fonts.
4. This font is saved in the Windows TEMP directory with a name beginning with "~FL" and with a TMP extension.
5. The new font is installed in the system.
6. All previews are made with this font. Previews in the Preview panel can use grayscale output if it is available from the system and is allowed by the font.
7. When the font is no longer needed it is uninstalled and the font file is removed.

Like the Type 1 hinting preview panel, the TrueType hinting preview panel can be opened and its options can be customized. Please refer to the description of the Type 1 hinting preview panel on page 679 for more information.

Program Panel

In the Program panel you can see the text of the instruction program as it is interpreted:



```
12:  SingleLinkH 113 -> 108 0
13:  SingleLinkH 39 -> 115 r na
14:  AlignTop 14 (4)
15:  AlignTop 16 (4)
16:  AlignTop 19 (4)
17:  AlignTop 24 (4)
18:  AlignBottom 47 (0)
19:  AlignBottom 50 (0)
20:  AlignBottom 55 (0)
21:  AlignBottom 58 (0)
```

To open the Program panel use the command from the TrueType hinting options menu.

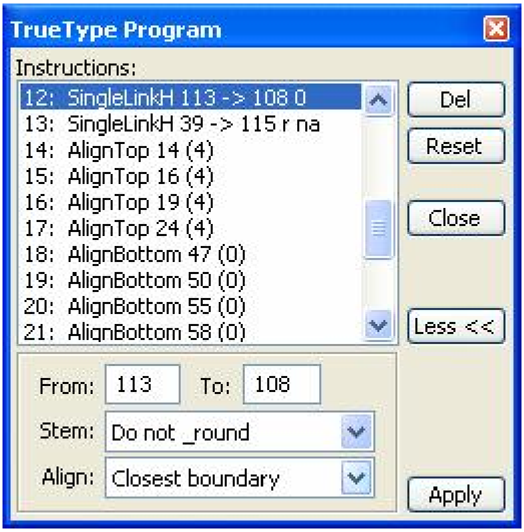
The Program panel consists of the program listing and four buttons:

Del	Removes the selected command
Reset	Removes all commands
Close	Closes the panel
More>>	Expands the panel to include the command options controls.

Here are the mnemonics that are used to represent commands. A detailed description of each command and its parameters will follow.

AlignTop	Align a point to the top alignment zone
AlignBottom	Align a point to the bottom alignment zone
Align	Align a point to the grid
SingleLinkH, SingleLinkV	Single Link commands in horizontal and vertical directions
DoubleLinkH, DoubleLinkV	Double Link commands in horizontal and vertical directions
InterpolateH, InterpolateV	Interpolate commands in horizontal and vertical directions
MDeltaH, MDeltaV	Middle Delta commands
FDeltaH, FDeltaV	Final Delta commands.

Click on the **More>>** button to expand the panel:



```
12:  SingleLinkH 113 -> 108 0
13:  SingleLinkH 39 -> 115 r na
14:  AlignTop 14 (4)
15:  AlignTop 16 (4)
16:  AlignTop 19 (4)
17:  AlignTop 24 (4)
18:  AlignBottom 47 (0)
19:  AlignBottom 50 (0)
20:  AlignBottom 55 (0)
21:  AlignBottom 58 (0)
```

From: 113 To: 108

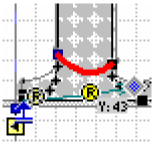
Stem: Do not _round

Align: Closest boundary

In expanded mode you see the command options panel in the bottom. Select the command and use the controls in that area to change the command parameters. Click the **Apply** button after you make changes to accept them.

The commands in the list have a two-way connection with the Glyph window: when you click on the visual representation of the command in the Glyph window, the related command is selected in the Program panel's list.

When you select a command in the Program list, the command is visually highlighted in the Glyph window:



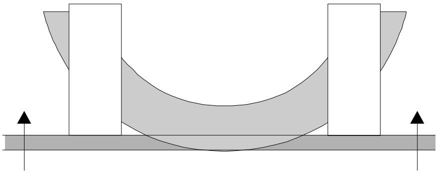
Use the command link to check the logic of the hinting program and to customize command parameters in complex situations.

Alignment Instructions

Alignment instructions are used to align points to the grid. There are two types of alignment instructions: those linked with alignment zones and those not linked with zones.

Alignment Zones

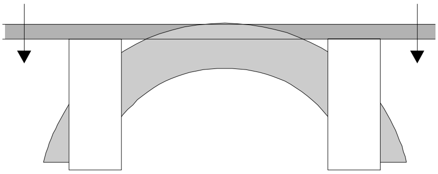
Alignment zones define important vertical positions that are common to many font characters. A good example of an alignment zone is a baseline and the bottom position of the 'O' character:



Bottom alignment zone

At low PPM sizes you must set the bottom point of the characters 'O', 'C' and similar characters to the baseline to suppress the bottom overshoot. In this case we have a so-called bottom alignment zone.

Another example of an alignment zone is the top line of the 'H' character and the 'O' character:



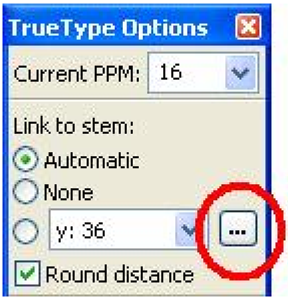
Top alignment zone

Alignment zones are previewed in the Glyph Window with a gray color.

Editing TrueType Alignment Zones

TrueType alignment zones are different from the Type 1 zones that we discussed in the previous section. To add new TrueType zones or edit existing zones do the following:

1. Click on the Options button of the Options panel:



Current PPM: 16

Link to stem:

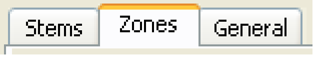
● Automatic

○ None

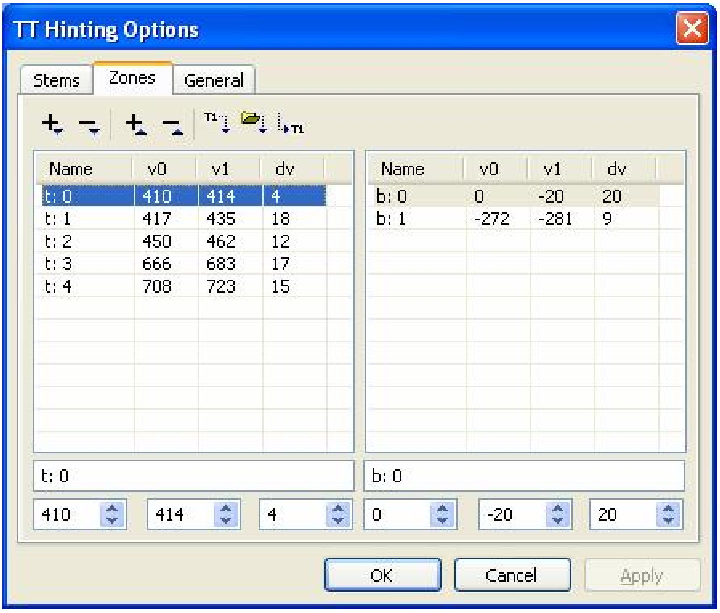
○ y: 36

☑ Round distance

2. Click on the Zones tab in the appearing dialog box:



You will see the Zones page:



Name	v0	v1	dv
t: 0	410	414	4
t: 1	417	435	18
t: 2	450	462	12
t: 3	666	683	17
t: 4	708	723	15

Name	v0	v1	dv
b: 0	0	-20	20
b: 1	-272	-281	9

t: 0

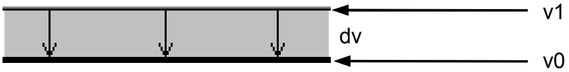
410 414 4

b: 0

0 -20 20

The zones page contains a toolbar, two lists and a command area below each list. The left list stores all information about the top zones (where alignment happens in top-to-bottom direction) and the right list -- about the bottom zones.

For each zone you may specify its name and position of the "snap to" (primary) line (v0) and a secondary (v1). The position of the secondary may be defined in absolute coordinates or as a distance from the primary line (top zone pictured):



To change settings for a zone select it in the list and use controls below the list.

There is a toolbar above zones lists. Use it to call following commands:

+ +	Add new top or bottom zone, respectively.
− −	Remove current top or bottom zone.
T1	Import Type 1 zones of the current font
📂	Import TrueType zones from another font (font selection dialog box appears)
T1	Replace Type 1 zones with the TrueType zones

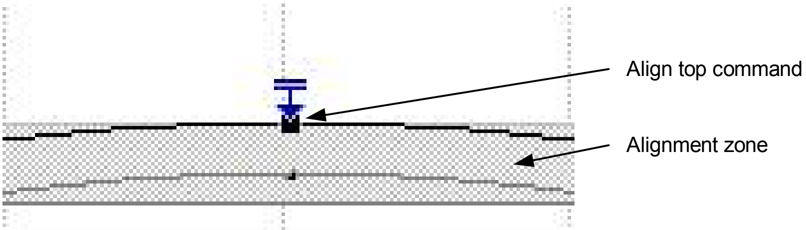
AlignTop and AlignBottom Instructions

These instructions are available only when the vertical hinting direction is selected.

To add AlignTop or AlignBottom commands:

1. Select the Align tool .
2. Position the cursor over the point that you want to align and click the left mouse button
3. If the selected point was in one of the alignment zones, an AlignTop or AlignBottom command will be added to the hinting program. If the selected point is not in the zone, the "free" Align command will be added.

The AlignTop command appears as:



The AlignBottom command is similar to the AlignTop command.

How AlignTop and AlignBottom Commands Work

1. In the prep program (this program interprets every time the PPM is changed) all alignment zones (stored in the cvt table) are aligned to the closest integer position.
2. When the glyph program interprets, the position of the point aligned to the zone by the AlignTop or AlignBottom command is set equal to the aligned position of the zone if the scaled distance between it and the zone is no more than 16/17 pixels.

The AlignTop and AlignBottom commands have two arguments: the index of the point that is aligned by the command and the index of the zone. In the Program panel these commands appear as:

```
AlignBottom 12 [1]
AlignTop 5[0]
```

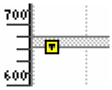
where 12 and 5 are point indexes and 1 and 0 are indexes of the bottom and top zone, respectively.

Hinting Alignment Zones

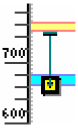
By default the position of the alignment zones is scaled linearly. Sometimes this may not be satisfactory and you may need to exactly specify the position of the alignment zones at some PPMs.

With FontLab Studio you can adjust the position of the zones around the linearly scaled position.

Every alignment zone has a yellow icon at the left:



You can drag this icon up or down to adjust the position of the zone at the current PPM:



If you move the icon you will see all glyphs that have align commands applied to that zone changed their shape.

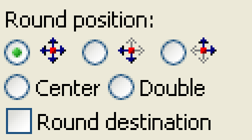
You may find this feature useful when you have to add glyphs to an already hinted TrueType font. New glyphs often have a different height at some PPMs and you can correct that with the zone alignment command and zone hinting.

Align Instruction

Use the Align command when it's not necessary (or possible - you can't align points to horizontal alignment zones) to align a point to an alignment zone but you want to align the point's position to the grid. The Align command is available in both directions.

The Align command allows you to directly control how point coordinates are rounded.

To select a rounding method use the alignment control radio buttons in the Options panel:



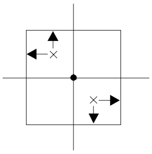
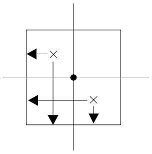
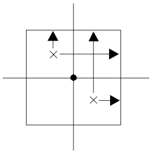
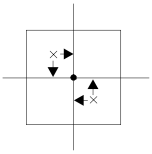
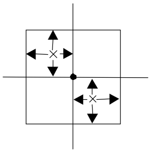
Round position:

● ○ ○

○ Center ○ Double

□ Round destination

Here is a graphical description of the various rounding methods:

Rounding	Appearance	Code	Description
		0	Aligns to the closest grid line
		1	Aligns to the left or bottom grid line
		2	Aligns to the right or top grid line
		3	Aligns to the closest center of pixel
			Aligns to closest edge of pixel or center of pixel

To set an alignment command on the outline:

1. Press the align button on the toolbar.
2. Position the mouse cursor on the point that you want to align.
3. Click the left mouse button. Hold the SHIFT key if you are setting vertical commands and the point is inside an alignment zone.

In the Program panel the Align command appears as:

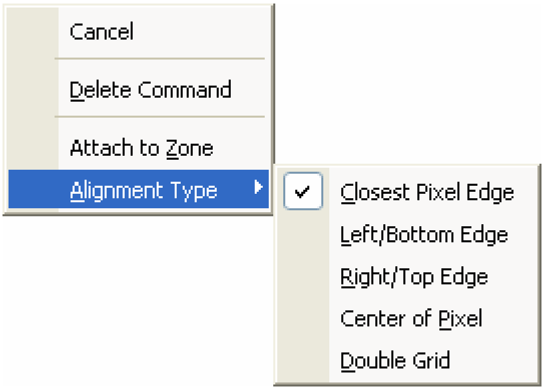
```
AlignV 12 [1]
AlignH 22 [0]
```

where 12 and 22 are point indices and 1 and 0 are the codes of the alignment rounding method as shown in the table above.

Align commands are the very first commands in any hinting program. They do not have base points and affect only one point.

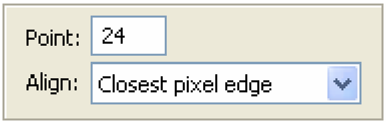
Customizing the Align Instructions

You can customize Align instructions with the context menu. Right-click the point to which the align command is to be applied and you will see the menu:



You may delete the command, attach or detach it from the alignment zone (this option is available only if the point is in the zone) and change the alignment type.

Another way to customize the command is to use the Program panel in expanded mode:



Point: 24

Align: Closest pixel edge

Links

Links are the most important visual commands. They are used to set relationships between outline points and to set distances between points to one of the standard stem values.

There are two types of links: single links and double links. Single links need to have a base point that is set by a previous command. This can be any command except a final delta.

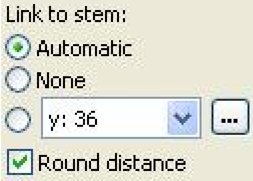
A double link does not need to have base points. It sets the position of two points and they can be used as base points for a single link or interpolate command.

Standard Stems

All link commands can be connected with one of the standard stems. When a link is connected to a stem it sets the distance between points to the scaled and rounded width of the stem. Using this technique you can implement standard-stem-based hinting, keeping important stem widths the same in every character in which they are used.

Please note that Type 1 standard stems and TrueType stems are different, although they function similarly. There is no limitation to the number of TrueType stems and they may be named. We will discuss all the different options of TrueType stems later on page 731.

You can use the Options panel **to select standard stem options**:



Link to stem:

● Automatic

○ None

○ y: 36 ...

☑ Round distance

There are three main options: **Automatic** connection to the stem, **Manual** connection and no connection at all.

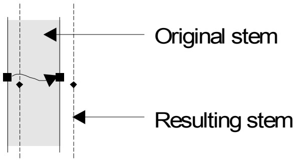
In automatic mode FontLab Studio will automatically select the standard stem that is closest to the linking distance. It will not connect the link with the stem if the difference between the distance and the stem width is more than either the stem or the distance.

In manual mode, you select a stem to which you want to connect a link in the stems combo box and switch on the **Select** option. However, if the difference between the distance and the selected stem is too high, FontLab Studio will not connect the link to the stem.

To keep from connecting a link with a standard stem switch on the **None** option.

Single Links

The single link connects an outline point to a point whose position is set by another command. If you set a single link that linked point will always be at the given distance from the base point:

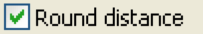


Single link instruction

A single link may be linked with one of the standard stem widths. If it is so linked then the distance to the base point is replaced by the scaled and rounded stem width. So if several links are connected to the same stem width the distances from the base points will always be the same.

Single links are very straightforward: they have one base point and one affected point.

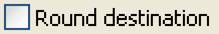
If a single link is connected with one of the standard stems the linking distance is always rounded to the grid. If the link is not so connected, then it may be rounded or not depending on the currently selected **Round distance** option:



☑ Round distance

Rounding distances is the default option for this command because it usually gives better control of the position of the destination point.

There is a special kind of single link called the *aligned single link*. It can be described as a combination of a single link and the Align command on the linked point. You can’t set a normal Align command at the end of the link but you can use an aligned link in this case. To make a link aligned switch on the **Round destination** option on the Options panel:



□ Round destination

Aligned single links use the current Align mode.

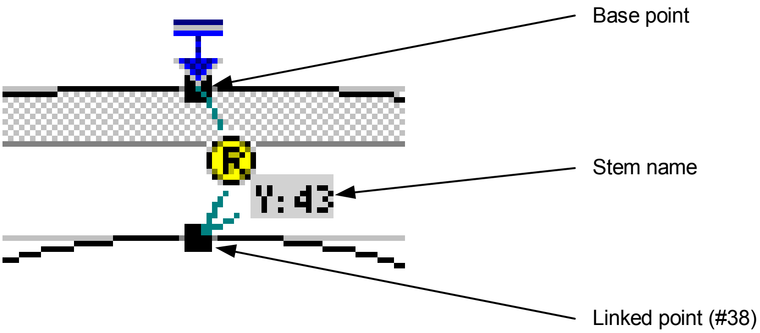
To set a single link:

1. Select the single link tool .
2. Position the cursor on the base point. Don’t forget that the position of the base point must be set by an instruction.
3. Press the left mouse button and drag the mouse to the point that you want to link. A circle will highlight it. Release the button.

Hold the **Shift** key down if you do not want to connect the single link to a standard stem width. If you hold the **Shift** key the stem settings in the Options panel will not work.

If the base point of the link is not aligned by some other command, FontLab Studio will automatically set an Align command on it. Hold down the **Ctrl** key if you want to prevent this.

In the Glyph Window the single link command appears as a directed line with a mark in the middle. The mark is yellow if the link is connected to a standard stem width, and gray if it is not. If the link is connected, the stem name may appear near the mark:



In the Program panel a single link command appears as:

```
SingleLinkV 12 -> 38 [0] 1
```

where 12 is the base point; 38 is the linked point; 0 is the number of the stem to which this link is connected (or “ns” if it is not connected to the stem); and 1 is the type of alignment for aligned links (or “na” for links that are not aligned).

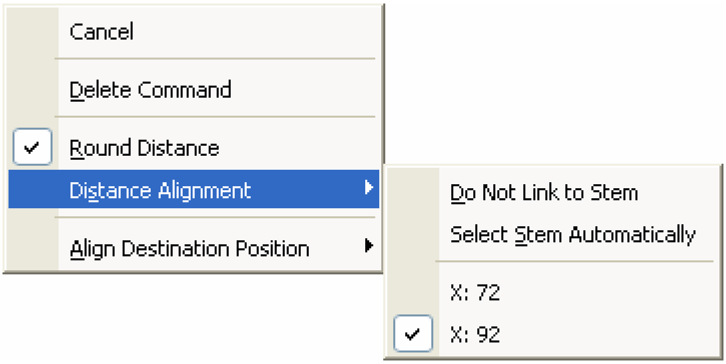
How the SingleLink Command Works

1. First the original (not grid-fitted) positions of the base point and the linked point are r etrieved and the distance between them is measured.
2. If the link is connected with a stem the distance is replaced by the prepared stem width for this PPM. If the scaled distance is equal to or exceeds 3 pixels it is rounded to the closest integer. If the link is not connected to the stem the distance is rounded or not depending on the rounding option of the command.
3. The distance of the linked point is set equal to the grid -fitted position of the base point shifted by the distance.
4. If a link is aligned then the position of the linked point is rounded to the grid according to the align mode stored as the last command parameter.

Customizing the Single Link Command

There are two ways to customize the single link command: the context menu and the Program panel.

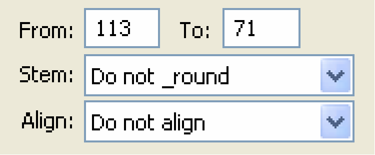
To customize a command with the context menu right-click the round icon in the middle of the link:



Use the **Delete** command to remove the command and the other options to customize it. The **Distance alignment** sub-menu lets you link the command to one of the stems.

The **Align destination position** submenu is the same that you can see in the Align command's context menu and defines the rounding of the destination position.

In the Program panel the Single link options looks like:

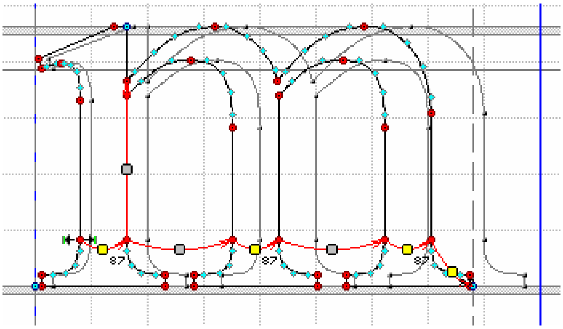


From: 113 To: 71
Stem: Do not _round
Align: Do not align

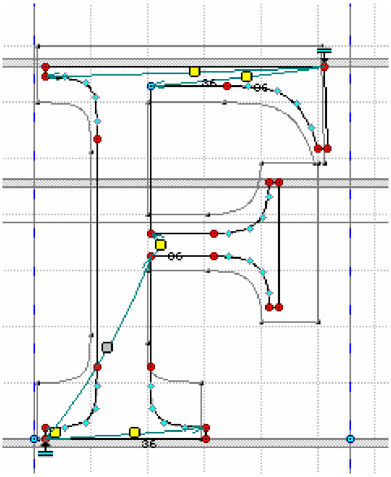
You can change the indexes of the starting and destination points and change the distance rounding and destination alignment options.

Single Link Examples

Here are some examples of single link hinting:



Horizontal hinting of the Times 'm' character

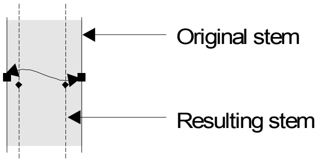


Vertical hinting of the Times 'F' character

Double Links

Double links let you set the distance between two “untouched” points. Both points will be moved by this command and both points will be touched afterward.

The distance between points can be connected to one of the standard stem widths using the usual procedure described above. If the distance is connected to the stem width, it will scale with the stem.



Double link instruction

You can’t predict where points will move that are connected by a double link so we recommend that you use this command only for stems for which the position is not very important or for stems that will be used as the basis for hinting.

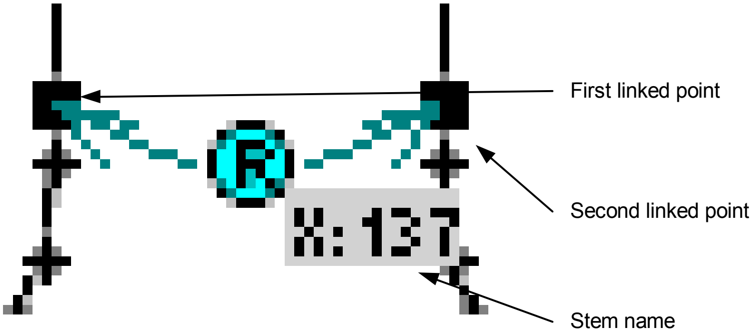
The double link command does not have base points, but it sets the position of points.

To set a double link:

1. Select the double link tool .
2. Position the cursor over one of the points you want to link. Press the left mouse button.
3. Drag the cursor to the point you want to link to the first point. A circle will highlight any point over which you move the cursor. Release the mouse button when the desired point is highlighted.

Hold the **SHIFT** key down if you do not want to connect the double link to a standard stem width. If you hold down the **SHIFT** key the stem settings in the Options panel will not work.

In the Glyph Window the Double link command appears as a line with two arrows and a mark in the middle. The mark is blue if the link is connected to the stem, and gray if it is not connected. If the link is connected the stem width will appear near the mark:



In the Program panel a double link command appears as:

```
DoubleLinkV 12 <-> 36 [0]
```

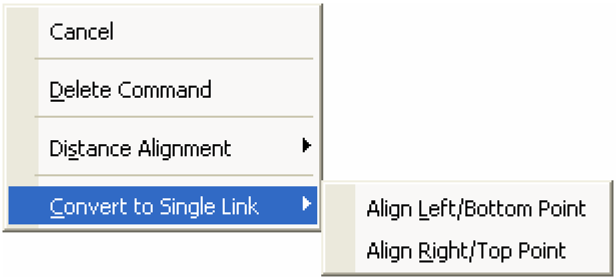
where 12 and 36 are points that are linked; and 0 is the number of the stem to which this link is connected (or "ns" if it is not connected to the stem).

How the Double Link Command Works

1. The original (not grid-fitted) positions oftwo linked points are retrieved and the distance between them measured.
2. If the link is connected with the stem the distance is replaced by the prepared stem width for the PPM. If the scaled distance is equal to or exceeds 3 pixels it is rounded to the closest integer. If the link is not connected to a stem the distance is rounded to the closest integer, starting from 1.
3. The grid-fitted positions of the two linked points are stored.
4. Both points are aligned to the closest grid line.
5. Rounding errors for both points are calculated by comparing original and rounded positions.
6. The point whose rounding error is less remains in place and the second point is set at the distance calculated in step 1. If the rounding errors are equal then the point with the lower coordinate value is set.
7. The distance of the linked point is set equal to the grid-fitted position of the base point shifted by the distance.

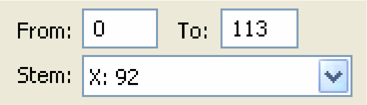
Customizing the Command

Right-click the middle icon on the double link to open the context menu:



The **Delete** command and **Distance alignment** options are the same as in the **Single link** menu. An additional command is “Convert to single link”. Use it to replace the double link command with the combination of the align and single link commands.

Program panel options for the double link command are simple:



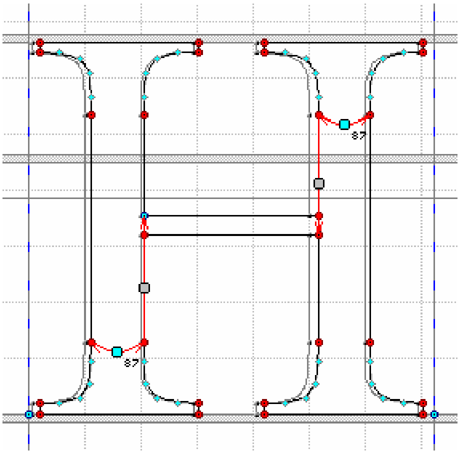
From: 0 To: 113

Stem: X: 92

There are controls to select the indexes of the linked points and the list of stem names to which the distance must be aligned.

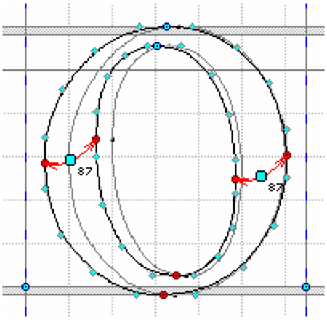
Double Link Examples

Some examples of double link command usage:



Horizontal hinting of the Times 'H' character

There are two double links and two single links in this example. The double links set the width and position of the two vertical stems and the single links align other points that are on the same stem.

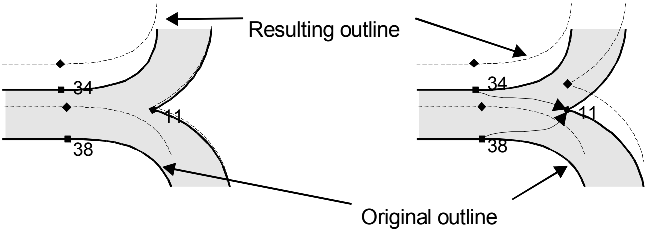


Horizontal hinting of the Times "o" character

Double links are usually used to hint characters in the horizontal directions in cases where stem position is not important. As you saw in the Single Links section we used single links to set horizontal instructions in the 'm' character because   we wanted to keep the distances between vertical stems the same.

Interpolation

Most of the time, the align and linking commands are enough to hint most characters, but in some cases a very different kind of command is necessary. Look at the enlarged middle-right region of the character B in the vertical direction:



Without interpolation With interpolation

You can see that point 11 in the original outline in the vertical direction is set exactly between points 34 and 38. But because these points are connected by a double link and point 11 is not controlled it becomes too close to point 38.

In this and similar cases you can use the interpolate command. This command sets the position of a point in the same proportion between two other points as it was in the original outline.

Or the intermediate point could be aligned to he grid and serve as the starting point for a single link or another interpolation command.

This command has two base points and one affected point.

To set the interpolate command:

1. Select the interpolate tool .
2. Position the cursor over the first base point
3. Holding the mouse button down move the cursor to the interpolated point and release the button.
4. Move the cursor to the second base point and click the left mouse button.

In the Glyph Window the interpolate command appears as two directed lines from the interpolated point to base points.

In the Program panel the interpolate command appears as:

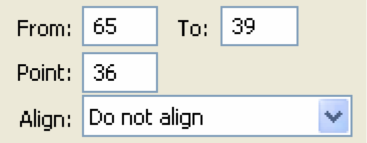
```
InterpolateV 34 -> 11 <- 38
```

where 11 is the interpolated point and 34 and 38 are the base points.

Customizing the Command

To customize the command right click the command icon (small green circle). In the context menu you can use the **Delete** command to remove the command and the **Align destination** menu to align the destination point to the grid.

In the Programs panel the Interpolation command options look like this:



From: 65 To: 39

Point: 36

Align: Do not align

The Options panel allows you to choose the source and destination points for the command and to customize the alignment of the destination point.

Delta Instructions

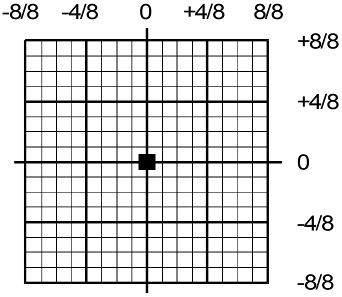
Now you know all about the visual hinting commands that can be applied to an outline at all PPMs. In addition to these commands the TrueType hinting language lets you set special commands that will work only at specific PPM sizes. These commands are called delta instructions.

There are two delta instructions for each hinting direction: middle delta instructions and final delta instructions.

Final delta instructions are necessary when you want to slightly change the instruction set - usually to add or remove some pixels:

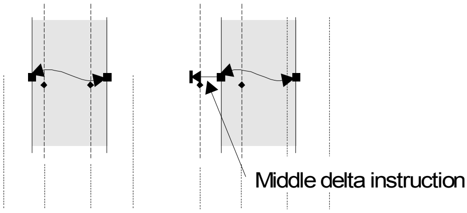
Middle Delta Instructions

A middle delta instruction can move outline points like any other instruction. It can move any outline point in 1/8-pixel increments from one pixel left (or bottom) to one pixel right (or top):



Movement space of delta instruction

Middle delta instructions are interpreted like other commands in the hinting program. They are automatically inserted between “normal” instructions that move points and so can be used to modify the normal interpretation of the hinting program:



In the example above, the vertical stem is moved one pixel to the left when the middle delta instruction is applied.

A middle delta instruction may be applied to a touched or untouched point and the point becomes touched afterwards.

It’s a good idea to use middle delta instructions to correct the rounding direction on some PPMs, like on the character ‘e’ at small PPM sizes.

Another good application of middle delta instructions is the correction of diagonal hints. A middle delta instruction “touches” the point to which it is applied, so any other point between two delta instructions will be interpolated in the final interpolation routine.

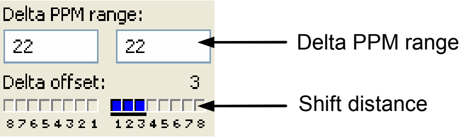
The middle delta instruction has 4 arguments: point to move, PPM_0, PPM_1 (the PPM range in which this instruction works), and the shift distance in eighths of pixels. In the Program panel this instruction looks like:

```
MDeltaV 18 <6> 12-14
```

where 18 is the point index, 6 is the distance to move (in this case - move up by ¾ of a pixel. A minus sign in front of the number would indicate a move down), 12 is PPM_0, and 14 is PPM_1. This means that point 18 will be moved up ¾ of a pixel when PPM is 12, 13 or 14.

To set a middle delta instruction:

1. Select the Middle Delta tool .
2. In the Options panel select the shift distance, direction and PPM range:



Delta PPM range: 22 22

Delta offset: 3

Delta PPM range

Shift distance

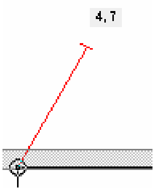
By default the PPM range is equal to the current PPM.

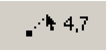
3. Move the cursor to the point at which you want to set the delta instruction and click the left button.

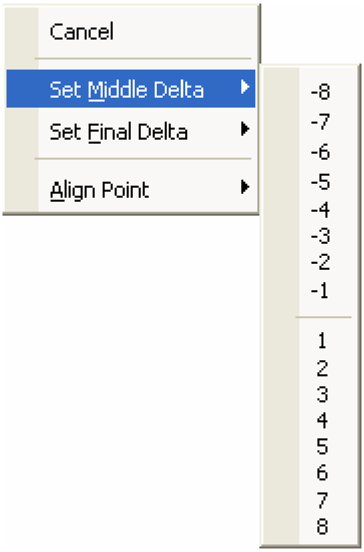
Faster Me thods to Set Delta Instruction

There are two other methods to set delta instructions. The simplest method is to select the Middle Delta tool, position the mouse cursor over the point you want to move and drag the point in the needed direction. Hold down the **Shift** key to move the point only in the current hinting direction (horizontal or vertical).

While you are dragging the mouse to set the instruction you will see its value both near the end of the line and on the Meter panel:



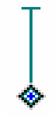




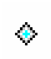
You can also right-click any point on the outline and select the delta command in the context menu.

Active and Inactive Delta Instructions

Delta instructions may be active or inactive. When the current PPM is within the PPM range of the delta instruction the instruction is active. Otherwise it is inactive.



Active delta instruction (shift up)



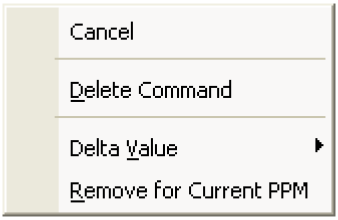
Inactive delta instruction

Note: if you set a new middle delta instruction at a point where a delta instruction is already set and is active the old instruction will be replaced by the new one.

If you set delta instructions for the same point and with the same shift distance but for different PPM ranges FontLab Studio will try to combine PPM ranges and unite delta instructions where it is possible.

Customizing the Delt a Instruction

Right-click the delta instruction mark to get access to the context menu:

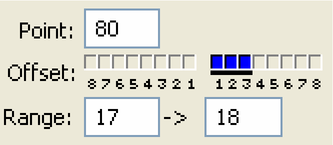


Use the **Delete** command to remove a middle delta instruction, so it will be removed for all PPMs for which it is defined.

Use the **Remove for current PPM** command to remove a middle delta instruction only for the currently selected PPM. For example, if the delta instruction is defined for the PPM range 12-18 and the current PPM is 14, after you use **Remove for current PPM** you will get two delta instructions: 12-13 and 15-18.

The Delta value submenu lets you choose the delta instruction shift distance.

Another way to customize delta instructions is to use the options area in the Program panel:



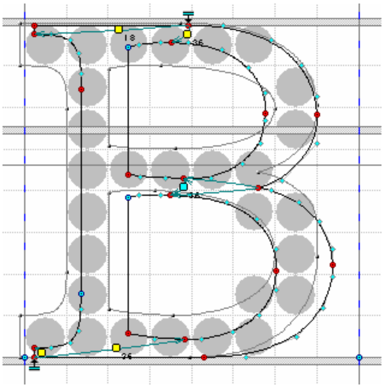
Point: 80

Range: 17 -> 18

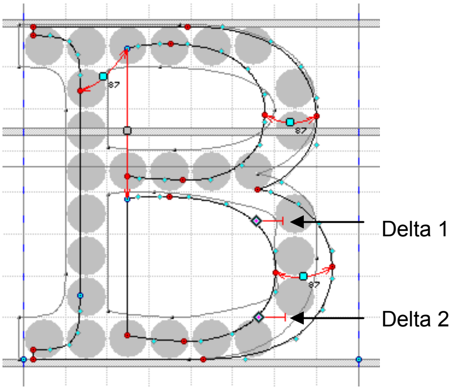
You can change the point number, shift distance and the PPM range.

Final Delta Instructions

Final delta instructions are applied after the final interpolation of all untouched points. They are used as a last resort to shift points to remove or add pixels at PPM sizes where it is still necessary after application of zones, stems and all other hints:



Hinted character at 12 PPM without delta instructions



Same character with two delta instructions

The sequence of interpretation is the only difference between middle and final delta instructions. They work exactly the same way. To set final delta instructions, select the final delta tool and follow the same instructions as above for middle deltas.

Some recommendations:

1. Delta hinting is a very time-consuming operation because you have to check the rendering results at many PPMs. So always try first to get the best possible results from normal, *linear* hinting.
2. Use the waterfall preview in the Preview panel to see where delta hinting is necessary.
3. Switch off font grayscaling in the Display Properties panel to see a real rendering preview. Display Properties are accessible through Control Panel.
4. Try to set as few delta instructions as possible. They increase font size and complexity.
5. It's better to set one delta instruction with a larger range than two less comprehensive delta instructions.

Removing Instructions

You can remove any instruction using two methods:

1. Select the instruction in the Program panel and press the **Del** button.
2. Position the cursor on the hotpoint of the instruction, hold the **Ctrl** key and click the right mouse button.

   AlignTop, AlignBottom, Align, MiddleDelta and FinalDelta instructions have hotpoints on the point to which they are applied.

   SingleLink and DoubleLink instructions have hotpoints on the mark in the middle of the line that connects the two points.

   The Interpolate instruction has a hotpoint near the point that is interpolated.

Standard Stems

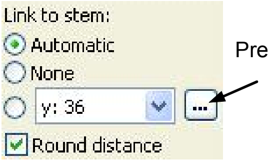
There are two sets of standard stems in FontLab Studio: Type 1 standard stems and TrueType stems. Type 1 stems are used by the Type 1 font rasterizer and have some limits. For example, it is possible to define only 12 stems for each direction.

TrueType stems have no limits and also have some additional properties. They may be named and their rounding may be specified for selected PPMs.

In FontLab Studio you can control the rounding of the standard stem widths. You can set the PPM size at which any standard stem width is changed from 1 to 2 pixels, from 2 to 3 pixels, from 3 to 4 from 4 to 5 and from 5 to 6 pixels. We call these critical PPM sizes “jump” PPMs because here the stem width makes a jump from 1 to 2 pixels, from 2 to 3 pixels and so on up to 6 pixels wide. By default, standard stems are scaled linearly and are rounded to the closest integer value.

When you add a new Type 1 stem, it is added to both stem lists: Type 1 (editable with Font Info) and TrueType.

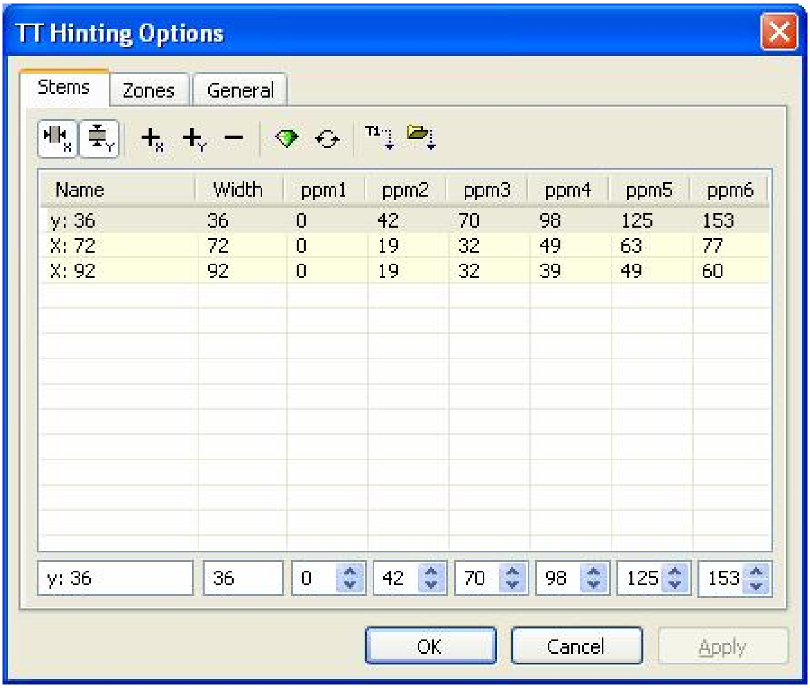
To control the TrueType stems’ properties you open the TrueType stems dialog box:



Link to stem:
● Automatic
○ None
○ y: 36
☑ Round distance

Press this button to open the Stems dialog box

You will see the following dialog box:



Name	Width	ppm1	ppm2	ppm3	ppm4	ppm5	ppm6
y: 36	36	0	42	70	98	125	153
X: 72	72	0	19	32	49	63	77
X: 92	92	0	19	32	39	49	60

y: 36 | 36 | 0 | 42 | 70 | 98 | 125 | 153

Make sure that Stems page is selected on the tab control.

The dialog box consists of a toolbar on the top, a stem list, a row of controls to adjust stem parameters and the **Advanced** button that gives access to some font-level hinting options that we will discuss later.

Buttons on the toolbar mean:

Include vertical stems in the list (stems measured along the X axis)

Include horizontal stems in the list

Add new horizontal stem

Add new vertical stem

Remove the stem selected in the list

Automatically calculate and optimize the rounding PPMs

Reset rounding PPMs to linear values

Import Type 1 stems into the list

Import stems from another font.

Columns in the list mean:

Name	Name of the stem. This is editable if you click the F2 button on the keyboard. You can also use the control below the list to change the stem name. The stem name appears when the stem is used in hinting program. We do not recommend using long stem names, 6-8 characters is enough in most cases
Width	Width of the stem. Use the control below the column to change the value
PPM2-PPM6	PPMs at which the stem is scaled to 2-6 pixels.

Click on the column header **to sort the list** by the column values.

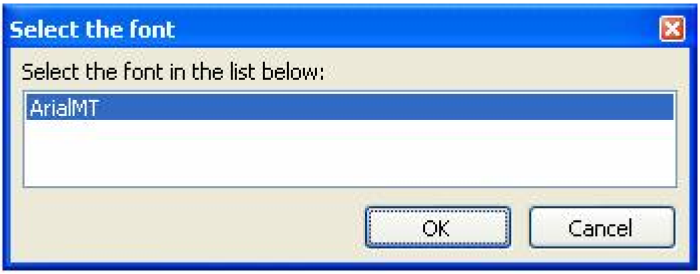
A yellow background in the list highlights vertical stems.

It is easy **to add a new stem**: just click on the +X or the +Y button and a new stem will appear with the <unnamed> name and a width of 100.

To remove a stem, select it in the list and click on the − button.

Click on the T1 button to append Type 1 stems to the list. FontLab Studio will append only those stems that are not already in the list.

With the 📂 button you can append stems from another font. Click it and select the source font from the list:



Select the font

Select the font in the list below:

ArialMT

When you remove stems that are used by the hinting program in some glyphs FontLab Studio will replace any stem-linked link with a simple rounded link.

Stems Rounding

Control over stem widths rounding is necessary for two reasons:

1. To control a font's contrast. If your font is low contrast, like Courier or Arial, you may want to set the jump PPMs for vertical and horizontal stems equal. This way, the font will never get high contrast, as when vertical stems are 2 pixels wide and horizontal stems are only 1 pixel wide.
2. To synchronise the scaling of stems with close widths - like the stems that control straight and round vertical stems in uppercase characters. At large PPM sizes they should be different but they have to make the 1→2 and 2→3 width jumps together.

Bigger jump values are necessary when you are working on a black or extra black font where 5-pixel width stems appear at low PPMs.

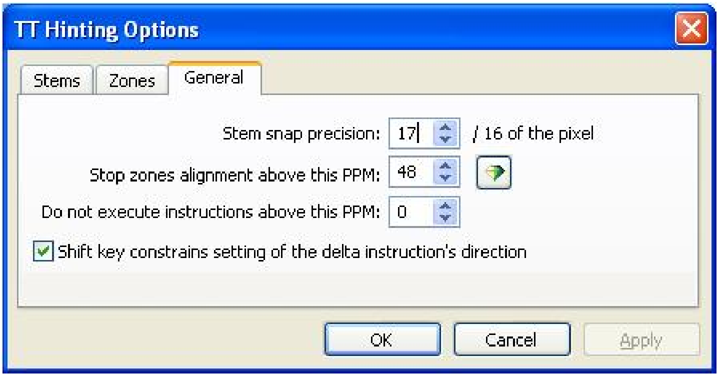
To change stem rounding:

1. In the list select the stem that you want to edit.
2. In the edit fields change the PPM sizes at which this stem makes its various jumps from one pixel up to 6 pixels.

Press the 💎 button to automatically optimize the stem rounding while trying to keep optimal contrast. Use the 🔄 button to reset all stem PPMs to linear values.

General Options

Click on the ⋯ button in the Options panel and select the General tab on the tab control. You will see a General Options dialog box:



Stem snap precision: 17 / 16 of the pixel

Stop zones alignment above this PPM: 48

Do not execute instructions above this PPM: 0

☑ Shift key constrains setting of the delta instruction's direction

Stem snap precision

Measured in 1/16 of a pixel, this value defines the difference between the actual stem width (scaled but not rounded) and the stem width in pixels specified by the stems dialog box. If the difference is more than the defined value, the stem is rounded linearly. A value of 16/16 will mean that stem rounding will be controllable only when the difference is less than one pixel. A value of 32/16 defines a possible difference of 2 pixels.

Stop zones alignment above this PPM

Enter the font size in PPM after which zone alignment will not be operative and all points controlled by the AlignTop and AlignBottom commands will be rounded to closest pixel edge.

Do not execute instructions above this PPM

Defines the PPM above which instructions will not be operative anymore. Enter 0 to never stop instructions.

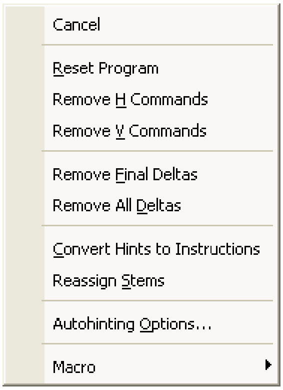
Shift key constrains setting of the delta instruction’s direction

Inverts the function of the **Shift** key when you define delta instructions. By default you can freely move the destination point of the delta offset and you have to press **Shift** key to limit direction to the current hinting direction. When this option is deactivated, delta offset direction will be fixed and you have to press **Shift** key to “free” it.

You may click **Apply** button to immediately see results of the new options in the Preview panel.

Context Menu

If you press the right mouse button in the free space of the Glyph Window edit field you will see a popup menu:



The commands available in this menu are:

Cancel	Closes the menu
Reset Program	Removes all instructions
Remove H Commands	Removes all horizontal commands including delta instructions
Remove V Commands	Removes all vertical commands including delta instructions
Remove Final Deltas	Removes all final delta instructions
Remove All Deltas	Removes all delta instructions (middle delta and final delta)
Convert Hints to Instructions	Tries to convert Type 1 hints and links to visual hints. You can use this command as a kind of TrueType autohinting. If a glyph doesn't have any Type 1 hints, use the Tools > Hints & Guides > Autohint command to generate them. Follow with the "Convert Hints..." command to generate a TrueType hinting program for the glyph
Reassign Stems	Checks all single and double links that are attached to one of standard stems and tries to automatically select the best stem for the link length.
Autohinting options	Opens the Autohinting options dialog box that lets you customize the process of converting Type 1 hints to TrueType instructions. This dialog box is described below.

Autohinting Process

When you select the **Convert Hints to Instructions** command in the popup menu or apply the same action in the Transform or Transform All dialog box, FontLab Studio:

1. Converts all hints to links to find what points are linked by the hint.

2. For every horizontal link:

2.1 If one of the linked points is in the top or bottom alignment zone: adds an AlignTop or AlignBottom command and connects another point to it by the SingleLink command. Automatically links the SingleLink command with one of the standard stems.

2.2. If none of points is in the alignment zone: links them by a DoubleLink command or by a single link command if one point is linked to another outline point.

2.3 Checks all outline points and if one of them is on the same horizontal line as one of the linked points: links it by the SingleLink command. It doesn't do this if the point is adjacent to an already connected point.

3. For every vertical link:

3.1 Connects two points by the DoubleLink command or by the single link command if one of the points is linked to another outline point.

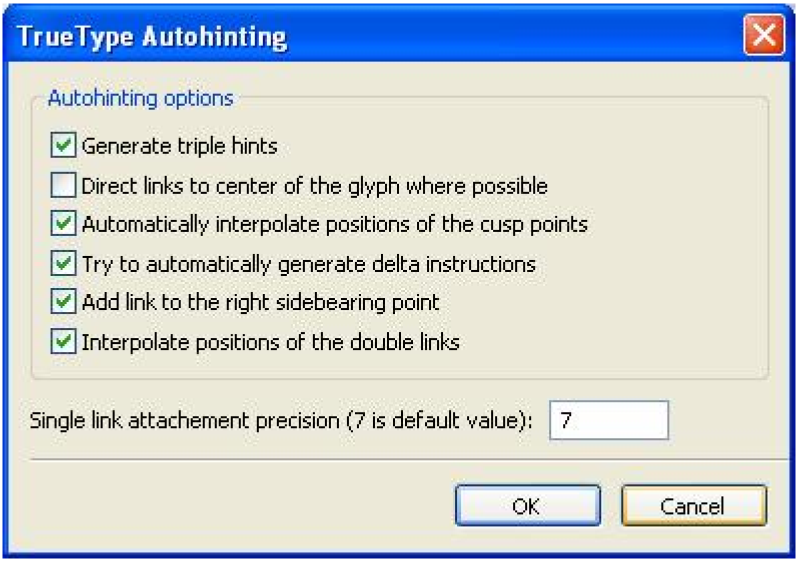
3.2 Checks all outline points and if one of them is on the same horizontal line as one of the linked points: links it by the SingleLink command. It doesn't do this if the point is close to an already connected point.

4. FontLab Studio optionally detects "cusp" points and links them to one of the single and double link commands.

5. For single and double link commands that connect round points, like on the left and right sides of the 'O' FontLab Studio may optionally add middle delta commands that correct the rasterization of the curve.

Autohinting Options

You can customize the conversion process with the **Autohinting Options** command. Use this command to open the dialog box:



Autohinting options

☑ Generate triple hints

□ Direct links to center of the glyph where possible

☑ Automatically interpolate positions of the cusp points

☑ Try to automatically generate delta instructions

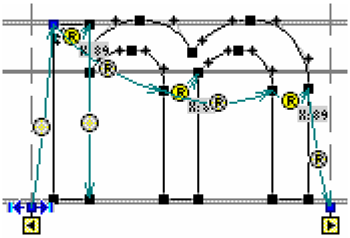
☑ Add link to the right sidebearing point

☑ Interpolate positions of the double links

Single link attachement precision (7 is default value): 7

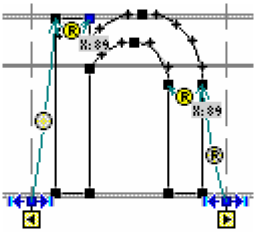
Generate triple hints

If this option is active FontLab Studio will try to generate TrueType instructions that simulate Type 1 triple hints for characters like ‘m’ where the distance between stems must be kept the same at all PPMs:

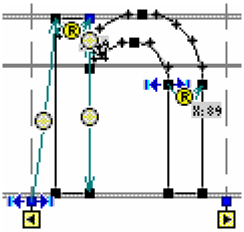


Direct links to center of the glyph where possible

FontLab Studio can try to hint starting from the left sidebearing and going to the right or starting from both sidebearings and going to the center of the glyph. Use this option to customize the hinting direction:

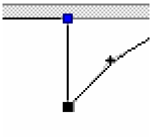


or

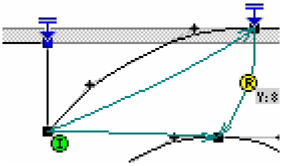


Automatically interpolate the position of cusp points

A Cusp is a point where the contour sharply changes direction:

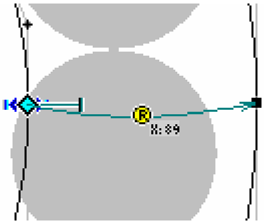


If this option is on, FontLab Studio will generate an Interpolate command that will link the cusp point to one of the links:



Try to automatically generate delta instructions

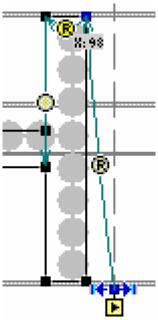
Our research shows that it is useful to include small middle delta commands at the end of links that connect round parts of the glyph:



Use this option to control this feature.

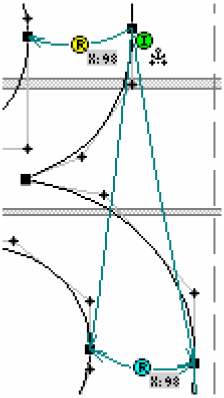
Add link to the right sidebearing point

FontLab Studio can generate a single, distance-rounded link that will go from the rightmost hinted point to the right sidebearing point. This feature guarantees at least one pixel distance between glyphs on all PPMs.



Interpolate positions of the double links

In glyphs like ‘B’, which have overlapping stems, FontLab Studio may hint them independently or hint the first stem and then interpolate the position of the second stem using the interpolation command with the final point aligned to the grid:



Whether this is appropriate for your font has to be decided on a case-by-case basis.

Single link attachment precision

If an outline is not very precise you can enter a value in this field so FontLab Studio will have a threshold to decide when several points are located along a line. For precise fonts set this value to 1 or 0.

Generally speaking, autohinting is a trial and error process. You can get very good autohinting results if you select the correct options for your font and define correct stem and alignment zone behaviour at the critical PPMs.

Processing Multiple Glyphs

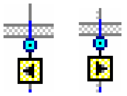
You can convert Type 1 hints to TrueType instructions for many glyphs at once if you use the Transform dialog box.

Open the Transform dialog box with the **Tools > Actions** command and select the **Convert to Instructions** command in the **Hints and Guidelines** section.

Hinting Sidebearings

With FontLab Studio's TrueType hinting tool you can set instructions that will control the horizontal position of a character's sidebearings. This gives you precise control over a character's metrics at small PPM sizes.

In the editing field of the Glyph window you can see yellow marks that designate sidebearing points. There are left and right sidebearing points. The left mark controls the position of the left sidebearing and the right mark controls the right sidebearing.



Sidebearing points are always aligned in the horizontal direction.

You may apply any command to the right sidebearing point, but the left point can be used only as a source of links or interpolate commands.

By moving the right sidebearing point you can control the amount of white space at the right side of the character.

Usually the position of the right sidebearing point is controlled by a rounded single link command or by a final delta instruction. Because the length of the single link with rounded distance cannot be less than one pixel you can set this command and be sure that left or right whitespace will never disappear.

Both sidebearing points may be used as sources of any command just like any other point of a character's outline.

How FontLab Studio Implements Commands that Move Sidebearing Points

The TrueType font format has a special table that can contain the widths of characters that are rendered at specific PPM sizes. This helps the rasterizer to preview lines of text on screen very quickly. FontLab Studio builds this table when it exports a font in TrueType format. To do this it interprets instructions that are applied to the sidebearing points at every PMM size from 9 to 24.

Hinting Composite Glyphs

FontLab Studio allows you to set TrueType hints for the composite glyphs. There is not much visible difference between hinting plain and composite glyphs – Glyph window and tools look as if you are hinting decomposed glyph.

The principle difference is that components of a composite glyph appear already hinted. It means that if you have hinted glyph 'E' and hinted glyph 'caron' and if you want to check hinting in glyph 'Ecaron' you will see that both components look exactly as they look in respective glyphs, and the only thing you need to do is to hint their relative position.

Usually all you need to do to hint a composite glyph is to put a few middle-delta instructions on the contours of accent components so they will get a correct and symmetric position in the composite glyph.

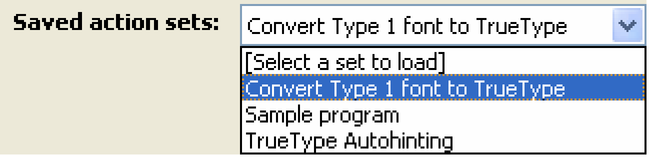
You can however completely override hinting of components and provide new hinting program for a composite glyph. In this case you may take a composite glyph as a combination of all components as if it is decomposed.

Automatic TrueType Hinting

There is no special command “TrueType autohinting” in FontLab Studio. There is Type 1 autohinting and automatic conversion of Type 1 fonts to TrueType instructions. This is a more flexible solution to the TrueType autohinting problem because it allows you to use all the correct Type 1 hints that you have or to build both hints at once.

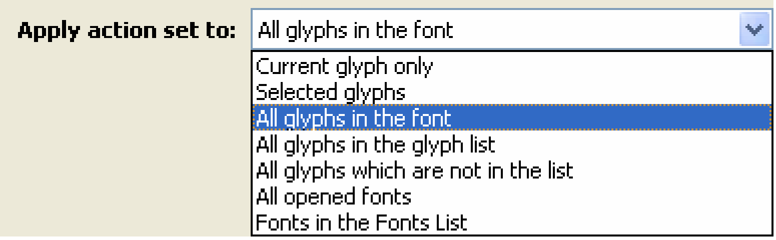
To automatically generate visual TrueType hints for the whole font:

1. Select the **Action Set** command from the **Tools** menu.
2. If you have a Type 1 font (outlines of 3rd-order curves) with a Type 1 hints set select **Convert Type 1 font to TrueType** from the program selection combo box:



Saved action sets: Convert Type 1 font to TrueType

3. If the font has no hints at all select **Generate TrueType hints** from the program selection combo box.
4. Choose an application range for the selected program:



Apply action set to: All glyphs in the font

5. Press the **OK** button to start the process.

Working With Bitmaps

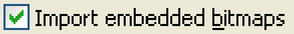
Setting complex instructions program and multiple delta instructions may take a lot of time. An alternative is to create bitmap versions of the glyphs for most important sizes so TrueType rasterizer will use them instead of rendering outline glyphs and instructions program.

Bitmaps can be defined for any combinations of glyphs and PPMs. A font may have only one bitmap for one glyph and one PPM or lots of bitmaps for different glyphs at different PPMs - there are no limits.

FontLab Studio supports import, export and editing of so-called embedded bitmaps.

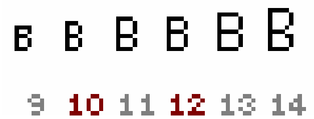
Importing Bitmaps

Import happens automatically if this option is active in the **Tools > Options > Opening OpenType & TrueType > TrueType/OpenType TT (.ttf)** dialog box:



☑ Import embedded bitmaps

When a font has embedded bitmaps, PPMs for which bitmaps are present are colored red in the TrueType tool Preview panel:



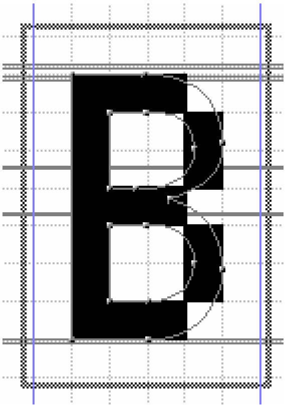
You can import embedded bitmaps from a different TrueType font. To do so:

1. Click on the button on the toolbar to enter the bitmap mode of the TrueType hinting tool.
2. Right click anywhere in the Glyph window and select the **Import bitmaps…** command in the context menu.
3. Select a TrueType font with embedded bitmaps in the standard File Open dialog box.

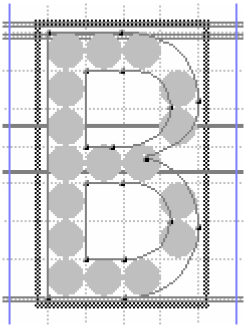
Editing Bitmaps

To get access to embedded bitmaps activate Bitmap mode by clicking on this button on the TrueType hinting toolbar: ⠿.

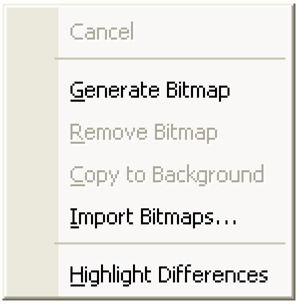
You'll see the Glyph window and preview panel change:



In Bitmap mode the Glyph window previews the bitmap with pixels represented as black squares. If there is no bitmap defined for the current PPM, it looks different:



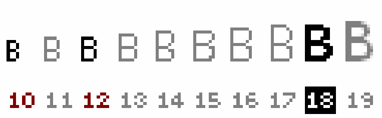
If you want **to add a bitmap for the current PPM**, right-click anywhere in the Glyph window and select the **Generate bitmap** command in the context menu:



You can edit the bitmap with the mouse: just click and drag the left mouse button.

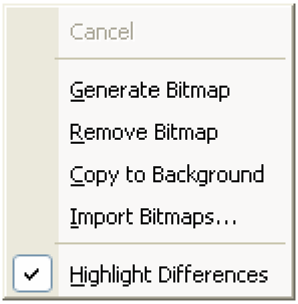
To remove the bitmap for the current PPM use the **Remove bitmap** command in the menu.

When there are bitmaps defined for the glyph, they are highlighted in the Preview panel:

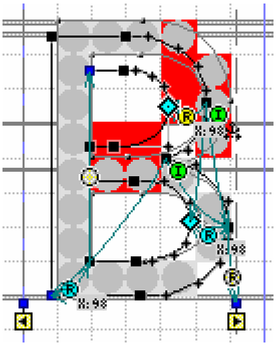


Highlight Differences

You may highlight the differences between the result of the rendered and hinted outline and a bitmap. Enter the Bitmap mode and select the **Highlight differences** command in the context menu:



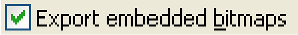
When you leave the bitmap mode (click on the ▦ button or select any other TrueType hinting tool) you will see that all pixels that are different in the rendered outline and in the bitmap are highlighted in red:



You can use this feature to separate the “artistic” and technical parts of the hinting process: make good bitmaps; activate the Highlight differences feature; go into hinting mode and set hints so there are no red pixels.

Exporting Bitmaps

To export embedded bitmaps make sure that this option:



☑ Export embedded bitmaps

is active in the **Tools > Options > Generate OpenType & TrueType > TrueType/OpenType TT (.ttf)** dialog box.

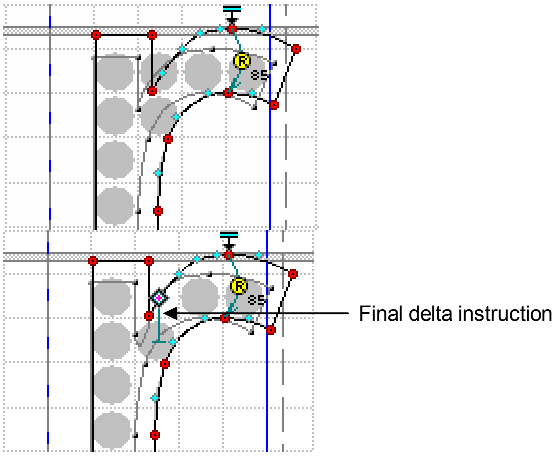
Please note that the operating system will display embedded bitmaps only when a font is rendered in black/white mode. If font smoothing is activated in the system and allowed for the point size in the font, bitmaps will not appear.

Hinting Strategies

This section will give some examples of visual hinting strategies that are applicable in different situations.

Middle Delta or Final Delta

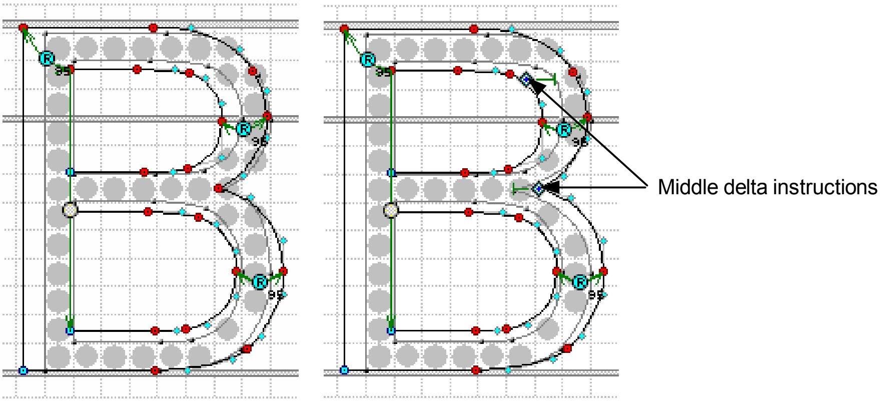
The final delta command is the very last command of the instruction sequence. This command moves only the point to which it is attached and only on PPMs for which it is set. We recommend using this command in situations where only one pixel needs to be “switched” on or off:



Final delta instruction

The middle delta instruction is much more flexible. You can use it to slightly modify the interpretation of the hinting program because it is automatically inserted between commands and is interpreted after the command that sets the position of a point and before any command that uses that position as a basis (like link and interpolation instructions).

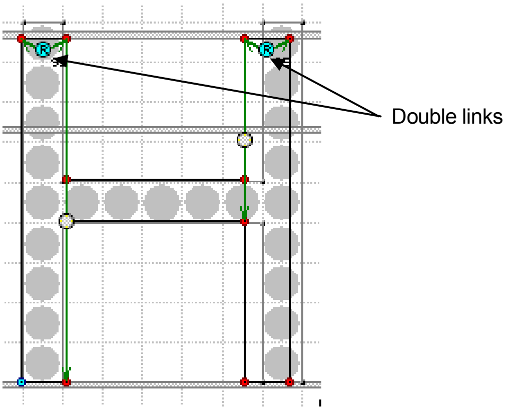
But even if the middle delta command is set on an untouched point it is applied to the point before final interpolation of the untouched points. This point becomes touched after interpretation of the middle delta command so the position of other untouched points will be changed proportionally to the shift of that point:



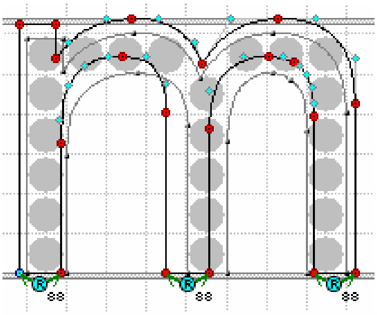
We recommend using the middle delta command with untouched points when it's necessary to shift several points at once. Usually you have such a situation on diagonal and curved stems.

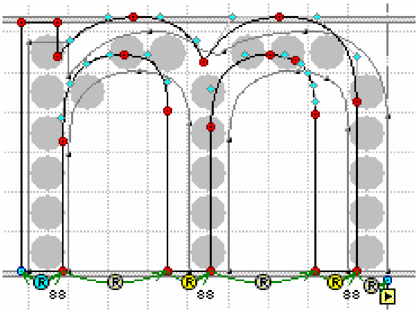
Single Link or Double Link

We recommend using the double link command only in situations where only the width of the stem is important, not the position:

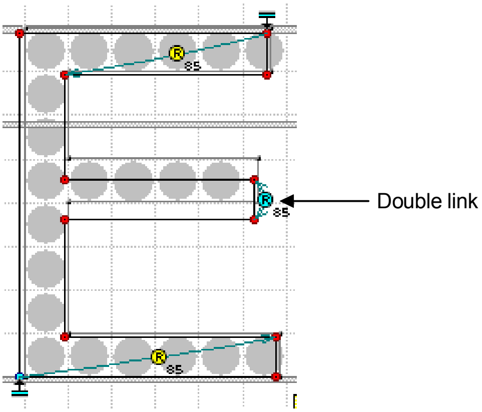


Here is a good example of the situation where **double links should be replaced by a chain of single links**:





Another possible application of the double link is hinting a character’s middle horizontal stem:

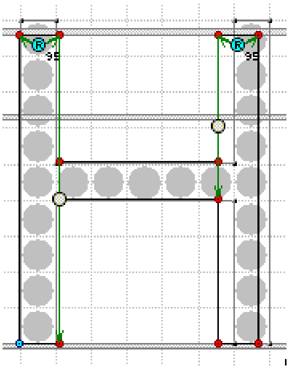


If the position of the middle stem in different characters is different, you cannot be sure that the hinted position will be the same at all PPMs, even if the difference is very small. There is always a chance that at some PPM the rounding of linked points will be different and the link will be shifted top or bottom.

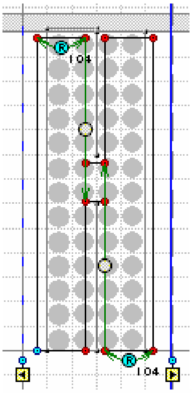
Be ready to set a number of middle delta instructions or, better yet, set a special middle line alignment zone and use a combination of align and single link instructions.

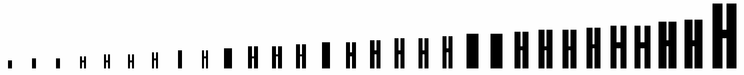
Hinting White Space

Sometimes it's necessary to set the width of the white space inside a character, especially with a narrow character that has more than one vertical stem. Take the character "H" as an example. With normal fonts we usually use two double links to set the widths of vertical stems:



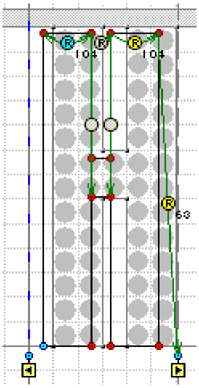
Because at all PPM sizes we will have enough space between stems we don't really care about white space. But look what happens if we try to use the same technique **with a narrow font**:

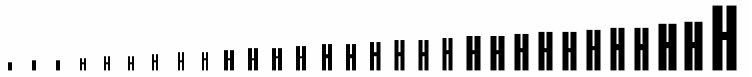




At many PPMs the vertical stems are snapped together and the character becomes completely unreadable.

We can, however, use only one double link, then link the two stems together with a single link with a rounded distance and set the width of the right stem with a single link connected to the stem:



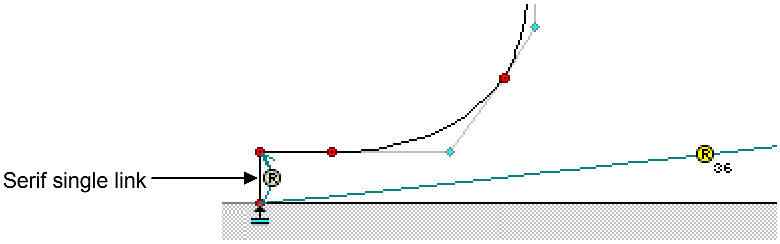


The rounded distance of the single links cannot be less than one pixel, so we will always have some white space between the stems.

To complete the hinting of this character we have to add a rounded single link to the right sidebearing point to make sure that the white space between our character and the next character does not disappear.

Hinting Serifs

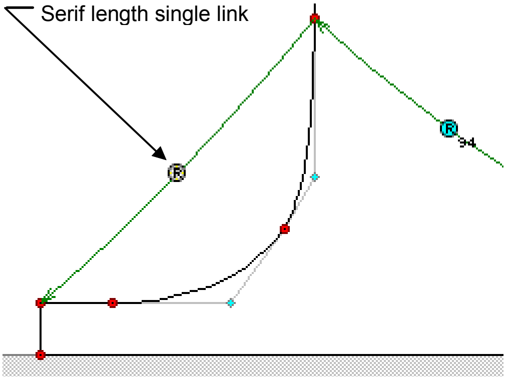
We recommend **hinting serifs in the vertical direction** by a single link command:



If the serifs are thin then it's not necessary to attach their width to the standard stem width. A single link with rounded distance will be enough. Rounded single links cannot appear less than one pixel in length so the serif will never disappear.

Of course, if you want to have more control over the serif's width you can define a special stem width and attach the serif's single links to this width.

For total control over serifs' behavior you can also set horizontal commands that will control the "length" of the serifs:



Hinting Diagonals

Hinting diagonal stems is the most complicated job in hinting. There are no special “diagonal” commands so you have to set both horizontal and vertical commands to control the width of a diagonal stem.

We know two ways to hint diagonal stems:

1. Define special standard stem widths. Set vertical and horizontal commands attached to these widths and control the rounding of stem widths using the stems dialog box.
2. Set the positions of one side of the stem using the usual commands (align and link) and set the position of the other side by single links that are not rounded and not aligned. Adjust the width of the stem using middle delta instructions.

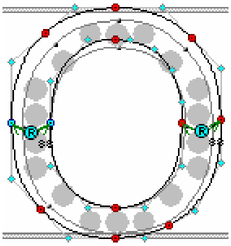
   If a diagonal stem is intersected by another vertical, horizontal or diagonal stem then we recommend using the interpolation instruction to set the position of the intersection points.

In most cases good hinting of diagonal stems is not possible without final delta-hinting.

Hinting Symmetrical Characters

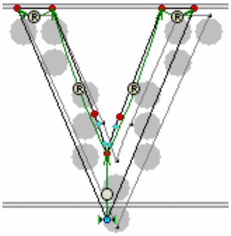
There are two types of symmetrical characters: round characters (like ‘O’) and “pike” characters (like ‘V’).

Round characters are “automatically symmetrical” in both directions. So it’s enough to set the positions and width of the vertical and horizontal “stems” and the center points will be interpolated and automatically set in the central position:



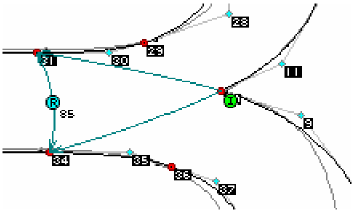
For “pike” characters this is not good enough because the position of the pike point is important. At most PPMs you must set the width of the pike to one pixel. Automatic interpolation of the outline may set the pike point to a position where the pike will disappear.

So in the case of pike characters we have to begin by positioning the pike point with the **align to pixel center** command and then set the positions of all other points by linking to this point:

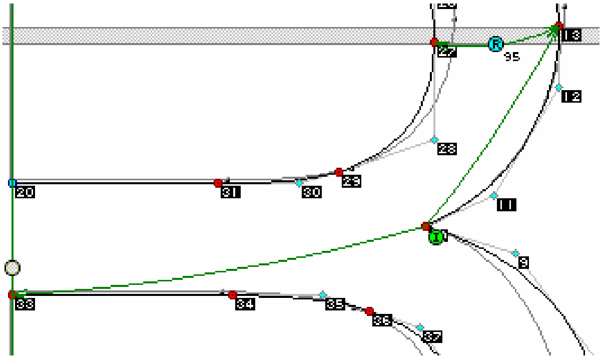


Interpolate or Not

As you already know all points that were not positioned by commands (untouched points) are interpolated automatically by the final interpolation command. Final interpolation sets the position of any untouched point proportionally to the closest untouched points. But sometimes you may want to control the interpolation process and directly set the base points of the interpolation. Usually this happens when a point is geometrically between two touched points that belong to different contours:



The only way to keep point 10 between points 31 and 34 is to set an interpolation command in the vertical direction. It's a good idea to interpolate the same point in the horizontal direction too:



✐ **Note:** When testing your hinted fonts, test a range of sizes. View sample text at what you consider to be “normal” viewing size, and test at 3-4 sizes above and below. Keep in mind that you may run your machine at much higher or lower resolution than others. Someone with a 1024 x 768 17” monitor will likely choose a smaller size than someone using the same resolution on a 12” laptop.

✐ **Tip:** You can use the zoom feature of Microsoft Word or a web browser such as Opera to simulate different DPI settings. The default DPI setting of Mac OS is 72 DPI and of Windows is 96 DPI. When you test your font on Mac OS at 12 pt, the 12-PPM size will be used. When you zoom Word or Opera to 133%, you will see the 16-PPM size which is the size, used for 12 pt type on Windows. Conversely, in Word or Opera on Windows, set your zoom to 75%. This way, your 12 pt type will be displayed using 12-PPM rather than the usual 16-PPM.

Hinting Multiple Master Fonts

✐ Multiple Master (or MM for short) fonts contain more than one layer of outlines making possible to create indefinite number of intermediate font variations. You can get more information about MM fonts in "Multiple Master Fonts" chapter in this book (page 765).

✐ Usually MM fonts are used to create font families, and in most cases they contain one or two axis: weight and width. In the case of one (let's say weight) axis font will contain two masters, so to say, two layers of information about the glyph shapes. First master will define "light" version of the font and second master – "bold" or "extra bold" version.

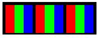
✐ With FontLab Studio 5 you can apply TrueType hinting to Multiple Master fonts. So, instead of hinting these two masters separately (and also provide TrueType hinting to all generated intermediate designs) you can do it only once.

There are some limitations:

1. You can apply hints to only one master, the first one.
2. TrueType alignment zones and standard stems are not compatible with MM fonts and will be simply copied to the generated intermediate designs from the first master. Which means that you will have to update stems and zones values.

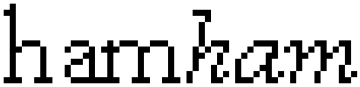
   However, Type 1 zones and standard stems are compatible with Multiple Master font structure, and they can be used to create intermediate values. There is one requirement: their ordering and value must be exactly the same as ordering and values of the zones and stems of the first master of the MM font.
3. Delta hints usually will not work well. Make basic hinting with the MM font, but apply delta hints after generating the intermediate font.

Hinting for ClearType

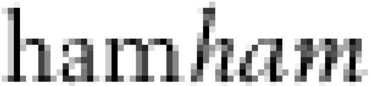
ClearType is a text rendering technology developed by Microsoft and introduced in Windows XP. It works with LCD screens and uses colored (green, blue and red) subpixels to increase visible screen resolution in one direction. On LCD screens each full-color pixel actually consist of three smaller subpixels colored with basic colors. These colors mix with each other, so by applying different brightness to each subpixel we can get a practically unlimited number of color combinations: 

By changing color values for each pixel it is possible to simulate the effect of changing the brightness of each subpixel. For example, rendering a fully-blue pixel effectively means that the red and green subpixels are turned off and the blue subpixel is on. The human eye reacts differently to brightness changes of different colors so the color combinations are chosen very carefully. If the pixels are sufficiently small, the human eye does not notice the individual colors but instead, perceives the color pixels as combinations of subpixels – resulting in an increased resolution.

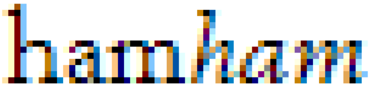
Pure black-and-white rendering gives sharp pixels but does not render well fine elements such as serifs. Also, italics are problematic.

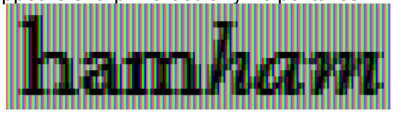


Grayscale rendering helps smoothing diagonals but usually either blurs the stems or makes them too black so the type either unsharp or unevenly colored.

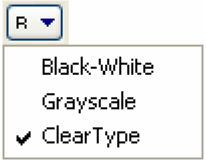


When enlarged (left), ClearType rendering looks like a mosaic of color pixels. However, in very small sizes, the user perceives each colored pixel as a combination of subpixels. The result is type that has smooth edges and yet appears sharp. Particularly helps italics.





TrueType hints work when font is rendered with ClearType technology, but with some limitations. For example, final delta instructions are not used at all. With the Preview panel you can see a sample of the font rendered with ClearType: use this button to choose the rasterizer:



If you select ClearType in this list, all rendering in the Preview panel will be done using this rendering technology.

Mac OS X (Apple) and Acrobat (Adobe) also use subpixel rendering algorithms. The principle is similar to ClearType but the details of the implementation differ. This means that the effects of subpixel rendering of the same font on Windows, on Mac OS X and in Acrobat will usually be different.

Multiple Master Fonts

With FontLab Studio you can make a special type of font called a Multiple Master font. Multiple Master fonts contain several font styles, called *masters*, in one font file. A program that uses a Multiple Master font can select not only one of the master fonts, but also any intermediate style created by interpolation of the master fonts. So it can use not only Bold, Normal, Narrow or Wide styles, but any style in between, such as 30% Weight and 47% Width. We will discuss this process in full detail in the next sections.

10

Multiple Master Fonts Theory

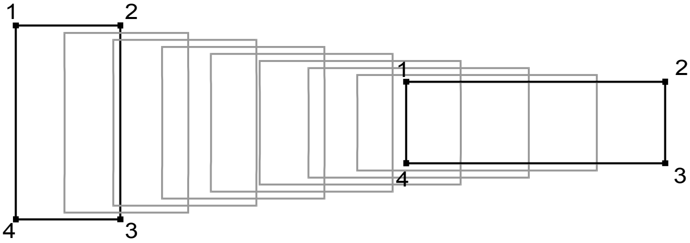
The Multiple Master font format was developed by Adobe Systems as an extension of the Type 1 font format. This means that Multiple Master fonts (or MM fonts, for short) are compatible with all PostScript printers. MM fonts can be used on Microsoft Windows and Mac OS if Adobe Type Manager (ATM) is installed. Mac OS X doesn't support MM fonts.

The Multiple Master font format is not very widely used as the final deliverable format. However, many type designers use Multiple Master fonts during the design process and use them to generate a family of single-master fonts that go into distribution. Using MM fonts as a design tool can be an excellent way to speed up the design of large font families.

For technical details and an excellent background in this subject we strongly recommend you read “Designing Multiple Master Typefaces”, a book published electronically by Adobe Systems:

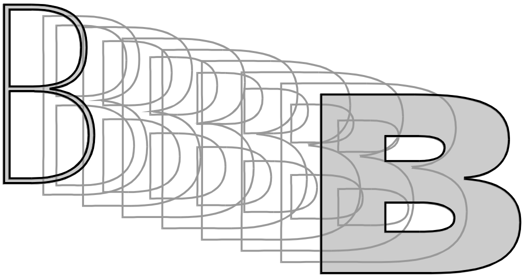
http://partners.adobe.com/asn/developer/pdfs/tn/5091.Design_MM_Fonts.pdf

A simple picture can describe the main idea of the Multiple Master font format:



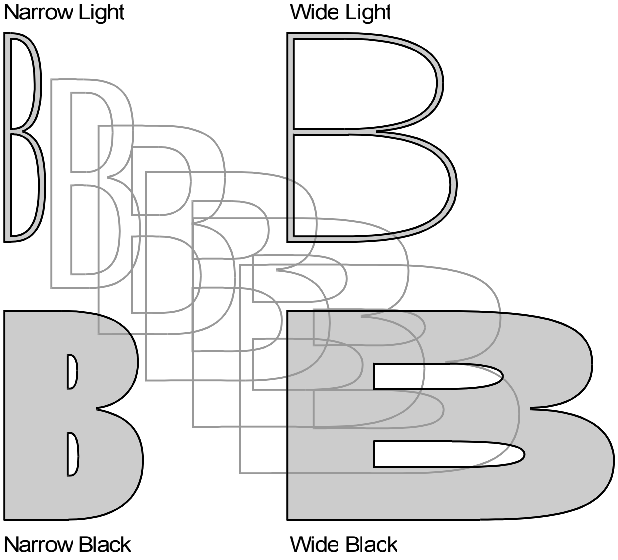
If we have two contours that have the same number of segments of the same type (straight or curve), we can always make intermediate contours by interpolation. The number of these different contours is limited only by the precision that we choose.

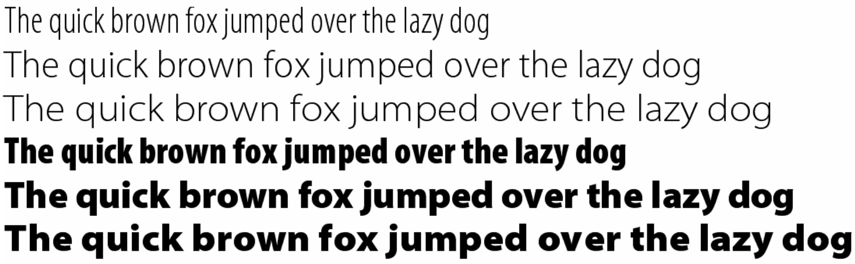
Applied to fonts, this idea gives us the following:



In this picture we used two styles of the same typeface, Light and Black, as ends and, as you can see, we have many more styles in the middle. Fonts that are used to define end designs are called *masters*. A combination of several masters into one font file is called a *Multiple Master font*.

In the example we used only two masters, and we changed only one property of the font using interpolation. But we can define more masters and get even more choices for changing the design of the font. For instance here's what happens when we use four masters: now we can vary both the fonts' width and weight:




The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog

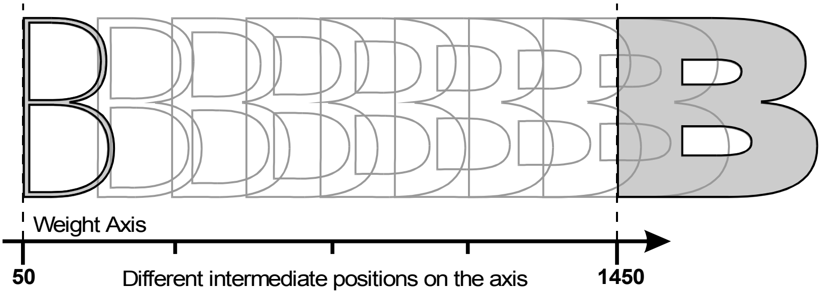
The text sample typed with different instances of the same Multiple Master font

Design Axes and Dynamic Range

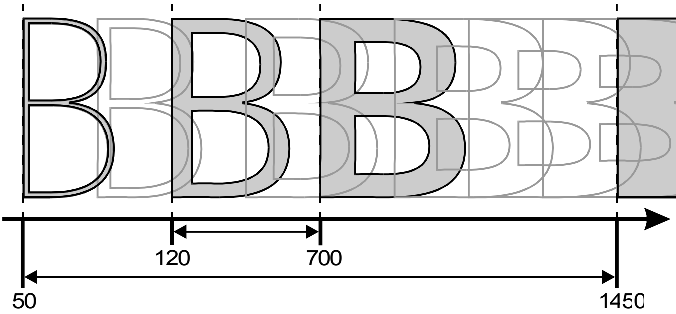
It is possible to define a number of properties of an MM font using masters. These properties are called *design axes*, or simply *axes*, for short.

You can define as many of these design axes as you want, but four axes in a single MM font is the practical limit since there is no program as of this printing that can use more than that. The number of masters that is necessary to define a given number of axes can be calculated as 2^n, where n is the number of axes. So a single axis font requires 2 masters, a two-axis font - 4 masters, a three-axis font - 8 masters and finally, a four-axis font requires 16 masters.

You can see in this picture how design axes and masters are used to select an intermediate design of the MM font:



In MM fonts it is important to know how much the property connected with the design axis can be changed. If we take the Weight axis, for instance, then it might be changed from normal (120) to bold (700), a moderate change, or from light (50) to black (1450), a much larger change:



The range within which the property of the axis may be changed is called the *dynamic range*. It is the distance between the two masters that define an axis measured using a standard scale line.

In our example the first dynamic range is 580, from 120 to 700, and the second dynamic range is 1400, from 50 to 1450.

So that desktop publishing programs can use MM fonts that were designed by different manufactures some standards have been set for axes types and names.

Standard Axes

There are four standard axes defined by the Multiple Master standard. They are supported by Adobe and thus are likely to be compatible with all current desktop publishing programs. Of course, you can define your own design axes – this may be useful if you use MM as an internal design tool.

Weight

This axis allows you to change the weight of the font:

The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog

Changes in the weight (the defined dynamic range) may be very different in different fonts, for example, from normal to bold or from light to black or from bold to heavy, depending on the designer's intentions.

Width

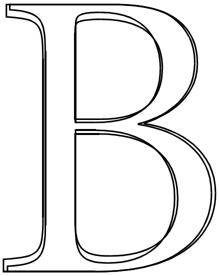
This design axis allows you to change the width of the font:

The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog
The quick brown fox jumped over the lazy dog

This is very useful in making text fit in a given space on the page. If the Condensed style is too narrow and the Normal style is too wide, with a MM font you can select an intermediate width style and the text will fit perfectly.

Optical Size

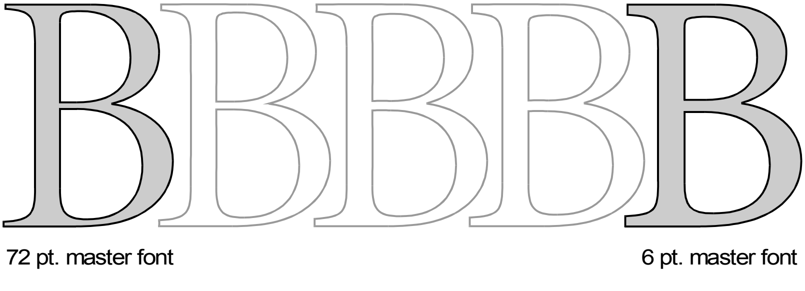
This is an axis for high-end typography. In the pre-computer age typographers used metal fonts that were aligned in strings manually or with the help of complex mechanical machines. In those times fonts were not “scalable” and there was a separate physical type-font for each point size of a typeface. And fonts that were designed for different point sizes of the same typeface had slightly different designs for improved legibility:



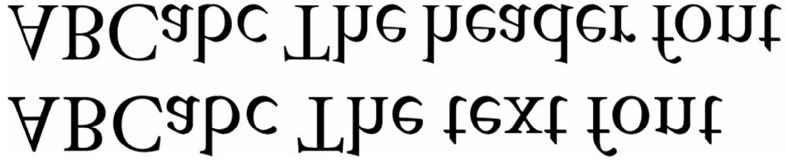
Designs of the same character for 6 and 72 pt. point size

When scalable fonts appeared this typography feature wasn’t compatible with the technology so it all but disappeared. We had scalable fonts that could be shrunk or enlarged to any point size, but the price for this was a little decrease in the quality of typeset text.

With Multiple Master fonts it is possible to define two optical size masters, one for small point sizes and another for large point sizes, and use MM interpolation to create the proper font design for the final selected point size:



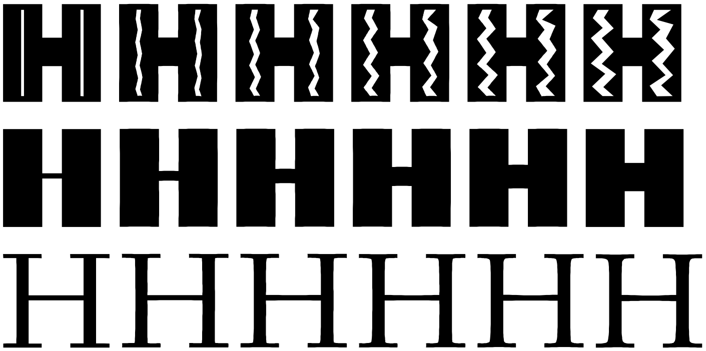
In the following example you can see two lines of text typed with the same font but different optical size selection:



For better comparison, both lines were typed at the same point size (28 pt) but with the different optical sizes. Note the different contrast and inter-character spacing.

Style

This design axis can cover many different design properties. Here's one example of what you can do with it:

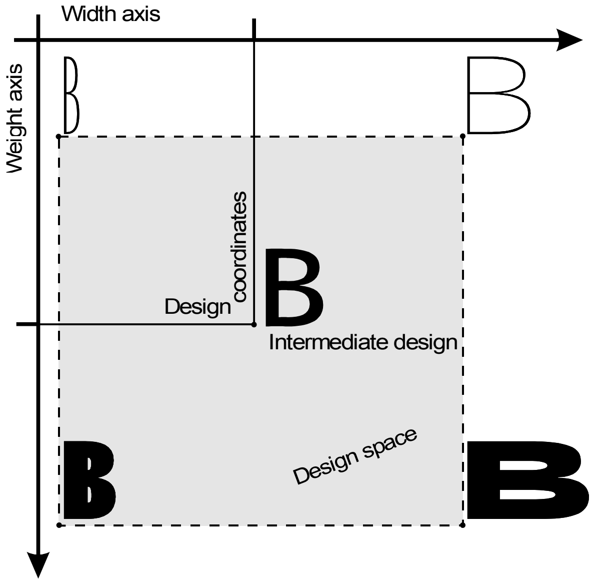


There is no standard definition or real property of this axis. And there is no standard for its dynamic range.

Design Coordinates and Weight Vectors

You know that all axes have ranges. These ranges can vary from 0 to 9999, but a more practical range of 0 to 1000 is usually used. Somehow we have to define a way to designate the position of an intermediate MM design in the design axis space.

A very natural way to define the position of the intermediate font is to use its position on each design axis. These coordinates are called *design coordinates*:



There is also another type of coordinate called *blend coordinates*. Blend coordinates are normalized to the given dynamic range of the axis. If an axis has a (50-400) dynamic range then the design coordinate (50) equals the blend coordinate 0.0. The design coordinate (400) equals the 1.0 blend coordinate. Intermediate design coordinates are converted to the blend coordinates using linear calculation (by default) or a non-linear axis graph (described in the next section).

When we know the design coordinates we can calculate what proportion of each master we need to build the intermediate font. This process is called blending.

Simple formulas are used to make these calculations and as a result we get an array of values that define the "weight" of each master in the final interpolation that produces an intermediate font:

[0.13, 0.77] - for a one-axis font (two masters are blended)
[0.02, 0.24, 0.11, 0.63] - for a two-axis font (four masters are blended)

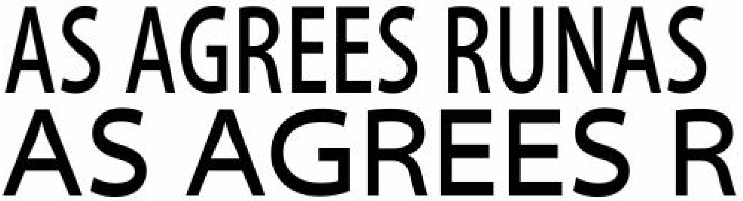
Note that the sum of all weights is always equal to 1.

This array of masters' weights is called the *weight vector* and is used internally by the font interpreter to build the intermediate font. Note that while blend coordinates are used internally, externally, design coordinates are used.

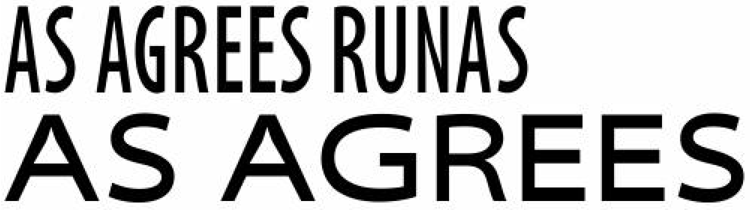
A special weight vector, called the default weight vector, should be set in the font header to define a standard intermediate design of the MM font. A MM font is "seen" as a typical Type 1 font by a PostScript device or program, and this Type 1 font is an intermediate instance of the MM font with the default weight vector.

Extrapolation

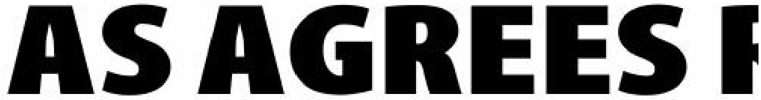
The Multiple Master font specification allows only *interpolation* of the master designs to define an intermediate font. In addition to that basic feature, however, the Multiple Master font structure allows linear *extrapolation* of the designs also. This feature allows us to artificially extend the design range of the MM font, which sometimes produces interesting results:



Standard dynamic range for the Width axis



Extrapolated range for the Width axis

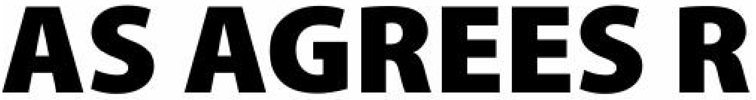


Extrapolated Weight

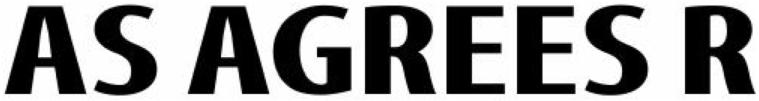
In real life this feature lets you extend font families with very little effort: for instance, build an MM font using the normal and bold styles and then add light and extra bold using the extrapolation feature.

Anisotropic Interpolation

Standard MM fonts have the same interpolation values for both the X and Y directions. In FontLab Studio it is possible to define a different interpolation weight for directions. With this you can make interesting form variations:



Standard (proportional) interpolation



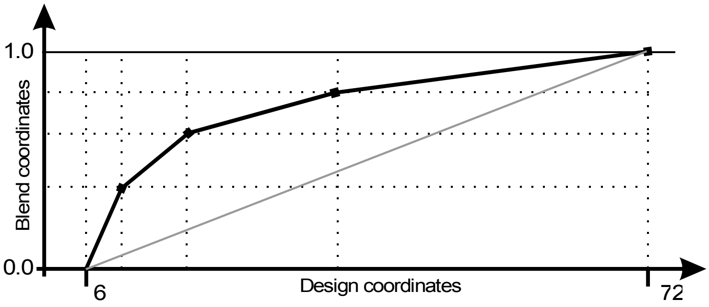
Anisotropic interpolation

As with the extrapolation, this feature is not a part of the MM specification and anisotropic interpolation (or extrapolation) will work only inside FontLab Studio. You can use it to generate single-master fonts from MM fonts.

➲ **Tip:** If you have a font with one Weight axis that has a Light (or Regular) master and a Bold (or Black) master, you can use the anisotropic interpolation to quickly create nearly-optically correct condensed or extended fonts. First, create an anisotropic interpolated instance as shown on the picture above, and then condense it using a normal scaling transformation. This will produce condensed letterforms with visually equal stems that may require very minimal manual work to polish up.

The Axis Graph

Usually design coordinates are translated to the weight vector using simple linear calculations. It is possible, however, to define a map for non-linear calculations:



This map sets a series of points that map the design and blend coordinates. Between these points linear interpolation is used (this is called a piece-wise linear function).

Usually this kind of *axis graph* (or *axis map*, in some literature) is used for the Optical Size axis. The Optical Size axis usually has a dynamic range of 6-72. The design coordinate 6 means the version of the typeface adjusted for 6 pt. type. The design coordinate 72 represents the typeface design for 72 pt. type. Between these values the blend coordinates are mapped using the axis graph, as in the picture above. This mapping gives better control of the variation of the design for the different design coordinates. In this case it causes a more rapid change in the appearance of the typeface at smaller optical sizes than at larger.

The value of the leftmost and rightmost design coordinates of the axis graph (6 and 72 in our example) are always mapped to 0 and 1 blend coordinates and are used by the font interpreter to get information about the dynamic range of the axis. So an axis graph is always present for each axis but in most cases it is just a single straight line.

We again recommend you read the “Designing Multiple Master Typefaces” book to get more information about the axis map.

Multiple Master Fonts in Studio

As we said before, in FontLab Studio you can make Multiple Master fonts that will be completely compatible with the Multiple Master specification. You can edit every aspect of the MM fonts, from master outlines to metrics to kerning and font header data. You can make up to four axes, which means that the font will need 16 masters. And at any time you can view an intermediate font made from the designed MM font in its current state.

In the following sections we will discuss MM-specific FontLab Studio features. We presume that you have read the previous chapters of this book and know all the single-master features of FontLab Studio.

Creation of MM Fonts in FontLab Studio

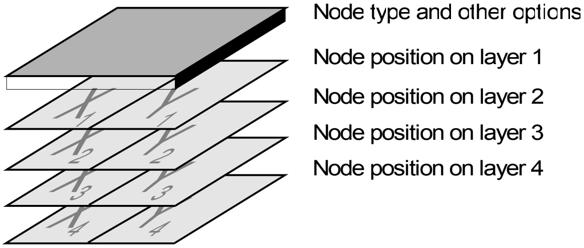
In FontLab Studio you can do the following MM-specific things:

1. Open any existing MM font for editing
2. Convert a single-master font to a MM font
3. Define additional axis in a MM font
4. Remove any of the axes of a MM font
5. Convert a MM font to a single-master font.
6. Edit axis graphs, rename and rearrange axes.

You can also use FontLab Studio's special feature, called **Assign Master,** to simplify the combination of several single-master fonts into one MM font.

Multiple Master Outlines in FontLab Studio

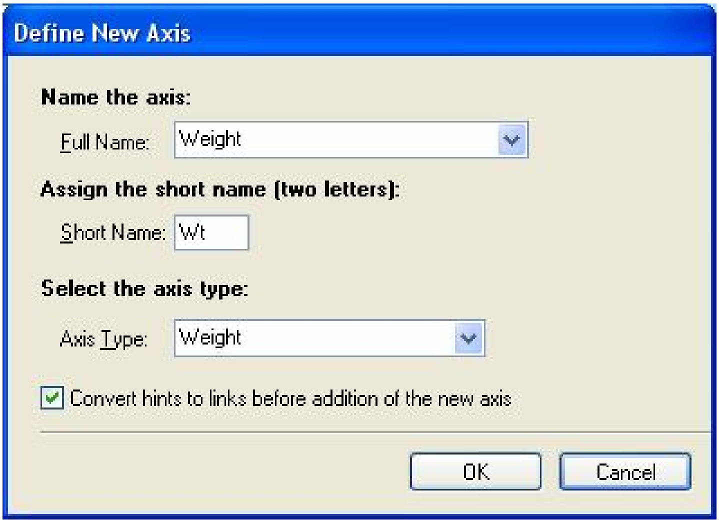
In FontLab Studio all outlines are multiple master-compatible from the very beginning. Every node of the outline has a layered structure:



Thus, a Multiple Master font in FontLab Studio is not a combination of several separate masters, but a single multilayered font. This means that in FontLab Studio it's impossible to make masters incompatible, because they are just the different layers of the same font.

Defining an Axis

If you want to convert a single-master font to a Multiple Master font you must define a new design axis. Select the **Tools > Multiple Master > Define New Axis** command. You will see a dialog box:



Name the axis:

Full Name: Weight

Assign the short name (two letters):

Short Name: Wt

Select the axis type:

Axis Type: Weight

☑ Convert hints to links before addition of the new axis

To define an axis you must enter an axis name, a short name and select an axis type.

Select the name of the axis in the **Full Name** list. You can enter your own custom name, but we strongly recommend you use only names that are in the list in order to make the font compatible with font interpreters. When you are adding a new axis to a Multiple Master font the names of the axes that are already present in the font will *not* appear in the list.

The short name of the axis is used when a font interpreter needs to make a name for an intermediate font. Usually the name looks something like:

MinionMM_245 wt 580 wd

where **MinionMM** is the name of the MM font, **245** and **580** are design coordinates of the intermediate font and **wt** and **wd** are short names of two axes, Weight and Width respectively.

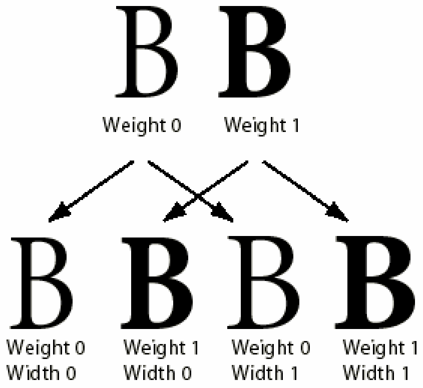
The axis type is necessary to identify a new axis. As we said in previous sections, there are four registered axis types:

Weight	Variation of the font's weight
Width	Variation of the font's width
Optical Size	Variation of the font's design to make it more legible at different font sizes.
Serif	Modification of the font's style. Usually this is used for modification of the font's serifs. For example, from serif to sans-serif font, or variation of the serifs' width.

Usually it is not necessary to fill in all three edit fields. Just select or enter the axis name and FontLab Studio will automatically fill in all the other fields.

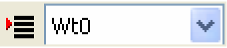
Check the **Convert hints to links before adding new axis** option to automatically apply the **Convert Hints to Links** action to all characters of the font. We recommend converting hints to links because in a MM font it is much easier to edit links than hints. Links are Multiple Master-compatible by default, because they connect multilayered nodes, while hints connect points that have different coordinates on different masters.

When you define an axis the number of masters will be increased twofold. Therefore, a single-axis font will have two masters, a two-axis font will have four masters, etc. The contents of all existing masters will be duplicated, as seen in the picture:

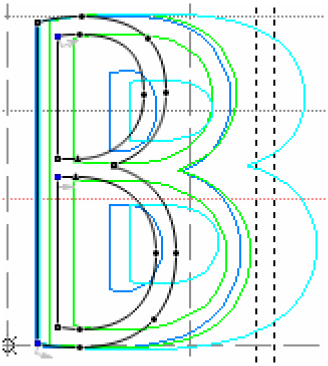


Selecting a Master

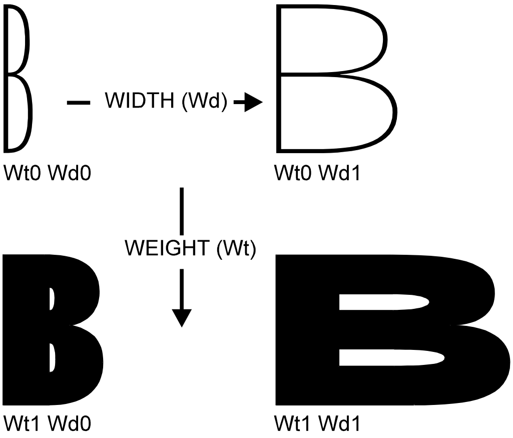
When you define an axis or open a Multiple Master font you will have more than one master. Open a Glyph window with any character and you will see several masters appear in the editing field and the master selection combo box enabled:



Different masters of the Multiple Master font appear as outlines of different colors. One master appears in black and it is the only editable master, called the active master. All editing tools, actions and operations are applied to this master:

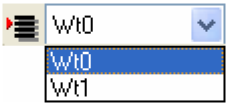


All masters are identified by their names. The master name is the position of the master on the design axis:

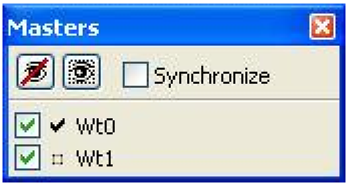


You can select the active master using the following methods:

1. Double click the master outline that you want to activate.
2. Select a master in the master selection combo box:



3. Select the **Window > Panels > Masters** command. The Masters panel appears:



Click on a master's activate control in the Masters panel.

Using the Masters panel you can also select which masters will appear in the Glyph window. Use the masters' check boxes in the Masters panel to show or hide masters.

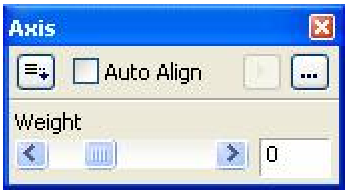
Press the **Hide All** button in the Masters panel to hide all masters except the active master or press the **Show All** button to show all the masters.

The **Synchronize** option when switched on allows you to synchronize changing active masters both in the Glyph window and in the Metrics window if it's open.

Using an Axis Panel

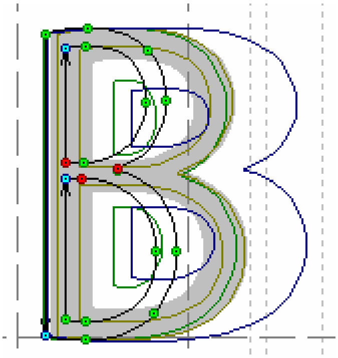
When the Preview mode of the Glyph window is active you can display an intermediate instance of the MM font that is selected for editing.

Open the Axis Panel by using the **Window > Panels > Axis** command. You will see the Axis panel appear:



This panel has a slider and an edit box for each axis in the MM font. Use these controls to select the design coordinates of the intermediate instance that you want to preview.

The filled preview (**View > Show Layers > Fill Outline**) of the selected intermediate design will appear in the Glyph Window in gray:



Four masters' outlines and an intermediate preview in gray

If an active master is the same as the selected instance (as when master Wt0 Wd0 is active and both sliders are in the leftmost positions), the filled preview will appear in black because it precisely corresponds to the active master.

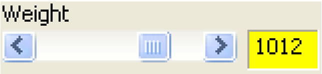
To preview the active master (in black) press the **Align** ≡ button in the Axis panel. Switch on the **Auto Align** check box to make alignment of the intermediate preview to the active master automatic, so that when you select another master as active, the preview will automatically follow it and you will see a filled preview of the master that you are working on.

The ▸ button allows you to quickly preview primary instances defined for the font on the Multiple Master Settings page of the Font Info dialog box. This button is disabled if no instances were defined.

Extrapolation

The Axis panel allows you to select not only design coordinates that are within the axis dynamic range, but to go beyond that point, thus extrapolating the master designs.

If one of the values is out of defined dynamic range, the editing control background turns yellow:

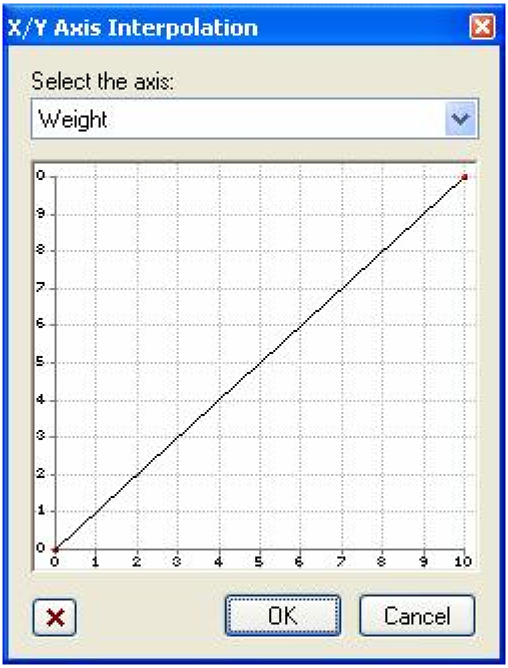


Weight

1012

Anisotropic Interpolation

Click on the … button in the Axis panel to open the anisotropic interpolation dialog box:

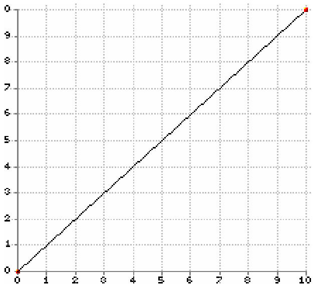


X/Y Axis Interpolation

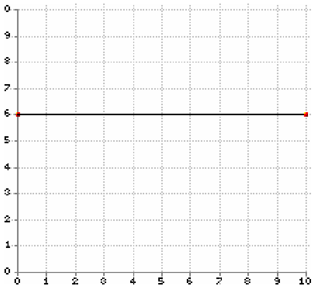
Select the axis: Weight

Select the axis in the list at the top and use the graph to define the relationship between X and Y interpolation.

The X-axis on the graph represents the X interpolation position on the design axis. The Y-axis represents the relative Y interpolation. Here are some examples of the possible X-Y interpolation relationships:



Isotropic, proportional interpolation. This is the default setting



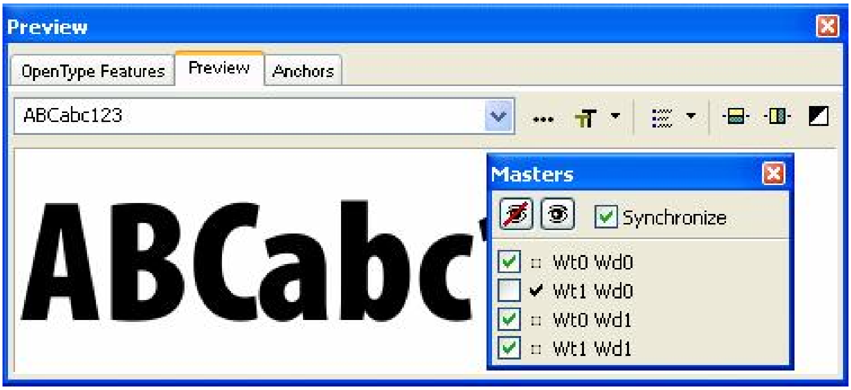
Fixed Y (width) axis. Width does not change when you move the slider. The weight (X axis) changes linearly along the weight axis.

To edit the graph, use same mouse commands as when you are editing a glyph's outline. Right+Left-click inserts a point. Right-click when a point is being moved removes the point.

Click on the ✕ button to reset any changes and return the graph to the linear state. Click **OK** to apply changes and close the dialog box.

Previewing the Intermediate Design

You can use the Preview panel to preview an intermediate design of a MM font in high-quality mode. Use the **Window > Panels > Preview** command to open the panel:



☑ Synchronize

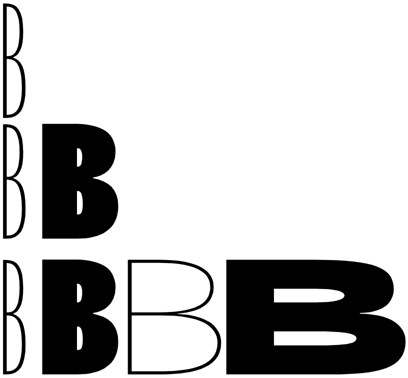
☑ Wt0 Wd0
□ ✓ Wt1 Wd0
☑ Wt0 Wd1
☑ Wt1 Wd1

Please, refer to page 376 in the “Glyph Window” chapter for basic information about the Preview panel.

Use the Masters panel to change the previewed masters. Use sliders in the Axis panel to see intermediate designs in the Preview panel.

Designing Masters

In FontLab Studio you can make a Multiple Master font by “raising” it from a single-master font by adding an axis. When you have a one-axis MM font you can add another axis and so on:

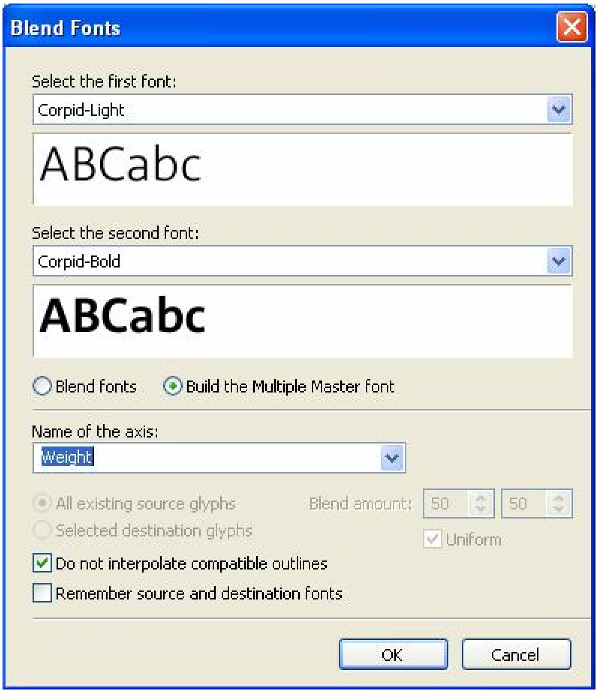


There is an automatic way in Studio to take two fonts and make a MM font from them using one as the first master and another as the second master. This approach has pros and cons. On one hand, this process is fast and convenient. On the other hand, you sometimes can get an improperly made MM font. There is a chance that one of the font’s characters has not been converted according to MM rules.

We have, however, included several special features in FontLab Studio that can help you make MM fonts from different fonts.

Using the Blend Feature to Build MM Fonts

If you have two single-master fonts and want to build a Multiple Master font you can use the **Tools > Blend Fonts** operation. Open the fonts and select the **Blend Fonts** command. You will see the Blend Fonts dialog box:



Blend Fonts

Select the first font: Corpid-Light

Select the second font: Corpid-Bold

○ Blend fonts ● Build the Multiple Master font

Name of the axis: Weight

● All existing source glyphs
○ Selected destination glyphs

Blend amount: 50 50

☑ Uniform

☑ Do not interpolate compatible outlines
□ Remember source and destination fonts

Select the first and second fonts in the combo boxes in the top area of the dialog box and choose the **Build the Multiple Master font** option.

Choose the name of the Multiple Master font axis in the **Name of the axis** control. You can select one of the standard names or you can enter any other name.

Click the **OK** button and wait while FontLab Studio generates a font. Some glyphs cannot be blended (usually these glyphs have different number of contours). If they are present, FontLab Studio will show a warning dialog box and these glyphs will have the first font on the outline layer and second font on the Mask layer, so you can correct outlines and use the **Mask to Master** feature (described below) to build the MM font.

To not let FontLab Studio add nodes to compatible contours leave the **Do not interpolate compatible outlines** option switched on.

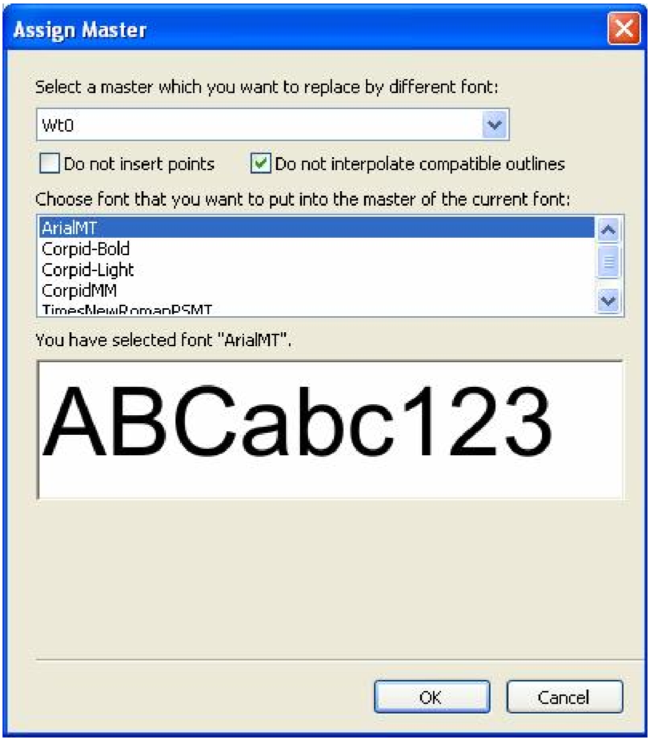
Those glyphs that had compatible outlines and do not get additional nodes during the blend operation will be marked with green color in the font window.

If you want you may check the **Remember source and destination fonts** option to ask Studio to remember your choice of the fonts until you repeat the Blend Fonts operation.

Assigning a Master

With this command you can take glyphs from one font and put them into one of the masters of the current MM font. The glyphs of the fonts are linked using their names, so the glyph with the name “zero” in the assigned font will be placed into the master of the glyph with the name “zero” in the font where the master is being assigned.

When you select the **Assign Master** command from the **Tools > Multiple Master** menu, you will see the dialog box:


Assign Master
Select a master which you want to replace by different font:
Wt0
☐ Do not insert points
☑ Do not interpolate compatible outlines
Choose font that you want to put into the master of the current font:
ArialMT
Corpid-Bold
Corpid-Light
CorpidMM
TimesNewRomanPSMT
You have selected font "ArialMT".
ABCabc123
OK
Cancel

There is a list of masters in the popup menu in the top of the dialog box. Select one of the masters to be assigned here. There is a list of all open fonts below the masters popup menu. Select the font whose glyphs you want to put into the selected master of the current font. If you select a Multiple Master font scroll bars and edit controls will appear allowing you to select an intermediate design of the font.

If you switch on the **Do not insert points** option, then FontLab Studio will copy outlines as they were in the source font regardless their compatibility with the outlines in the destination font. Use this option only if you are sure the outlines in the source and destination fonts are completely compatible.

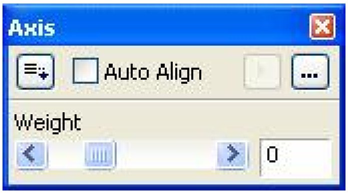
To prevent FontLab Studio from adding nodes to compatible contours leave the **Do not interpolate compatible outlines** option switched on.

Mask to Master Action

The **Mask to Master** operation from the **Tools > Multiple Master** menu just replaces the outlines of the current master with the contents of its mask layer. (Each master can have its own mask on the Mask layer.)

Suppose you have a Multiple Master font that has one axis, two masters (that are the same) and a Bold style on the Mask layer of the second master.

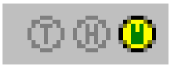
Open any character for editing and activate the Wt1 layer, switch on the Fill Outline mode and select an intermediate position of the design coordinates in the Axis panel:



□ Auto Align

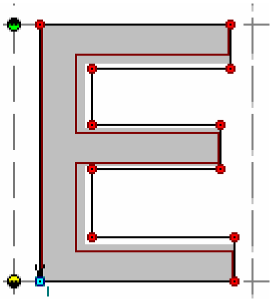
Weight 0

Look in the top-right area of the Glyph window. There is a special mark (rightmost) that may be gray, red or green:



A red mark shows that the mask layer is not compatible with the master. “Incompatible” means that mask and outline layers have different numbers of contours, so FontLab Studio cannot match the points and curves.

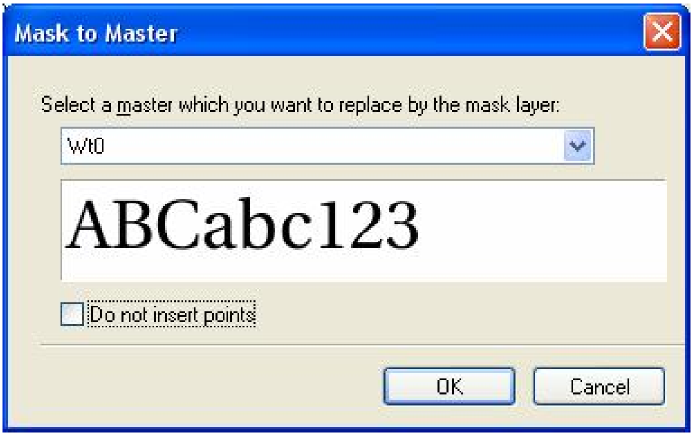
A green mark means that the mask and outline layers seem to be compatible and you may apply the **Mask to Master** action. This action replaces the contents of the active master with the contents of its Mask layer. If the Mask layer is completely compatible with the outline you will instantly get a properly made master for the active layer:



FontLab Studio uses the Blend algorithm to match points in the Mask and outline layers. Sometimes it can produce incorrect results, so we recommend you check your outlines after you complete the Mask to Master operation.

You can apply the Mask to Master action to several characters at once:

1. Activate the Font window. Note the mask compatibility marks in the top-right corner of the characters' cells.
2. Select the characters to which you want to apply the Mask to Master action.
3. Click on the **Tools > Multiple Master > Mask to Master** command.
4. A dialog box appears:



Mask to Master

Select a master which you want to replace by the mask layer:

WtO

ABCabc123

□ Do not insert points

If you switch on **Do not insert points** option, then FontLab Studio will copy outlines as they were in the Mask layer regardless their compatibility with the font. Use this option only if you are sure the Mask layer is completely compatible with the outline.

Select the master that you want to replace by its Mask layer in the masters list box. Press the **OK** button to begin the transformation.

Using Interpolation to Make Masters

If two styles are completely incompatible you can use the Interpolate operation (described in the "Glyph Window" chapter) to make masters.

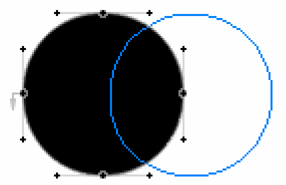
Put one style on the outline layer and define an axis. Put the other style on the Mask layer using the Assign Mask dialog box.

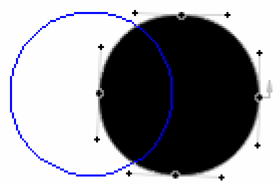
Select the master that should look close to the appearance of the style on the Mask layer and activate an Interpolation operation. Use Interpolation to "stretch" the outline on the Mask layer. This is relatively easy to do because the destination points of the interpolation links will stick to the Mask layer.

After you complete work with the Interpolation tool use the Edit tool to fine-tune the master.

Match Masters Operation

Sometimes you may need to change contours of the master so that they become compatible with contours of the other master. For example, the startpoints in two masters do not match:

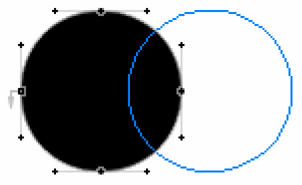


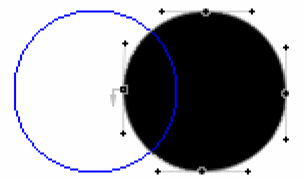


Master Wt0 *Master Wt1*

To fix the startpoints or correct the order of contours for two masters in the Glyph window, select the **Match Masters** command in the **Tools > Multiple Master** menu.

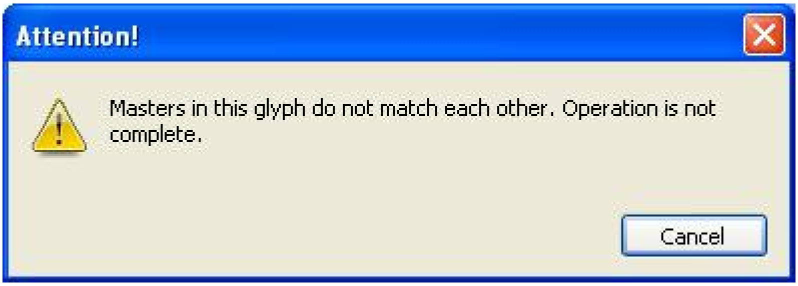
FontLab Studio will check contours and correct them if needed. For example, the startpoint of the contour in one of two masters will be changed:





Master Wt0 *Master Wt1*

If FontLab Studio cannot check contours for some reason it will present the warning message:

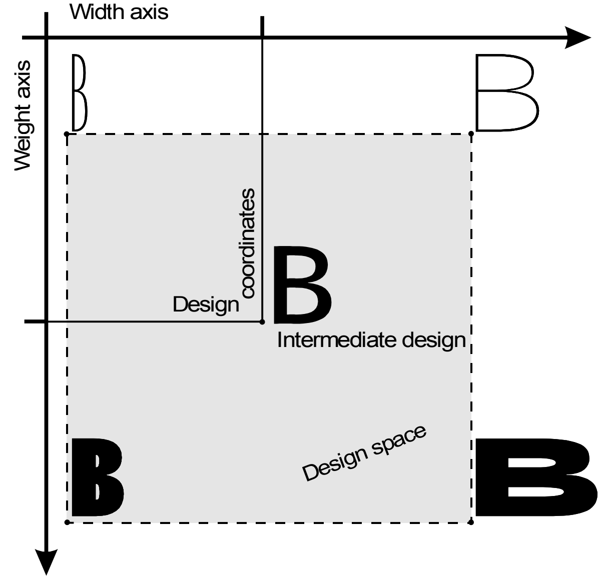


Attention!

Masters in this glyph do not match each other. Operation is not complete.

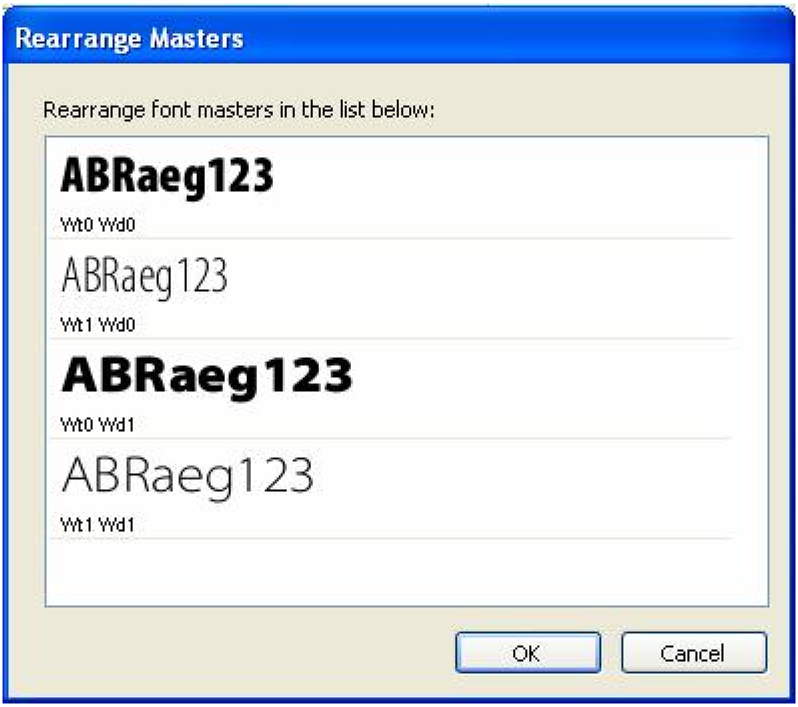
Rearranging Masters

Very rarely you may need to change the position of a master on the design axis. Look at the picture:



Increasing of the width value does increase the width of a glyph. That's OK. But sometimes you can meet a font with the messed up masters where increasing of the values actually decreases the design.

To fix the coordinates in a MM font FontLab Studio has the Rearrange Masters feature:



Rearrange Masters

Rearrange font masters in the list below:

ABRaeg123
Wt0 Wd0

ABRaeg123
Wt1 Wd0

ABRaeg123
Wt0 Wd1

ABRaeg123
Wt1 Wd1

The dialog box contains a list of masters. You can see in the preview that the glyphs from Wt1 are thin while the glyphs from Wt0 are thick. This means the direction of the weight axis is not correct. Just drag the "Wt1 Wd0" master and drop it above the "Wt0 Wd0" master. The order of the masters will change. Then drag and drop the "Wt1 Wd1" font above the "Wt0 Wd1" font. Click **OK** to apply changes and the masters in the font will be rearranged according to the selected order. The weight axis will get its normal direction.

Multiple Master Metrics

You can set metrics for Multiple Master fonts as easily as you can for a single-master font. Of course, you can use the Edit tool to adjust sidebearings but it is much easier to do it with the Metrics window.

When a MM font is opened in the Metrics window its four modes (text, preview, metrics and kerning) work slightly differently.

The text and preview modes show the intermediate font in the sample window. Use the Axis panel to select the design coordinates of this intermediate font.

In metrics and kerning modes only a master can be previewed in the Metrics window. You can use the Masters panel to select the master to preview and edit.

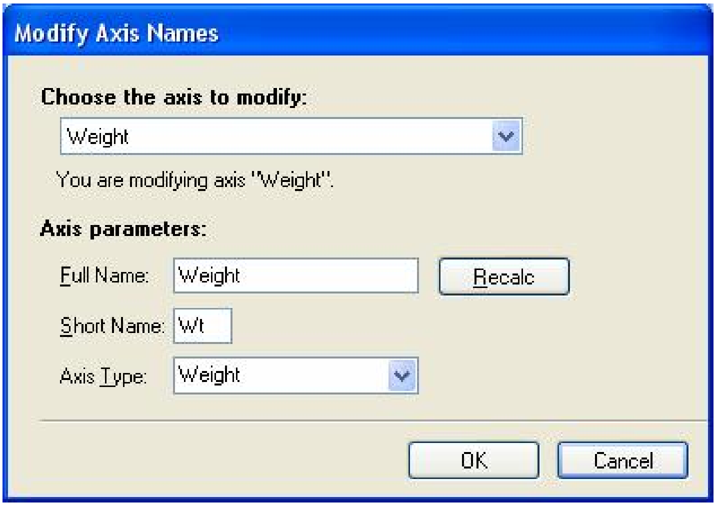
So, to edit metrics and kerning information, select the master that you want and edit it as a single-master font. FontLab Studio will automatically track all changes and complete the Multiple Master data for the font.

Another difference is the save format for the metrics file. If a MM font is open then a binary MMM (Multiple Master Metrics) file is used to store the metrics data. Or you can save a set of text AFM files for each master and linked MM file. Select the format that you want to use in the **Format** combo box of the Save File dialog box that appears when you press the **Save Metrics** button in the Metrics window toolbar.

When you are opening or saving single-master metrics files, they will be applied to (or generated from) the currently active master.

Editing Axis Settings

When you are editing a Multiple Master font you can change the axis names at any time. Select the **Tools > Multiple Master > Modify Axis Names** command and you will see a dialog box:



Modify Axis Names

Choose the axis to modify:

Weight

You are modifying axis "Weight".

Axis parameters:

Full Name: Weight

Short Name: Wt

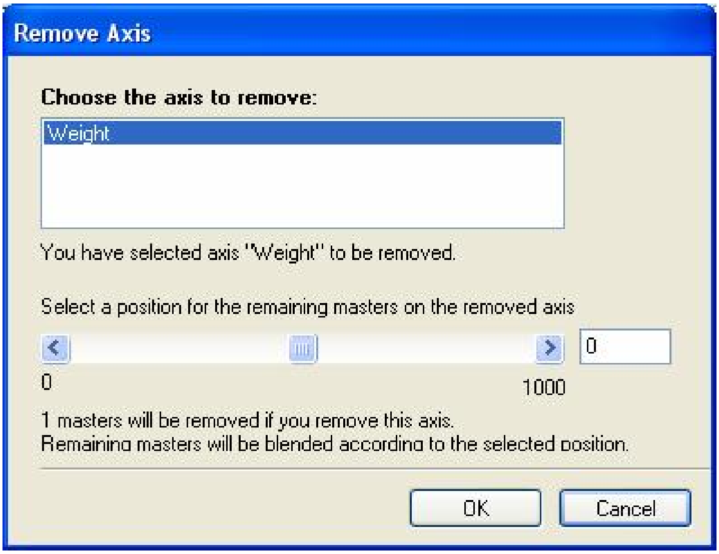
Axis Type: Weight

Select the axis that you want to change in the list box located in the top area of the dialog box and use the editing fields to change the axis' name, type or short name. Press the **Recalc** button after you change the axis' name to let FontLab Studio automatically calculate the rest of the data.

Removing an Axis

At some point you may want to remove one of the design axes of a Multiple Master font. When you remove an axis the number of masters will be decreased by half. You can lose half of the information also, so be careful with this operation. The remaining masters will be blended according to their position on the removed axis (which you can specify).

To remove an axis, select the **Tools > Multiple Master > Remove Axis** command. A dialog box appears:



Choose the axis to remove:

Weight

You have selected axis "Weight" to be removed.

Select a position for the remaining masters on the removed axis

0

1 masters will be removed if you remove this axis.
Remaining masters will be blended according to the selected position.

Select the axis you want to remove in the axis list at the top of the dialog and use the scroller to set the "blending coordinate" that will be used to blend the remaining masters.

You can use the Generate Instance feature (described on the page 810) if you want to convert the MM font to single-master font. Sometimes it is easier to use than the Remove Axis feature.

Multiple Master and Font Info

Here is a list of the pages of the Font Info dialog box with notes about their information in a Multiple Master font:

Basic Set of Font Names

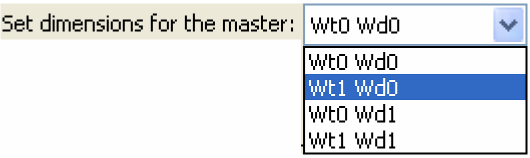
Have minor changes:

1. Multiple Master fonts usually have the “MM” suffix at the end of their names.
2. The length of the Menu name is limited to 7 characters.
3. MM fonts with a Weight axis have the “All” value in the **Weight** field. MM fonts with a Width axis have the “All” value in the **Width** field.

Use the **Check** button to automatically validate font names.

Key Dimensions

Each master has its own set of Dimension values. Use the master selection combo box at the top of the page to choose the Master for which you want to set dimensions:



Set dimensions for the master: Wt0 Wd0

Alignment Zones and Stems

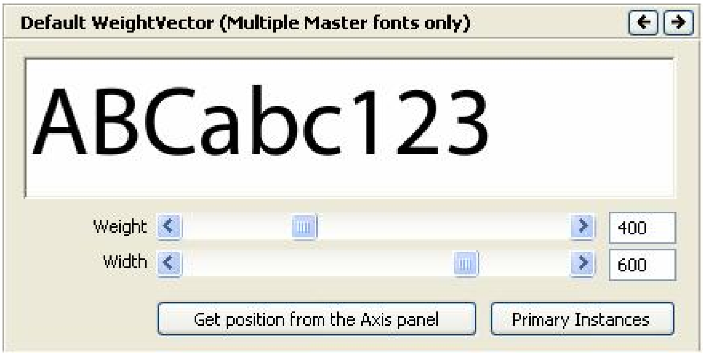
Each master has its own set of alignment zones, standard stems and other font-level hinting information. Use the master selection list to choose the master whose alignment setting you want to change. Note that when you add new alignment zones they will appear in all masters, so always check all the masters to be sure that the alignment information is set properly.

Panose Identification

Enter settings in the Panose fields Weight or Proportion if your font has Weight or Width axes respectively.

Multiple Master Settings

This page appears only if you are editing the Font Info of a MM font. Use the sliders below the preview window to choose the default Weight Vector of the font. Then press **Apply**.



Default WeightVector (Multiple Master fonts only)

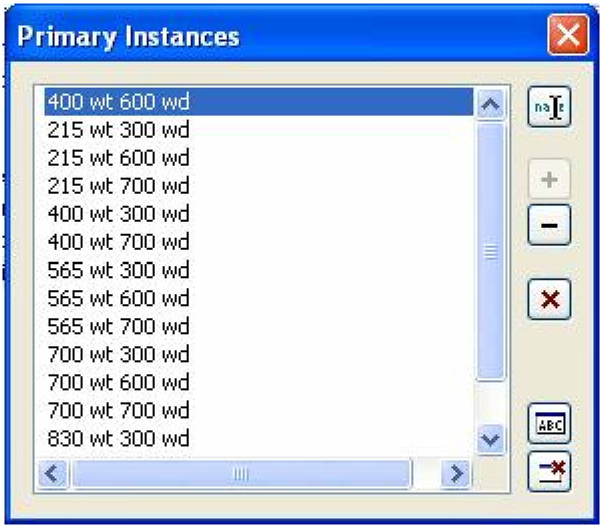
ABCabc123

Weight 400

Width 600

Press the **Get position** button to put the values from the Axis panel if it is open.

Press the **Primary Instances** button to define more default instances for the font. The Primary Instances panel appears:



Primary Instances

400 wt 600 wd
215 wt 300 wd
215 wt 600 wd
215 wt 700 wd
400 wt 300 wd
400 wt 700 wd
565 wt 300 wd
565 wt 600 wd
565 wt 700 wd
700 wt 300 wd
700 wt 600 wd
700 wt 700 wd
830 wt 300 wd

Here is the list of the panel's buttons and their meaning:

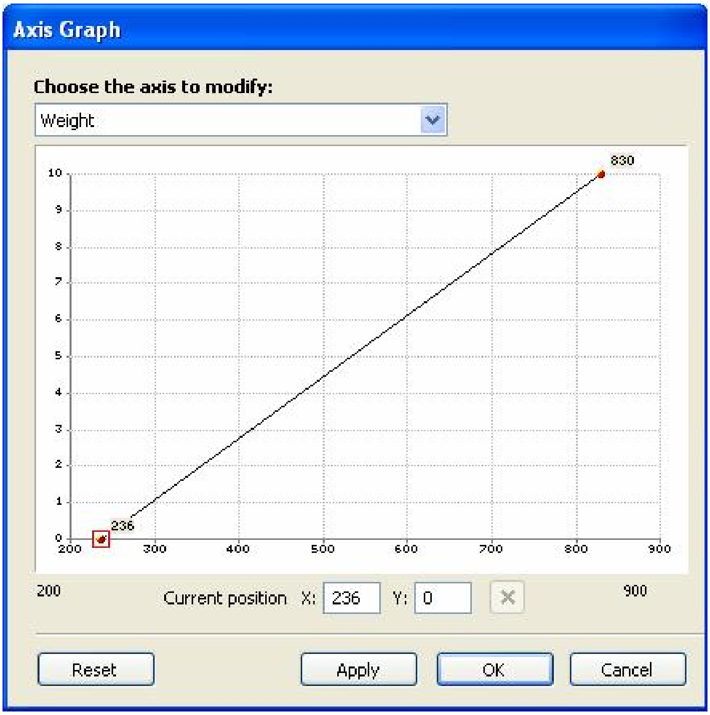
I	Allows you to rename the instance selected in the list. The name of an instance is used as style name for a font generated with the **Generate Instance** command.
+	Adds new instance to the list according to the design selected in the Font Info dialog box
−	Removes the selected instance without a warning
✕	Removes all primary instances defined for the font. This command will require confirmation
ABC	Allows you to preview the selected instance in the Font Info dialog box
⇥✕	Closes the panel.

Press the **Apply** button in the Font Info dialog box to set the current intermediate design as the font's default vector.

Editing the Axis Graph

You can edit an axis graph for every axis defined in a MM font. As we said before, the axis graph is used to set the dynamic range of the axis, so it is always necessary to adjust it.

To edit an axis graph, select the **Tools > Multiple Master > Edit Axis Graph** command. The Axis Graph dialog box appears:



Axis Graph

Choose the axis to modify: Weight

Current position X: 236 Y: 0

To edit a graph:

1. Select an axis whose graph you want to edit in the axis list located at the top area of the dialog box.
2. Position the mouse cursor on the leftmost point of the line in the graph and click the left mouse button.
3. In the **Current position** editing fields enter the lowest design coordinate for this axis or position the cursor on the leftmost point and drag it.
4. Do the same with the rightmost point to define the dynamic range.
5. If you want to define a more complex graph you can add points. To add a point, position the mouse cursor on the line segment where you want to add the point, press the right mouse button and click the left button.
6. To move a point, position the mouse cursor on the point, press the left button and drag the point to a new position.
7. To enter the position of the point, click on the point and enter the position of the point in the **Current position** editing fields.
8. To delete a point, select it with a click and press on the ☒ button. Or you may just right-click the point while dragging it.
9. Press the **Apply** button to accept any changes that you have made or **Reset** to return to the original design.

Choosing Dynamic Range

When you define a design axis you should choose the proper edge design coordinates and dynamic range for it. It is important to make your font compatible with Multiple Master fonts made by other manufacturers. Dynamic range is not so important for the Style axis because there is no standard for it and it is relatively easy to set the dynamic range for Optical Size because it is usually known for this axis. So we have the Weight and Width axes to choose dynamic ranges for.

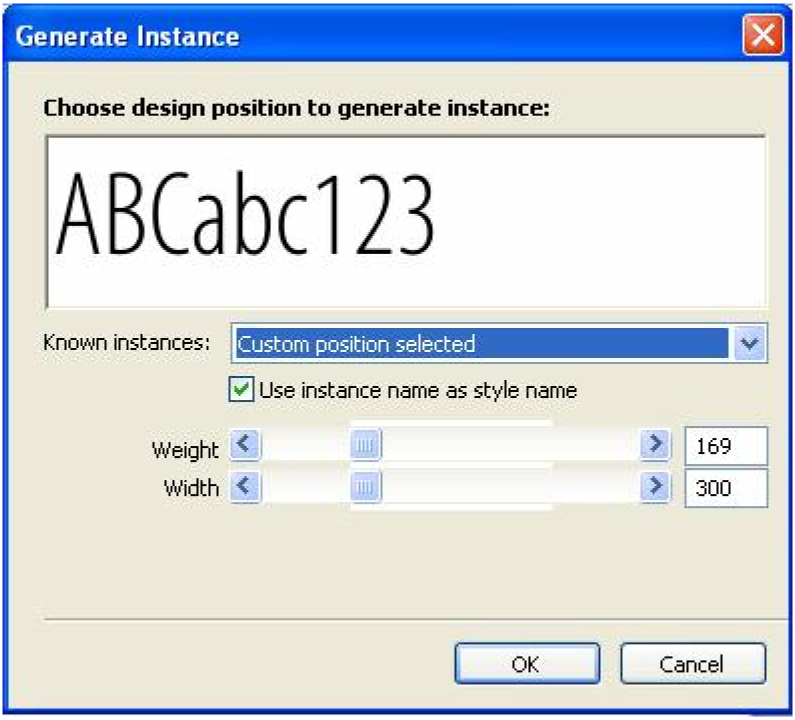
As you know, the dynamic range is the distance between the lowest and highest design coordinates, so all you have to do is to choose the proper low and high edge values.

The best way to choose these values is to compare your font with a font that already has these values assigned properly. We recommend you use one of Adobe's fonts for this comparison.

Another recommendation is to choose edge values so that the design coordinate of the Normal style (normal weight and normal width) of the font will be 500-600 units.

Generating a Single-Master Font

You can create a regular single-master font from an instance of a Multiple Master font using FontLab Studio. Use the **Tools > Multiple Master > Generate Instance** command to open the Generate Instance dialog box:



Generate Instance

Choose design position to generate instance:

ABCabc123

Known instances: Custom position selected

☑ Use instance name as style name

Weight 169

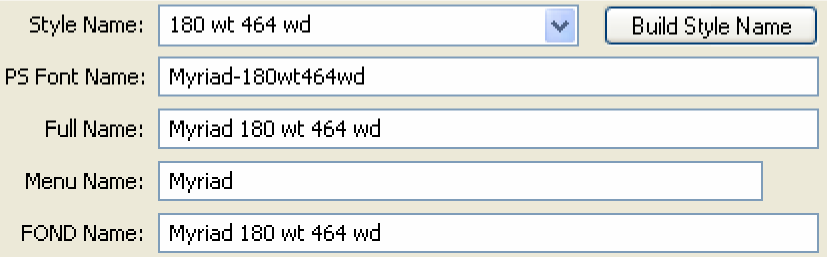
Width 300

Select one of the masters or primary instances in the **Known instances** list. The preview and the values of the selected design will appear.

Use the controls to select the intermediate (or extrapolated) design. The Edit controls have a white background when the selection is within the dynamic range and a yellow background when extrapolation is used. The white background under the scroll bars visually represents the font’s dynamic range. Using the keyboard you can enter values into the editing fields that are even beyond the scroll bar range.

Click **OK** and FontLab Studio will generate a single-master font and open it in a new Font Window.

If the option ☑ Use instance name as style name is on the name of the selected primary instance will be used in the single-master font names:



Style Name: 180 wt 464 wd

PS Font Name: Myriad-180wt464wd

Full Name: Myriad 180 wt 464 wd

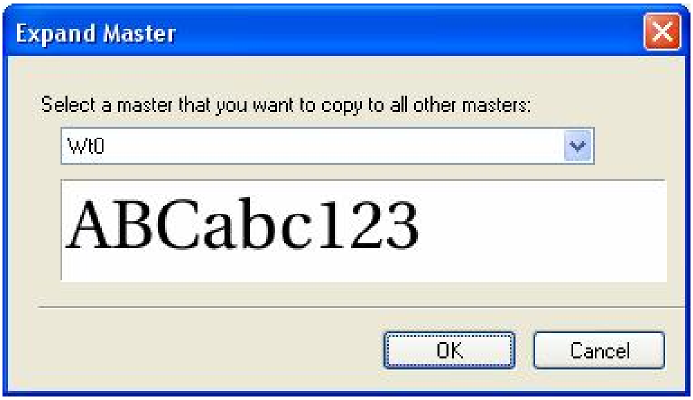
Menu Name: Myriad

FOND Name: Myriad 180 wt 464 wd

➲ **Tip:** You can define custom primary instance names in **Font Info > Multiple Master settings**, and this way, determine in advance the style names of the generated single-master instances. This can save you repeated renaming steps when working on a large font family.

Expanding the Master

Use **Tools** > **Multiple Master** > **Expand Master** to copy the contents of one of the masters to all other masters. If this command is selected when the Glyph window is active, it is applied to the currently active master. If it is used when the Font window is active, you will see a dialog box that lets you select the master for copying:



This operation may be useful if applied when the Mask layer is in editing mode – you may need to copy one of the Mask masters to all the other masters to simulate the single-master Mask layer.

Hinting Multiple Master Fonts

As you know, in FontLab Studio you can use hints and links to do character-level hinting. You can also do character-level hinting of MM fonts using hints or links.

Hints are pairs of parallel lines that define the position and width of a vertical or horizontal stem. Hints are independent from the outline; they exist in a different layer. And they are multilayered, just like outline nodes are. If you use hints to do character-level hinting you will have to hint all the masters separately.

A better way is to use links. Links connect nodes, so they are not dependent on the number of masters in the font. On export of the MM font the links will be automatically converted to hints and hints will be automatically generated according to the master's design.

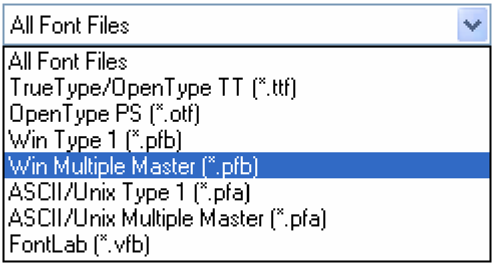
So to hint MM fonts most efficiently use vertical and horizontal links to connect the outline nodes and you will save time in direct proportion to the number of masters your font has.

You can make a hint replacement program using the Type 1 hinting tool if necessary. The preview panel of the Type 1 hinting tool will show an intermediate version of the hinted font according to the design coordinates selected in the Axis panel. Use the sliders of the Axis panel to see how your font will look on the screen when different font instances are generated.

Generating a Multiple Master Type 1 Font

When you finish your work with a MM font you need to build a font file that you can use on PostScript devices or printers.

To build a Multiple Master Type 1 font for PC, choose the **File > Generate font** command. When the standard Save As dialog box appears, select Windows Multiple Master format in the **Save As type** combo box:


All Font Files
All Font Files
TrueType/OpenType TT (*.ttf)
OpenType PS (*.otf)
Win Type 1 (*.pfb)
Win Multiple Master (*.pfb)
ASCII/Unix Type 1 (*.pfa)
ASCII/Unix Multiple Master (*.pfa)
FontLab (*.vfb)

Press the **Save** button to save the font in Multiple Master format.

✏ **Note 1:** If you choose this format when exporting a single-master font a generic Type 1 font will be built.

✏ **Note 2:** PFB and MMM files will be saved if you make a MM Type 1 font. These files are necessary to install MM fonts in Adobe Type Manager.

Select ASCII/Unix Multiple Master format to make a MM font in downloadable format. Fonts in this format can be instantly downloaded to a PostScript printer.

OpenType Fonts

In this chapter we will discuss working with the OpenType fonts. The OpenType font format, jointly developed by Microsoft and Adobe, allows us to combine the best features of the TrueType and Type 1 font formats.

OpenType fonts are stored in a single font file, use Unicode as their encoding and work in Windows and Mac OS X.

This all has been true for older TrueType fonts but the advantage of OpenType against older font formats is the support of layout features, which allow better typographic layout, and precise support of complex scripts.

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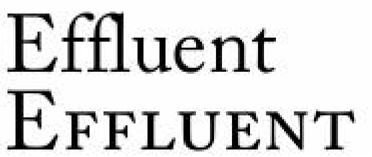
Font Features

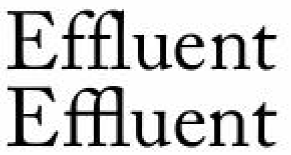
OpenType fonts come in two formats, sometimes called flavors, OpenType TT and OpenType PS. Both sorts of OpenType fonts may include so-called OpenType Layout features. The layout features are rules that change the standard behavior of the font.

For example, the small caps layout feature (abbreviated *smcp*) may change all lowercase glyphs to their small caps counterparts.



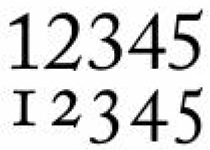
Small caps

The standard ligatures layout feature (abbreviated *liga*) can replace some letter combinations with ligatures.



Ligature

The old-style numerals layout feature (abbreviated *onum*) can replace lining figures with old-style figures.



Old Style Numerals

OpenType Layout features can serve typographic purposes like shown above. In this case, applications such as Adobe InDesign, Adobe Illustrator CS, Adobe Photoshop CS, Apple Pages or Apple Keynote on Mac OS X 10.4 offer the user some user interface to turn selected features on an off.

OpenType Layout features also play a crucial role in rendering complex scripts, i.e. writing systems such as Arabic, Devanagari or Thai. These writing systems have complex rules for displaying characters. For example Arabic uses different forms of letters if a letter is found at the beginning, in the middle or at the end of the word. Also, complex scripts often use vowel marks that are positioned dynamically over consonant letters. In all these cases, the layout features contain mapping rules that are automatically applied by the layout application.

Note that not all layout applications offer the same level of OpenType support. For example, Microsoft Word 2003 for Windows supports complex-script layout features for Arabic and Devanagari but does not support Western typographic layout features. Adobe InDesign CS2 U.S. English and Apple Keynote on Mac OS X support Western typographic layout features but do not support any complex-script layout features. Adobe InDesign CS Middle East edition supports Western and Arabic layout features, but does not support Devanagari.

Information about **using** OpenType fonts can be found at:

http://www.myfonts.com/info/opentype/
http://store.adobe.com/type/opentype/

Information about **developing** OpenType fonts can be found at:

http://www.microsoft.com/typography/SpecificationsOverview.mspx
http://www.microsoft.com/typography/developers/opentype/
http://partners.adobe.com/public/developer/opentype/

Probably the best thing about OT features is that they do not change the source string of characters. To explain this we need to again talk about the character-glyph model.

The source text that you type on the keyboard or get from another source is a sequence of characters that have strong links to the codes that the computer uses to store data. The picture of the text that you see on the screen is a sequence of glyphs or character images. It is important to understand that there is not necessarily a one-to-one relationship between character and glyph: it is possible to have a single glyph used as the image for more than one character (Latin A and Cyrillic A, for instance, are different characters, but use the same glyph) and sometimes you may have more than one glyph “serving” a single character.

Please, remember this key OpenType principle: OpenType layout engine doesn't know anything about characters! All the features that OpenType can have are defined for glyphs. This is the process of OpenType text processing:

0. As a source we have a sequence of characters.
1. Character codes are mapped to default glyphs using the Unicode mapping table. In FontLab Studio this is what you see in the Font window when you select one of the codepages. Here we have a sequence of characters replaced by a sequence of glyphs. No character information is available beyond this point!
2. The source sequence of glyphs is passed to the OpenType processing module, which then applies the font features in a pre-defined sequence. The list of the features to apply is determined by the application (for example, in Adobe InDesign you can explicitly select features to apply) or operating system (e.g. the rendering of Arabic text with an OpenType font).
3. The resulting sequence of glyphs is passed to the second stage of feature processing which can shift the positions of glyphs. Kerning is applied at this stage.
4. The sequence of glyphs, accompanied by the positioning information, is passed to the rasterizer, which does the imaging of the features on the destination device: screen or printer.

Features and Lookups

Every feature consists of one or more *lookups*. A Lookup is an elementary procedure performed on a glyph sequence or positioning data. For instance, “replace the sequence of ‘f’ and ‘l’ with the ‘fl’ ligature glyph” is a lookup. A combination of similar lookups forms a feature.

The sequence of lookups is important. They are applied in the order they are defined. The sequence of features is also important, but the application or operating system may make changes in the feature preference.

By default all features and lookups are defined for the default language of the Latin script.

Scripts and Languages

The second great OpenType feature is support for multiple scripts and languages. With an OpenType font you can define different behaviors of the font when it is used to type text in different languages. For example, some ligatures that are necessary in English are not applicable to Turkish. Other features, like support for initial, medial and final forms of the characters are applicable only to Arabic script, and so on.

OpenType allows us to define script and language dependence at the lookup level, so the same feature may work differently when different languages are supported.

OpenType Font Formats

Another key feature of the OpenType format is the fact that from the user's point of view there is only one font format for Mac, PC or any other platform.

From the inside, there are two possible forms of OpenType fonts: OpenType TT and OpenType PS.

The general structure of the font file is the same and both versions of the format provide the same functionality. There are some technical differences:

Version	OpenType TT	OpenType PS
Outlines	2nd-order, like in TrueType fonts	3rd-order, like in Type 1 fonts
Hinting	TrueType instructions	Type 1 declarative hints
File extension	.ttf (but may be also .otf)	.otf
Comments	Technically, these fonts are an extension of the PC TrueType format and are backwards compatible with them. Therefore, in FontLab Studio we refer to them as TrueType / OpenType TT. From the practical point of view, any PC TrueType font is automatically an OpenType TT font and vice versa.	Outline data is stored in a CFF (Compact Font Format) table. When printed to a PostScript device, the font is converted to Type 1 so it is backwards-compatible with all PostScript devices.

What Format to Prefer

It is not easy to say which version is better. Both formats will work on both platforms. For Windows-centered office use we would recommend TT-flavored OpenType fonts, as they will provide better compatibility with the old versions of the OS.

For cross-platform and DTP-oriented applications OpenType PS fonts seem to have some advantage because they will provide better outline quality in Bezier drawing (less outline points). On the other hand, OpenType TT fonts may theoretically be delta-hinted and therefore have excellent screen quality.

Please note that the differences are minor and the most important thing to choose is the source format in which you have your fonts. If you have TrueType fonts that you want to convert to OpenType format by adding features, then OpenType TT is your choice.

If you have Type 1 fonts, it will be easier to convert them to OpenType PS.

OpenType Tables

OpenType fonts consist of multiple tables. Every table is identified by a tag, which is a combination of up to 4 characters.

3 tables are “responsible” for the OpenType features:

GDEF	Glyph definition table. Contains information about font glyphs, including their type (simple, mark or ligature), cursive-attachment points and position of the caret inside the ligature character
GSUB	Glyph substitution features
GPOS	Glyph positioning features.

Other tables may exist in OpenType fonts, for example the BASE table that defines different baseline positions for non-Latin scripts, but FontLab Studio cannot work with these tables yet.

Please note that the presence of any one of these tables makes a TrueType font an OpenType font.

Feature Definition Language

Information about OpenType features is stored in a binary form inside the font file. This is not easy to modify and not easy to handle with visual tools (like the tools that FontLab Studio provides to edit outlines that are also stored in a binary form).

To define features in human-readable form Adobe has developed the feature definition language (FEA). It is very easy to read and it is the most compact way to represent OpenType font features.

Let's take a simple example: a ligature feature that covers the basic "fi" and "fl" ligatures that are present in almost every Western font. In feature-definition language this feature will be defined as follows:

```
feature liga{
  sub f i by fi;
  sub f l by fl;
} liga;
```

Other possible features are defined in a similar way, keeping the feature definition both compact and readable.

When FontLab Studio opens an OpenType font file that contains features it tries to decompile the binary tables into the feature definition language. With a few exceptions it works for most possible combinations of substitution and/or positioning features.

In the following sections we will describe the feature definition language in more detail. The next section covers the basic rules of the language.

Language Syntax

Information in this section is partially taken from the official Feature File Format specification by Adobe with their permission. Only those parts of the language that are supported by FontLab Studio are described.

Comments

The "#" character indicates the start of a comment; the comment extends until the end of the line.

Special characters

#	**pound sign**	Denotes start of comment
;	**semicolon**	Terminates a statement
,	**comma**	Separator in various lists
@	**at sign**	Identifies glyph class names
\	**backslash**	Distinguishes glyph names from an identical keyword
-	**hyphen**	Denotes glyph ranges in a glyph class
=	**equal sign**	Glyph class assignment operator
'	**single quote**	Marks a glyph or glyph class for contextual substitution or positioning
"	**double quote**	Marks a glyph or glyph class for contextual substitution or positioning
{ }	**braces**	Enclose a feature, lookup, table, or anonymous block
[ ]	**square brackets**	Enclose components of a glyph class
< >	**angle brackets**	Enclose a device, value record, contour point, anchor, or caret
( )	**parentheses**	Enclose the file name to be included

Number

A <number> is a signed decimal integer (without leading zeroes). For example:

-150
1000

Glyphs

These are represented by the glyph name. A glyph name may be up to 31 characters in length, must be entirely comprised of characters from the following set:

```
A-Z
a-z
0-9
. (period)
_ (underscore)
```

and must not start with a digit or period. The only exception is the special character ".notdef". For an extensive discussion about devising custom glyph names in OpenType fonts, refer to the "Advanced Glyph Naming and Encoding" section of the "Editing Fonts" chapter.

"twocents", "a1", and "_" are valid glyph names. "2cents" and ".twocents" are not.

An initial backslash serves to differentiate a glyph name from an identical keyword in the feature file language. For example, a glyph named "table" must be specified in the feature file as:

```
\table
```

Glyph classes

A feature file glyph class, <glyphclass>, represents a single glyph position in a sequence and is denoted by a list of glyphs enclosed in square brackets.

For example:

```
[endash emdash figuredash]
```

An example of a sequence that contains a glyph class is:

```
space [endash emdash figuredash] space
```

This would match any of the 3 sequences "space endash space", "space emdash space", or "space figuredash space" during OpenType layout.

A feature file glyph class that contains only one single glyph is known as a singleton glyph class.

A feature file glyph class is also used to represent the set of alternate glyphs in an alternate substitution lookup type rule.

Ranges

A range of glyphs is denoted by a hyphen:

```
[<firstGlyph> - <lastGlyph>]
```

Spaces around the hyphen are not required since hyphens are not permitted in feature file glyph names. For example:

```
[A-Z]
```

Named glyph classes

A glyph class can be named by assigning it to a glyph class name, which begins with the "@" character, and then referred to later on by the glyph class name. For example:

```
@dash = [endash emdash figuredash];      # Assignment
space @dash space                        # Usage
```

The part of the glyph class name after the "@" is subject to the same name restrictions that apply to a glyph name, except that its maximum length is 30.

Glyph class assignments can appear anywhere in the feature file. A glyph class name may be used in the feature file only after its definition.

When a glyph class name occurs within square brackets, its elements are simply added onto the other elements in the glyph class being defined. For example:

```
@Vowels.lc = [a e i o u];
@Vowels.uc = [A E I O U];
@Vowels = [@Vowels.lc @Vowels.uc y Y];
```

Here the last statement is equivalent to:

```
@Vowels = [a e i o u A E I O U y Y];
```

No square brackets are needed if a glyph class name is assigned to another single glyph class name. For example:

```
@Figures_lining_tabular = @FIGSDEFAULT;
```

Ranges, glyphs, and glyph class names can be combined in a glyph class. For example:

```
[zerooldstyle - nineoldstyle  ampersandoldstyle  @smallCaps]
```

In FontLab Studio, you can include define FontLab Studio classes in the Classes panel. They will be automatically included as your OpenType classes, so it will not be necessary to copy the information twice. We will discuss this later.

Including files

Including files is accomplished by the directive:

```
include(<filename>)
```

In this FontLab Studio implementation an included file must be located in the **Features** directory.

A maximum include depth of 5 ensures against infinite include loops (files that include each other).

Specifying features

Each feature is specified in a feature block:

```
feature <feature tag> {
	# specifications go here
} <feature tag>;
```

For example:

```
feature liga {
	# …
} liga;
```

A feature file "rule" is a statement that specifies glyph substitution or glyph positioning. A feature block may contain glyph substitution rules, glyph positioning rules, or both.

FontLab Studio automatically separates features into feature records and provides feature templates that simplify definition of new features.

Language system

In practice, most or all of the features in a font will be registered under the same set of language systems, and a particular feature's lookups will be identical across the language systems that the feature is registered under.

The "languagesystem" statement takes advantage of this fact. It is the simplest way to specify a language system in the feature file. One or more such statements may be present in the feature file at global scope (i.e. outside of the feature blocks or any other blocks) and before any of the feature blocks:

```
languagesystem <script tag> <language tag>;
```

When these statements are present, then each feature that does not contain an explicit "script" or "language" statement will be registered under every language system specified by the "languagesystem" statement(s).

If no "languagesystem" statement is present, then the implementation will behave exactly as though the following statement were present at the beginning of the feature file:

```
languagesystem latn DFLT;
```

Script and Language

Occasionally you may need to specify a feature whose lookups vary across the language systems of the feature, or whose language systems vary from the set of language systems of the rest of the features in the file (specified by the "languagesystem" statements).

In these cases, the "script" and "language" statements should be used within the feature block itself. (A "script" and/or "language" statement must be present before the first rule in the feature in order to indicate to the feature file parser that this feature is not to be registered under the language systems specified by the "languagesystem" statements).

The feature's lookups will be registered under the script and language attributes current at the definition of the lookup. The attributes may be changed as follows:

"script" statement:

```
script <script tag>;
```

For example:

```
script kana;
```

When a "script" statement is seen, the language attribute is implicitly set to 'DFLT', and the lookupflag attribute is implicitly set to 0. The script attribute stays the same until explicitly changed by another "script" statement or until the end of the feature.

"language" statement:

The language attribute stays the same until explicitly changed, until the script is changed, or until the end of the feature. To change the language attribute, use the "language" statement:

```
language <language tag> [excludeDFLT|includeDFLT] [required];
```

The script and lookupflag attributes stay the same as before. (If no "script" assignment statement has been seen thus far in the feature block, then the script attribute is set to 'latn', but it is recommended that an explicit "script" statement be used in such cases for clarity.)

Here is an example statement:

```
language DEU;
```

As a result of this statement, (a) the language attribute is changed to 'DEU ', and (b) the 'DFLT' lookups of the current script are automatically included into the language system specified by the current script and language attributes. If (b) is not desired, as may occasionally be the case, then the keyword "excludeDFLT" must follow the language tag. For example:

```
language DEU excludeDFLT;
```

The keyword "includeDFLT" may be used to explicitly indicate the default 'DFLT' lookup-inheriting behavior. For example:

```
language DEU includeDFLT;    # Same as:    language DEU;
```

lookupflag

The chapter "Common Table Formats" in the OpenType Font File Specification describes the LookupFlag field in the Lookup table.

The lookupflag attribute defaults to 0 at the start of a feature block.

The lookupflag attribute stays the same until explicitly changed, until a lookup reference statement is encountered that changes it, until the script is changed, or until the end of the feature.

To change the lookupflag attribute explicitly, use the lookupflag statement, which takes two formats:

lookupflag format A:

```
lookupflag <named lookupflag value> (, <named lookupflag value>)*;
```

Here, the individual lookup flag values to be set are expressed in a comma-separated list of one or more <named lookupflag value>s, in no particular order. A <named lookupflag value> is one of the following:

```
RightToLeft
IgnoreBaseGlyphs
IgnoreLigatures
IgnoreMarks
```

At most one of each of the above 5 kinds of <named lookupflag value> may be present in a lookupflag statement. For example, to skip over base glyphs and ligature glyphs:

```
lookupflag IgnoreBaseGlyphs, IgnoreLigatures;
```

lookupflag format B:

```
lookupflag <number>;
```

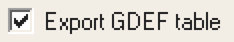
Here the entire lookup flag value is specified simply as a <number>. The format A example above could equivalently be expressed as:

```
lookupflag 6;
```

Format A is clearly a superior choice for human readability when the lookupflag value is not 0. However, a lookupflag value of 0 can be set only with format B, not with format A:

```
lookupflag 0;
```

The base glyphs, ligatures, and marks are defined in the Glyph Properties dialog. This information is stored in the OpenType font file in the GDEF table. Please, be sure to allow export of this table in the Options > OpenType if you are using the lookupflag feature in the feature definition file:



☑ Export GDEF table

lookup

The font editor can label a set of rules and refer to it explicitly later on, in order to have different parts of the font tables refer to the same lookup. This decreases the size of the font in addition to freeing the editor from maintaining duplicate sets of rules.

To define and label a lookup, use a named lookup block:

```
lookup <label> {
	# rules to be grouped
} <label>;
```

To refer to the lookup later on, use a lookup reference statement:

```
lookup <label>;
```

For example:

```
lookup SHARED {		# lookup definition
	# …
} SHARED;
# ...
lookup SHARED;		# lookup reference
```

Since the labeled block literally defines a single lookup in the font, the rules within the lookup block must be of the same lookup type and have the same lookupflag attribute. The lookup block must be specified within a feature block and may not contain any other kind of block.

OpenType and FontLab Studio

Implementation of OpenType features in FontLab Studio is based on the technologies provided by Adobe – one of the two inventors and key supporters of the format.

OpenType support may be separated into three stages:

1. Importing OpenType fonts and reading the binary OpenType tables. FontLab Studio may store the original binary tables in the .vfb file and also to try to interpret the binary tables into the feature definition format.
2. Editing the features and previewing the results. FontLab Studio provides a feature editor that is integrated into the FontLab Studio user interface and an OpenType Preview panel that can show how features work without actually exporting and installing the font file.
3. Feature compilation and export. At this stage the Adobe FDK for OpenType (AFDKO) library is used to compile the feature definitions into binary tables and build the OpenType font files.

Since FontLab Studio compiles the OpenType Layout tables from the feature definition language using the Adobe FDK for OpenType library, there are some limitations of lookup types supported by FontLab Studio.

FontLab Studio currently does **not** support:

- GSUB lookup type 2 (Multiple substitution, e.g. a b -> c d)
- GPOS lookup types 3 (Cursive attachment positioning), 4 (Mark-to-Base attachment positioning), 5 (Mark-to-Ligature attachment positioning), 6 (Mark-to-Mark attachment positioning), 7 (Contextual positioning), 8 (Chaining contextual positioning)

We plan to support these OpenType specification elements in future but currently, if you need to build OpenType fonts that support any of these specification elements, you need to create your OpenType Layout features using Microsoft VOLT, which is a free application available from

http://www.microsoft.com/typography/VOLT.mspx

In such case, you can still use FontLab Studio to design the glyphs, to create the subset of OpenType Layout features that does not use the unsupported specification elements, and to generate the OpenType font. Then, just use VOLT to add the missing bits.

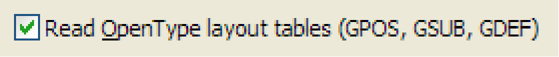
A detailed list of OpenType lookup types not supported by FontLab Studio can be found at

http://partners.adobe.com/public/developer/opentype/afdko/topic_feature_file_syntax.html

Importing OpenType Fonts

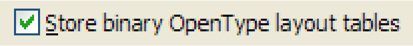
There is nothing special about importing OpenType fonts: use the **File > Open** command to open files with .ttf extension (OpenType TT fonts) or .otf extension (OpenType PS fonts).

To read OpenType features make sure that this option is active in the **Tools > Options > Opening OpenType & TrueType** page:



☑ Read OpenType layout tables (GPOS, GSUB, GDEF)

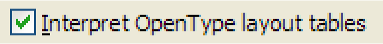
This option has several sub-options.



☑ Store binary OpenType layout tables

Enable this to store the original binary OpenType Layout tables – they will be stored in your .vfb file. This is useful if you wish to make some changes to an existing OpenType font (e.g. add or fix the design of some glyphs or change the hinting) but you do not want to touch the OpenType Layout tables. Remember that FontLab Studio cannot compile all lookup types so if you are editing complex script fonts that extensively use GPOS features (Arabic, Devanagari etc.), you most likely want to preserve the original OpenType tables. You can later remove the binary tables from your .vfb file using **Font Info > Binary and custom tables**

Disable this to prevent FontLab Studio from storing the binary OpenType Layout tables in the .vfb file.

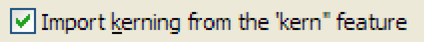


☑ Interpret OpenType layout tables

Enable this to have FontLab Studio try to interpret (decompile) the binary OpenType Layout tables into the feature definition language. If you are opening a font with Roman, Greek or Cyrillic glyphs, FontLab Studio will likely succeed in interpreting the features.

If you are opening an Arabic or Devanagari font, FontLab Studio will probably interpret the features but many of them will be disabled (commented out) in the feature definition language. This means that FontLab Studio will not be able to rebuild these features. In this case, it's better to disable the option and only store the binary tables. You will need to use Microsoft VOLT to develop the feature definitions for complex script fonts.

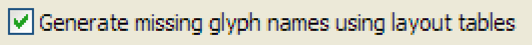
If a GDEF table is defined in the font, FontLab Studio will read information about anchors, glyph types and caret positions from it.



☑ Import kerning from the 'kern" feature

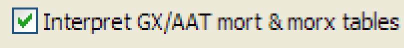
If enabled, FontLab Studio will import kerning defined in the "kern" positioning feature into the font pair kerning table. We recommended you have this feature active when you import the OpenType font.

An OpenType font may have two sets of kerning included: OpenType GPOS kerning (usually class-based) and plain kern table kerning. With this option enabled, FontLab Studio will only import the GPOS kerning. If you disable the option, FontLab Studio will import the plain kern table kerning into the Metrics Window and the GPOS kerning into the OpenType panel. You may later convert the GPOS kerning into plain kerning using the "Convert kerning" button on the OpenType Features Sample panel.



☑ Generate missing glyph names using layout tables

Some OpenType TT fonts do not include glyph names at all (they include a so-called "post" table format 3). With this option enabled, FontLab Studio will algorithmically build glyph names based on the Unicode values and the OpenType Layout features. Most users will want to leave this option enabled.



☑ Interpret GX/AAT mort & morx tables

GX/AAT is an Apple technology that provides layout features ("GX" is the older name, "AAT" is the current name). In principle, the technology is similar to OpenType Layout but it uses a different implementation and different tables.

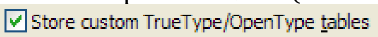
You can find comparisons between AAT and OpenType Layout at:

http://developer.apple.com/fonts/WhitePapers/GXvsOTLayout.html
http://fontforge.sourceforge.net/gposgsub.html

An OpenType font (TT or PS) can include layout features in AAT format and in OpenType Layout format, although it is more common that one font only contains one format of layout features. Mac OS X includes several AAT fonts, e.g. Skia, Hoefler Text, Zapfino or Apple Chancery. With this option enabled, FontLab Studio will attempt to convert the AAT features included in the font into the OpenType feature definition language.

Apple provides free command-line tools for Mac OS X that you can use to add AAT features to your font:

http://developer.apple.com/fonts/OSXTools.html

After you have added your AAT features, open the font in FontLab Studio with this option enabled (make sure to also enable  ☑ Store custom TrueType/OpenType tables), and you will receive an approximation of your AAT features in the OpenType feature definition language. Now edit and compile the feature definitions, and generate the font – you will receive a “hybrid” OpenType/AAT font with both AAT and OpenType Layout features included. You can also generate two fonts: one with OpenType layout features, another with AAT features.

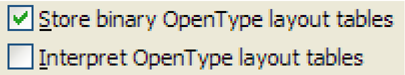
You can download free Arabic OpenType & AAT fonts from

http://scripts.sil.org/cms/scripts/page.php?site_id=nrsi&item_id=ArabicFonts

and use them as reference.

When you open existing OpenType fonts, it is important to realize the interaction of the two crucial options in FontLab Studio 5.

The combination:

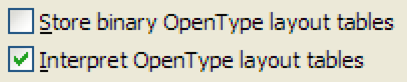


☑ Store binary OpenType layout tables
□ Interpret OpenType layout tables

means that the binary OpenType tables will be retained in your .vfb file but they will not be decompiled into human-readable feature definition language. When you re-generate your OpenType font later, the stored original binary tables will be written into the font.

You can decompile them later by choosing **Interpret Stored Binary Layout Tables** from the OpenType panel.

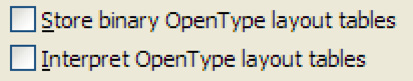
The combination:



☐ Store binary OpenType layout tables
☑ Interpret OpenType layout tables

means that the binary OpenType tables will not be retained in your .vfb file but they will be decompiled into human-readable feature definition language. When you re-generate your OpenType font later, the feature definition language will be compiled and new binary tables will be written into the font. Limitations discussed earlier (unsupported lookup types) apply here.

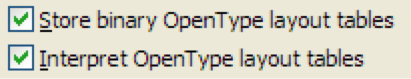
The combination:



☐ Store binary OpenType layout tables
☐ Interpret OpenType layout tables

means that no OpenType information will be imported.

The combination:



☑ Store binary OpenType layout tables
☑ Interpret OpenType layout tables

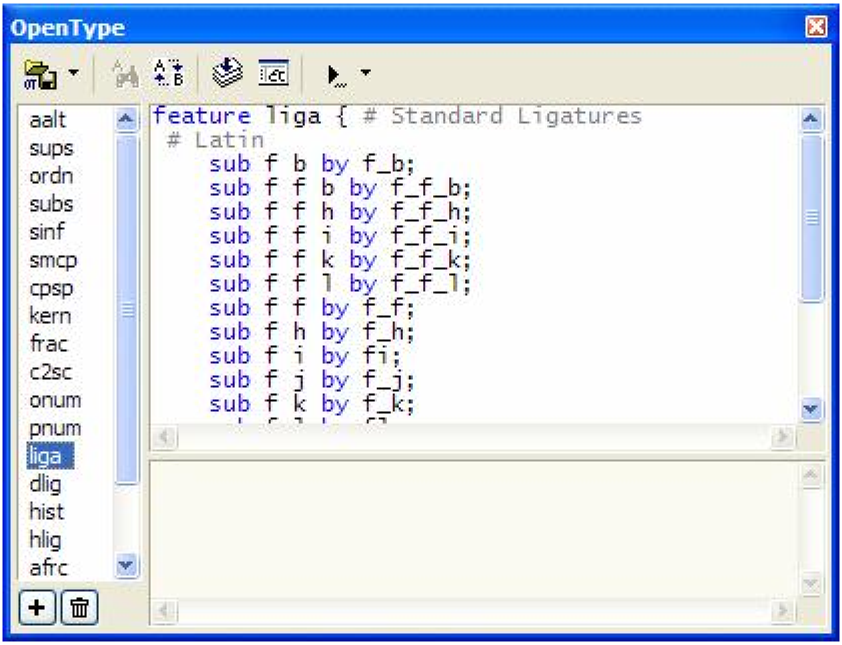
means that the binary OpenType tables will be retained in your .vfb file and they will be also decompiled into human-readable feature definition language. When you re-generate your OpenType font later, FontLab Studio will ask you which information it should use to write the OpenType layout tables.

OpenType Panels

FontLab Studio provides two panels that deal with OpenType features: the OpenType panel and the OpenType Features page of the Preview panel.

OpenType Panel

In FontLab Studio you can see OpenType features in the special OpenType panel. To open the panel use the **Window > OpenType panel** command. Below is the illustration of the panel that appears if you open the Palatino Linotype font (pala.ttf):



```
feature liga { # Standard Ligatures
 # Latin
    sub f b by f_b;
    sub f f b by f_f_b;
    sub f f h by f_f_h;
    sub f f i by f_f_i;
    sub f f k by f_f_k;
    sub f f l by f_f_l;
    sub f f by f_f;
    sub f h by f_h;
    sub f i by fi;
    sub f j by f_j;
    sub f k by f_k;
```

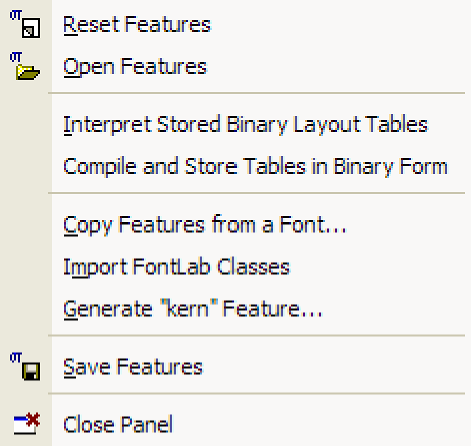
At the top of the panel you find a toolbar, at the left – a list of the features with two buttons below and a split field at the right. The top part of the field contains the feature definition text for the feature selected in the list and the bottom part contains the global definition data, which usually is a definition of the glyph classes (unless they are defined in the Classes panel).

You can use the separator bar between top and bottom panels to adjust their relative vertical sizes.

Buttons on the toolbar mean:

▾	Open the menu. The contents of the menu are described below
	Find the glyph or class. When the cursor in the feature-editing panel is on the glyph name you can click on this button to quickly find the glyph in the Font or Glyph windows. **Ctrl**+Right-click on the glyph name does the same. If the cursor is on the class name FontLab Studio will try to find the class in the bottom editing field or in the Classes panel
A B	Rename the glyph. Position the cursor on the glyph name and click this button to open the glyph rename dialog box, described in one of the following sections
	Compile the feature definitions
	Open the OpenType Features Sample panel.

When you click on the ▾ button you will see a popup menu:



Reset Features
Open Features
Interpret Stored Binary Layout Tables
Compile and Store Tables in Binary Form
Copy Features from a Font…
Import FontLab Classes
Generate "kern" Feature…
Save Features
Close Panel

Commands in the menu mean:

Reset features	Removes all feature definition information and allows you to start making a new set of features
Interpret Stored Binary Layout Tables	Converts the stored binary OpenType Layout tables into feature definition language – can be useful if FontLab Studio did not interpret the features when opening the font
Compile and Store Tables in Binary Form	Compiles the feature definition language into binary OpenType Layout tables and stores the binary tables in the .vfb file – can be useful if you want to store the binary tables and make some operations with them e.g. via Python scripting
Copy Features from a Font…	Copy the feature definition language from another font to the current font
Import FontLab Studio Classes	Explicitly imports the classes defined in the Classes panel into the lower portion of the OpenType panel; this is done implicitly and automatically if **Options > General Options > Unicode and OpenType > Add all glyph classes…** is enabled but sometimes it is practical to import the class definitions explicitly
Generate "kern" Feature	Generates the GPOS kerning based on the kerning defined in the Metrics Window and the classes defined in the Classes panel; synonymous to **Tools > Kerning Assistance > Update [kern] feature**
Open features	Opens an existing .fea file containing feature definition language. You can use this command to apply a previously created feature definition to different fonts. During import FontLab Studio automatically separates features into individual records and places the class definitions in the bottom editing control
Save features	Saves the current set of feature definitions to a file as a .fea (feature definition language) or .vtp (VOLT project file)
Close panel	Closes the OpenType panel.

Adding and Removing Features

To add a new feature click on the + button below the features list. The new feature (named “xxxx”) will appear in the list and the generic feature definition text will be posted to the feature editor:

```
feature xxxx {
   sub by ;
} xxxx;
```

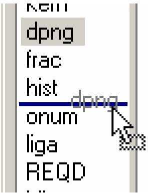
When you change the xxxx name to something real the name in the list will be updated automatically. Do not forget to make the ending name the same as the beginning name or the feature definition will not compile.

To remove the feature, select it in the list and click on the 🗑 button.

Reordering Features

The order of features is sometimes important. For example, if you have the ligature feature and the small caps feature they must be applied in a predefined order: the small caps feature should come first and only after that may ligatures be applied.

To reorder the features simply drag-drop feature names in the list:



Entering the Glyph and Class Names

All features contain glyph names. You can enter them on the keyboard but it's faster **to use the drag-drop method**:

1. Select the glyph (in the Font window or in the Classes panel) whose name you want to enter.
2. Press the left mouse button and drag the cursor to the feature definition field. The position where the name will be inserted is highlighted with the editing caret.
3. Select the destination position and release the mouse button to insert the glyph name.

If more than one glyph was selected for drag-drop operation, all the glyph names will be inserted separated by spaces and surrounded by brackets:

```
[zero one two three four five six seven eight nine]
```

To enter a class name defined in the Classes panel, drag the class name from the list of classes.

If you drop the class name, it will be inserted into the feature definition text preceded by the '@'

```
@smcp2
```

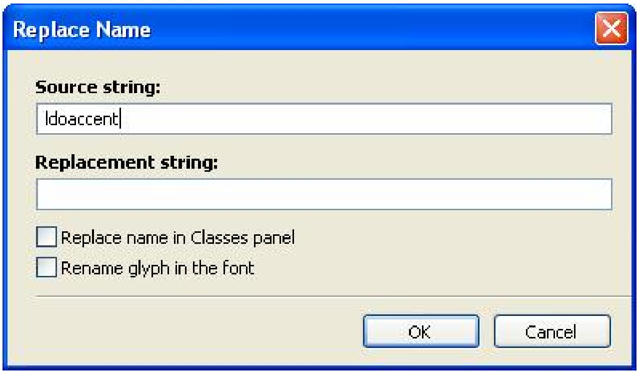
To insert the actual contents of the class rather than its name, hold the **Ctrl** key when you release the mouse button:

```
[perthousand perthousand percent threeeighths threequarters threeeighths
fiveeighths fiveeighths seveneighths seveneighths]
```

Renaming Glyphs and Classes

When a glyph name is entered into feature definition text the link with this glyph in the font is lost, so if you rename the glyph using the FontLab Studio glyph rename command the feature definition will not be updated.

To rename a glyph in the feature definitions, position the cursor on the glyph name in the feature editing field and click the button on the toolbar. You will see a dialog box:



Replace Name

Source string: ldoaccent

Replacement string:

□ Replace name in Classes panel
□ Rename glyph in the font

In the top field you can enter the name of the glyph you want to rename and in the bottom field you enter new name for the glyph.

Check the **Replace name in the Classes panel** checkbox to rename the glyph in the FontLab Studio Classes panel.

Check the **Rename glyph in the font** checkbox to rename the glyph in the font.

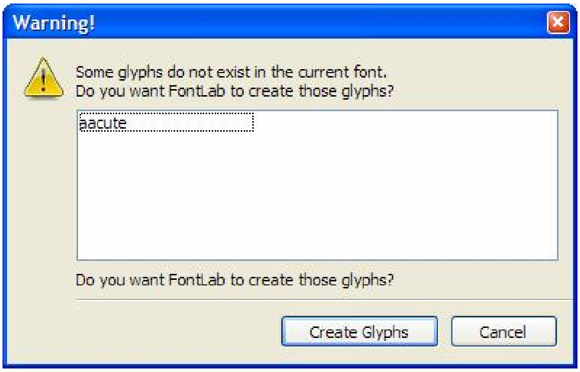
After you click **OK** in the dialog box FontLab Studio will scan all the feature definitions and replace the old glyph name with the new one. Note that you can enter a glyph class definition as a replacement string, for instance to replace “one” by “[one two three]”.

Compiling the Feature Definitions

When you import or create OpenType features they exist in form of the text-based feature definition language. To convert them to the usable binary format of the GSUB and GPOS OpenType tables they must undergo a process called “compilation”. During compilation the feature definition language (text) is checked for errors and glyph reverences are verified. When everything is confirmed OK the text is converted to binary form which you can preview or export.

To compile feature definitions click on the button on the toolbar. FontLab Studio will try to compile the features and if there are errors during the compilation they are put into a special Output panel.

There is one special error message: if glyphs are referenced by the feature definition but do not exist in the font, FontLab Studio will show the warning message:



Some glyphs do not exist in the current font.
Do you want FontLab to create those glyphs?

aacute

Do you want FontLab to create those glyphs?

If you click **Yes**, FontLab Studio will try to create the glyphs using their names as the source of information. The same algorithm as in the Generate Glyphs operation described on page 511 is used.

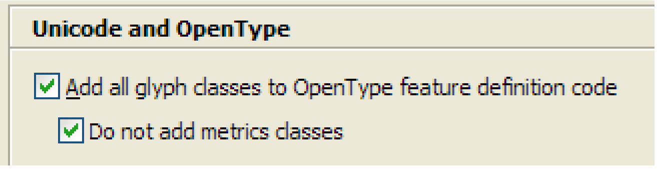
➲ **Tip:** If you import a feature definition file from an existing large OpenType font into your font and use this operation, FontLab Studio will automatically generate all the glyphs that are needed to support that feature definition file. This way, you can easily match another font's character set.

If you hold down the **Ctrl** key when you are clicking the button to compile the features, FontLab Studio will compile the features and decompile the resulting binary tables as if you had imported them from an OpenType font file.

Compiling the Classes

There are two set of classes: text-based class definitions made in the feature definition language and located in the bottom field of the OpenType panel, and FontLab Studio glyph classes that are represented in the Classes panel (for more information about the Classes panel please refer to page 583).

It is natural to provide a link between these classes. Use the following option in the **Tools > Options > General Options > Unicode and OpenType** dialog box:



Unicode and OpenType

☑ Add all glyph classes to OpenType feature definition code

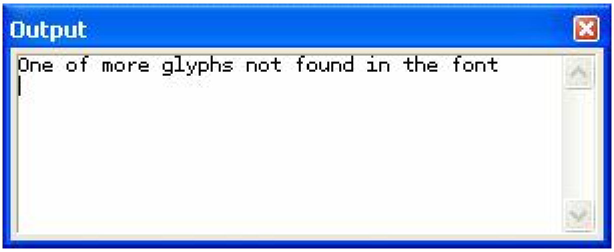
☑ Do not add metrics classes

to automatically include all FontLab Studio classes into the compiled feature definition code.

Please note that FontLab Studio will import all OpenType classes when an OpenType font is imported and will place them in the OpenType panel and FontLab Studio Classes panel, so when you use this option for an imported font you need to manually delete the OpenType classes **to avoid duplication**.

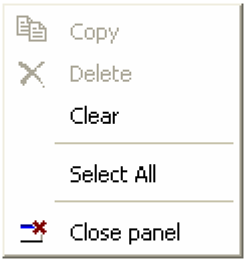
The Output Panel

The Output panel opens automatically when there is something to show and looks very simple:



```
One of more glyphs not found in the font
```

Basically it is just a text-output window with a scroll bar. You can right-click the panel to open the context menu:



Use the commands in the menu to close the panel or clear or copy the selected text.

You can manually open the output panel with the **Window > Panels > Output** command in the main FontLab Studio menu.

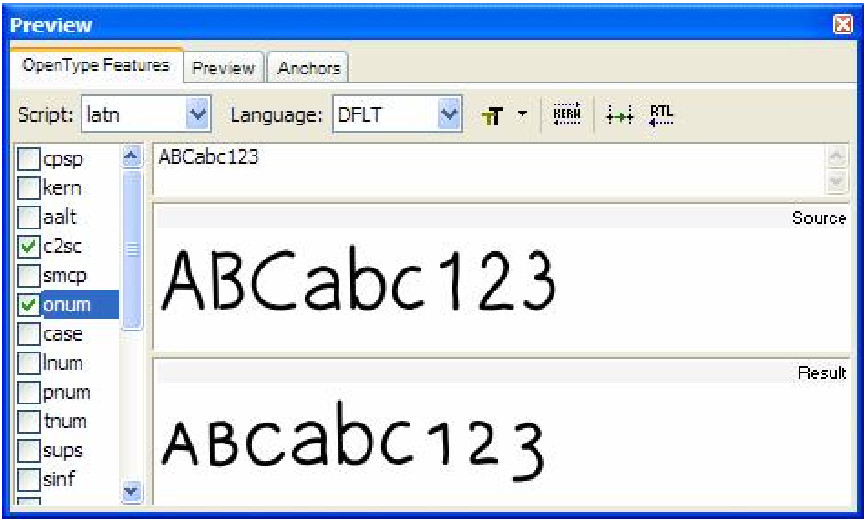
The output panel is also used by the FontLab Studio Macro system to show the results of macro program interpretation.

OpenType Features Sample Panel

When OpenType features are compiled you can preview them with the OpenType Features Sample page of the Preview panel.

To open the Preview panel use the **Window > Panels > Preview** command or click on the button located on the OpenType panel toolbar.

When there are OT features defined the OpenType Features Sample panel looks like this:



Script: latn
Language: DFLT

□ cpsp
□ kern
□ aalt
☑ c2sc
□ smcp
☑ onum
□ case
□ lnum
□ pnum
□ tnum
□ sups
□ sinf

ABCabc123

In the top part of the panel you find a command bar that contains script and language selection lists and some buttons.

When more than one script or language is referred to by the feature definition, they are listed in the combo boxes on the command bar. Use them to select the script and language to preview.

When a script is selected, you will see a list of the features that are defined for that script and language. Please note that when you select the non-default language only features that are unique for the selected language are listed.

Every feature name has a check box. Use it to turn the feature on or off. When several features are selected they are applied in the order in which they are listed.

To the right of the list there are 3 fields: *source text*, *source preview panel* and *resulting preview panel*.

You must **enter the text** you want to use to preview in the source text field. Use FontLab Studio notation to enter glyphs that are not directly accessible from the keyboard: '/' followed by the glyph name and a space or '\' followed by the Unicode index.

You can also **drag-drop glyphs** from the Font window or from the Classes panel into the source text field.

The **Source preview** shows the glyphs before OpenType features are applied. The **Resulting preview** panel shows the glyphs after the OpenType features do their work. You will also see the result glyph names below the Resulting preview.

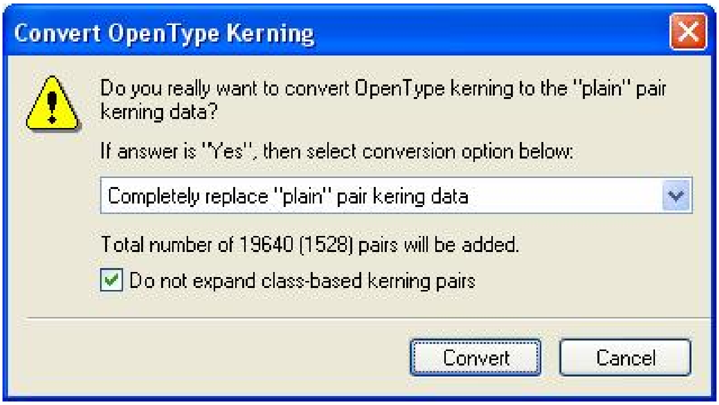
Interpretation of the features is based on the OpenType specification and is carefully tested for compatibility with OS and Adobe InDesign interpretation. However please be aware that feature interpretation is an application-centric system so it may vary in different applications.

Use the buttons on the top of the panel **to get access to options**:

TT ▾	Click on this button to set the size of the preview shown in the OpenType Features Sample panel; select a point size or choose "Auto" to make the preview automatically fit the size of the panel
KERN	Click on this button to convert the GPOS kerning from the OpenType kern feature into the plain pair kerning table. This operation is described in the following section
↔	If this button is pressed, FontLab Studio will preview the glyph metrics so you can see how the positioning features work
RTL	If this button is pressed both source and resulting preview windows work in right-to-left mode. This is good for working with Arabic or Hebrew fonts. **Note:** FontLab Studio 5 does not support automatic glyph reordering or special shaping rules for complex scripts when displaying OpenType features in the Features Sample panel. If you develop complex-script fonts such as Arabic, you should test the final font in the **Tools > Quick Test** window which uses the system OpenType Layout renderer (on Windows XP SP-2 it is Uniscribe if complex script support is enabled in **Control Panel > Regional and Language Options > Languages**)

Converting the Kerning

If you have defined a kern feature you can convert it into the plain pair kerning table at any time. Just click on the KERN button on the OpenType Features preview panel. You will see a dialog box:



Do you really want to convert OpenType kerning to the "plain" pair kerning data?

If answer is "Yes", then select conversion option below:

Completely replace "plain" pair kering data

Total number of 19640 (1528) pairs will be added.

☑ Do not expand class-based kerning pairs

There are two options that you can select in the list:

Completely replace "plain" pair kerning data

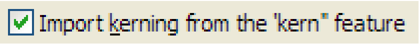
Use this option to remove existing kerning information and replace it with the result of the kern feature interpretation.

Append converted kerning to the existing kerning table

Only new pairs that do not already exist will be added to the existing pair kerning table.

Notes:

1. This operation is equivalent to the OpenType import option:

   ☑ Import kerning from the 'kern' feature

   The difference is that you can do it at any time not just during import of the OpenType font file.

2. Class-based kerning, defined in the kern feature, will be converted into class-based kerning as FontLab Studio understands it. Real kerning pairs will be added only for the key glyphs. Please, refer to the "Editing Metrics" chapter and page 581 for more information about class-based kerning.

Feature Development Process

When you want to create a feature we recommend you follow this sequence of operations:

1. Create a feature in the OpenType panel (click on the + button in the lower left corner).
2. Name the feature. Enter the name at the beginning of the feature block and at the end by replacing the default “xxxx”.
3. Fill the feature body with lookups. Descriptions of all the types of lookups that FontLab Studio can handle follows this section.
4. Click the button to compile the feature definition text.
5. Check the Output panel for warnings and errors. If there is an error, it will be highlighted in the feature definition text. Fix any errors.
6. When there are no errors, check the feature in the OpenType Features Preview panel. Open the panel, select the script and language and enter the test text.

At this point you know everything you need to create new features except the actual lookups that define a feature. In the following sections we will discuss the different types of substitution and positioning lookups.

Please note that you may combine substitution and positioning lookups in the same feature.

Substitution Lookups

Substitution lookups deal with the replacement of the source glyph(s) with some other glyph(s).

The simplest example of a substitution lookup is the replacement of lowercase characters by small-caps versions.

Lookups may be context-dependent or context-independent. Context-independent lookups are applied every time the source sequence of glyphs is present, like when you want to replace the 'f' and 'l' sequence with the 'fl' ligature. In other cases you may need to apply a substitution only when a source sequence of glyphs is surrounded by some other glyphs. For instance you may want to replace an uppercase character with a lowercase when it is followed by another lowercase character.

The OpenType specification declares the following types of basic substitutions:

Single	Replaces a single glyph with another single glyph: a->A
Ligature	Replaces multiple glyphs with a single glyph: f l -> fl
Multiple*	Replaces a single glyph with multiple glyphs: $ -> d o l l a r
Alternate	Replaces a single glyph with one of the glyphs in a list: A -> A.version1 or A.version2

All these substitutions may be context independent or context-dependent.

*) FontLab Studio supports all of the substitutions except the multiple substitutions.

Single Substitution

This is the simplest substitution – it replaces a single glyph with another glyph or a class of glyphs with another class. The Class form of the substitution requires that the number of glyphs in the source and destination classes be the same.

A single substitution rule is specified in one of the following formats:

```
substitute <glyph> by <glyph>;              # format A
substitute <glyphclass> by <glyph>;         # format B
substitute <glyphclass> by <glyphclass>;    # format C
```

You can use the codeword “sub” instead of the longer “substitute”.

Format B specifies that all glyphs in the target glyph class will be replaced by the same replacement glyph.

Format C specifies that any of the glyphs in the target glyph class must be replaced by its corresponding glyph (in the order of glyphs in the glyph classes) in the replacement glyph class. If the replacement is a singleton glyph class, then the rule will be treated identically to a format B rule. If the replacement class has more than one glyph, then the number of elements in the target and replacement glyph classes must be the same.

For example:

```
sub a by a.smcp;                                      # format A
sub [one.fitted one.onum one.taboldstyle] by one;     # format B
sub [a - z] by [a.smcp - z.smcp];                     # format C
sub @Capitals by @CapSwashes;                         # format C
```

The third line in the above example produces the same effect in the font as:

```
sub a by a.smcp;
sub b by b.smcp;
sub c by c.smcp;
# ...
sub z by z.smcp;
```

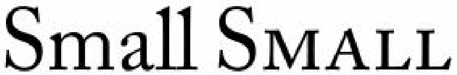
Sample applications of this rule:

Replace different types of figures:

```
sub @figs_lnum by @figs_onum;
```

Replace lowercase glyphs by small-caps:

```
sub @lc by @sc;
```



Ligature Substitution

The ligature substitution rule replaces several glyphs in sequence with a single glyph.

A Ligature substitution rule is specified as:

```
substitute <glyph sequence> by <glyph>;
```

<glyph sequence> must contain two or more <glyph|glyphclass>es. For example:

```
substitute [one one.onum] [slash fraction] [two two.onum] by onehalf;
```

Since the OpenType specification does not allow ligature substitutions to be specified on target sequences that contain glyph classes, the implementation software will enumerate all specific glyph sequences if glyph classes are detected in <glyph sequence>. Thus, the above example produces the same effect in the font as if the font editor manually enumerated all the sequences:

```
substitute one slash two by onehalf;
substitute one.onum slash two by onehalf;
substitute one fraction two by onehalf;
substitute one.onum fraction two by onehalf;
substitute one slash two.onum by onehalf;
substitute one.onum slash two.onum by onehalf;
substitute one fraction two.onum by onehalf;
substitute one.onum fraction two.onum by onehalf;
```

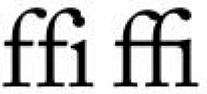
Note: Variant glyphs should be named just like their default counterparts but with a suffix appended after a period. The suffix can typically be the feature tag for the layout feature the variant glyph will be most likely accessed with. So, a small cap a can be named a.smcp and an old-style digit 2 can be named two.onum. Non-standard names should be avoided. For an extensive discussion about devising custom glyph names in OpenType fonts, refer to the "Advanced Glyph Naming and Encoding" section of the "Editing Fonts" chapter.

Almost all fonts contain at least two ligatures: "fl" and "fi" which can be easily encoded as:

```
substitute f l by fl;
substitute f i by fi;
```

Some fonts add longer ligatures:

```
substitute f f i by f_f_i;
```



Note: ligature glyphs should be named using the underscore rule, e.g. **f_f_odieresis** for an ffö ligature. Only the **fi** and **fl** ligatures should be named without the underscores. For an extensive discussion about devising custom glyph names in OpenType fonts, refer to the "Advanced Glyph Naming and Encoding" section of the "Editing Fonts" chapter.

A contiguous set of ligature rules does not need to be ordered in any particular way by the font editor; the implementation software does the appropriate sorting. So:

```
sub f f by f_f;
sub f i by fi;
sub f f i by f_f_i;
sub o f f i by o_f_f_i;
```

will do the same thing as:

```
sub o f f i by o_f_f_i;
sub f f i by f_f_i;
sub f f by f_f;
sub f i by fi;
```

Alternate Substitution

Alternate substitution replaces a glyph with one of the glyphs in a predefined list of alternatives. The application that uses the font is expected to decide which glyph to choose. A good example of this lookup is to provide several versions of some glyph, like the ampersand. Another application is the selection of several different forms of ornaments.

An alternate substitution rule is specified as:

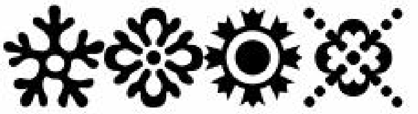
```
substitute <glyph> from <glyphclass>;
```

For example:

```
substitute ampersand from [ampersand.1 ampersand.2];
```

or ornament variations:

```
substitute asterisk from [orn.1 orn.2 orn.3 orn.4];
```



Context Dependent Substitutions

A context-dependent rule can be any of the rules described above with one important difference: it defines a context that must include a target sequence of glyphs (or glyph classes).

In the simple form of, say, ligature substitution we simply write:

```
sub a b c by D;
```

In context-dependent substitution we can declare that “abc”, which is a target sequence of glyphs for a ligature substitution rule, must be a part of a larger context:

```
sub period a' b' c' period by D;
```

Only when “abc” is surrounded by two “period” glyphs will substitution take place. Note that we have marked the target glyphs with the single quote character positioned immediately after the glyph name.

The rule is specified as follows:

```
substitute <marked glyph sequence>   # Target sequence with marked glyphs
by <glyph sequence>;                 # Sub-run replacement sequence
```

A <glyph sequence> comprises one or more glyphs or glyph classes.

<marked glyph sequence> is a <glyph sequence> in which a set of glyphs or glyph classes is identified, i.e. "marked". We will call this marked set of glyphs a *sub-run*. A sub-run is marked by inserting a single quote (') after each of its member elements.

This sub-run represents the target sequences of the lookups called by this rule. The lookup type of the lookup called by this rule is auto-detected from their target and replacement sequences in the same way as in their corresponding stand-alone (i.e. non-contextual) statements.

Example 1. This calls a lookup. The rule below means: in sequences "a d" or "e d" or "n d", substitute "d" by "d.alt".

```
substitute [a e n] d' by d.alt;
```

Example 2. This also calls a *single substitution* lookup. The rule below means: if a capital letter is followed by a small capital, then replace the small capital by its corresponding lowercase letter.

```
substitute [A-Z] [a.smcp-z.smcp]' by [a-z];
```

Example 3. This calls a *ligature substitution* lookup. The rule below means: in sequences "e t c" or "e.init t c", substitute the first two glyphs by the ampersand.

```
substitute [e e.init]' t' c by ampersand;
```

Specifying Exceptions to the Context Rule

Exceptions to a chaining contextual substitution rule are expressed by inserting a statement of the following form anywhere before the chaining contextual rule and in the same lookup as it:

```
ignore substitute <marked glyph sequence> (, <marked glyph sequence>)*;
```

The keywords "ignore substitute" are followed by a comma-separated list of <marked glyph sequence>s. At most one sub-run of glyphs or glyph classes may be marked in each <marked glyph sequence>, by a single-quote (') following each glyph or glyph class. This marked sub-run, when present, is taken to correspond to the "input sequence" of that rule. This generally means that it should correspond to the place where substitution would have occurred had the sequence not been an exception (see examples below). This is necessary for the OpenType layout engine to correctly handle skipping this sequence. When no glyphs are marked, then only the first glyph or glyph class is taken to be marked.

The "ignore substitute" statement works by creating subtables in the GSUB that tell the OT layout engine simply to match the specified sequences, and not to perform any substitutions on them. As a result of the match, remaining rules (i.e. subtables) in the lookup will be skipped.

Example 1. Ignoring specific sequences:

The "ignore substitute" rule below specifies that the substitution in the "substitute" rule should not occur for the sequences "f a d", "f e d", or "a d d". Note that the marked glyphs in the exception sequences indicate where a substitution would have occurred; this is necessary for the OpenType layout engine to correctly handle skipping this sequence.

```
ignore substitute f [a e] d', a d' d;
substitute [a e n] d' by d.alt;
```

Example 2. Matching a beginning-of-word boundary:

```
ignore substitute @LETTER f' i';
substitute f' i' by f_i.init;
```

The example above shows how a ligature may be substituted at a word boundary. @LETTER must be defined to include all glyphs considered to be part of a word. The substitute statement will get applied only if the sequence doesn't match "@LETTER f i"; i.e. only at the beginning of a word.

Example 3. Matching a whole word boundary:

```
ignore substitute @LETTER a' n' d', a' n' d' @LETTER;
substitute a' n' d' by a_n_d;
```

In this example, the a_n_d ligature will apply only if the sequence "a n d" is neither preceded nor succeeded by a @LETTER.

Example 4. This shows a specification for the contextual swashes feature:

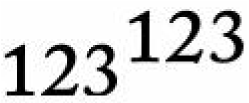
```
feature cswh {
 # --- Glyph classes used in this feature:
 @BEGINNINGS = [A-N P-Z Th m];
 @BEGINNINGS_SWASH = [A.swsh-N.swsh P.swsh-Z.swsh T_h.swsh m.init];
 @ENDINGS = [a e z];
 @ENDINGS_SWASH = [a.fina e.fina z.fina];

 # --- Beginning-of-word swashes:
 ignore substitute @LETTER @BEGINNINGS';
 substitute @BEGINNINGS' by @BEGINNINGS_SWASH;

 # --- End-of-word swashes:
 ignore substitute @ENDINGS' @LETTER;
 substitute @ENDINGS' by @ENDINGS_SWASH;
} cswh;
```

If a feature targets only glyphs at the beginning or ending of a word, such as the 'init' and 'fina' features, then the application could be made responsible for detecting the word boundary; the feature itself would be simply defined as the appropriate substitutions without regard for word boundary.

Positioning Lookups

The OpenType specification allows you to define many positioning lookups. The lookup types may be separated into three groups:

1. Basic lookups, single and pair positioning:



2. The Cursive attachment lookup that allows smooth connection of script and cursive glyphs:

3. Mark attachment lookups that define relative positions of glyphs and marks:

FontLab Studio can support only the first group of lookups: single and pair positioning. We expect to support cursive and mark attachment lookups in one of the next releases of FontLab Studio.

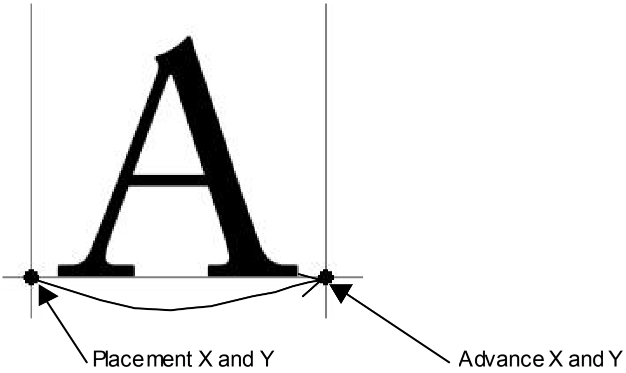
As in the case with substitution, positioning lookups may be *context-free* and *context-dependent*. Context-dependent lookups are the same as context-free but add a context that is verified against the source sequence of glyphs. Only when the context is matched is positioning performed.

Please note that glyph positioning is performed **after** substitution and that all positioning lookups must be defined for the glyph string that is a result of substitution.

Glyph positioning rules begin with the keyword "position"; this keyword may be abbreviated as "pos". (The "enumerate" or "ignore" keywords may precede the "position" keyword in some cases.) The GPOS lookup type is auto-detected from the format of the rest of the rule.

Glyph Geometry

Positioning lookups may change one of the glyph positioning metrics:



A single positioning lookup may tweak any of four values: placement_X, placement_Y, advance_Y and advance_Y.

Modification of the origin point of the glyph will shift it and all following glyphs. Modification of the advance vector will shift the next glyph in the glyph string.

Value Record

A <valuerecord> is used in positioning rules to define offsets to shift glyph origin or advance vector. It must be enclosed by angle brackets, except for format A, in which the angle brackets are optional. Note that the <metric> adjustments indicate values (in design units) to add to (positive values) or subtract from (negative values) the placement and advance values provided in the font (in the 'hmtx' and 'vmtx' tables).

Value record format A:

```
< <metric> >      # Angle brackets are optional
```

Here the <metric> represents an X advance adjustment, except when used in the 'vkrn' feature, in which case it represents a Y advance adjustment. All other adjustments are implicitly set to 0. This is the simplest feature file <valuerecord> format, and is provided since it represents the most commonly used adjustment (i.e. for kerning). For example:

```
-3          # without <>
<-3>        # with <>
```

Value record format B:

< <metric> <metric> <metric> <metric> >

Here, the <metric>s represent adjustments for X placement, Y placement, X advance, and Y advance, in that order. For example:

```
<-80 0 -160 0>      # X placement adj: -80; X advance adj: -160
```

Single Positioning

A Single Pos rule is specified as:

```
position <glyph|glyphclass> <valuerecord>;
```

Here, the <glyph|glyphclass> is adjusted by the <valuerecord> [§2.e.iv]. For example, to reduce the left and right sidebearings of a glyph each by 80 design units:

```
position one <-80 0 -160 0>;
```

To shift the glyph up by 100 units:

```
position A <0 100 0 -100>;
```

Note that we changed the placement by 100 units but compensated for that with a -100 change applied to advance. This is needed to shift only the current glyph and not the following glyphs in the string.

Pair Positioning

Rules for this lookup type are usually used for kerning and must follow this format:

```
position <glyph|glyphclass> <glyph|glyphclass> <valuerecord format A>;
```

This format is provided since it closely parallels the way kerning is expressed in a plain pair kerning table. Here, the <valuerecord> must be of value record format A only, and corresponds to the first <glyph|glyphclass>.

Kerning can most easily be expressed with this format. This will result in adjusting the first glyph's X advance, except when in the 'vrkn' feature, in which case it will adjust the first glyph's Y advance. Some examples:

```
pos T a -100;          # specific pair (no glyph class present)
pos [T] a -100;        # class pair (singleton glyph class present)
pos T @a -100;         # class pair (glyph class present, even if singleton)
pos @T [a o u] -80;    # class pair
```

Note that if at least one glyph class is present (even if it is a singleton glyph class), then the rule is interpreted as a class pair; otherwise, the rule is interpreted as a specific pair.

In the 'kern' feature, the specific glyph pairs will typically precede the glyph class pairs in the feature file, mirroring the way that they will be stored in the font.

```
feature kern {
    # specific pairs for all scripts
    # class pairs for all scripts
  } kern;
```

Enumerating Pairs

If some specific pairs are more conveniently represented as a class pair, but the editor does not want the pairs to be in a class kerning subtable, then the class pair must be preceded by the keyword "enumerate" (which can be abbreviated as "enum"). The implementation software will enumerate such pairs as specific pairs. Thus, these pairs can be thought of as "class exceptions" to class pairs. For example:

```
@Y_LC = [y yacute ydieresis];
@SMALL_PUNC = [comma semicolon period];

enum pos @Y_LC semicolon  -80;      # specific pairs
pos f quoteright 30;                # specific pair
pos @Y_LC @SMALL_PUNC -100;         # class pair
```

The enum rule above can be replaced by:

```
pos y semicolon -80;
pos yacute semicolon -80;
pos ydieresis semicolon -80;
```

without changing the effect on the font.

Subtable Breaks

The implementation software will insert a subtable break within a run of class pair rules if a single subtable cannot be created due to class overlap. A warning will be given. For example:

```
pos [Ygrave] [colon semicolon] -55;         # [line 99]   In first subtable
pos [Y Yacute] period -50;                  # [line 100]  In first subtable
pos [Y Yacute Ygrave] period -60;           # [line 101]  In second subtable
```

will produce a warning that a new subtable has been started at line 101, and that some kern pairs within this subtable may never be accessed. The pair (Ygrave, period) will have a value of 0 if the above example comprised the entire lookup, since Ygrave is in the coverage (i.e. union of the first glyphs) of the first subtable.

Sometimes the class kerning subtable may get too large. The editor can force subtable breaks at appropriate points by inserting the statement:

```
subtable;
```

between two class kerning rules. The new subtable created will still be in the same lookup, so the editor must ensure that the coverages of the subtables thus created do not overlap. For example:

```
pos [Y Yacute] period -50;                # In first subtable

subtable;                                 # Force a subtable break here

pos [A Aacute Agrave] quoteright -30;     # In second subtable
```

If the subtable statement were not present, both rules would be represented within the same subtable.

Known Features

OpenType feature processing is an application-centric system. The application knows which features it needs to apply and then searches the font for these features. If a feature is present in the font, it is applied. To implement this system features must be standardized and registered so everybody will know what is done by a feature with a particular name.

The Microsoft Typography group performs feature registration:

http://www.microsoft.com/typography

The full list of registered features may be found in this document:

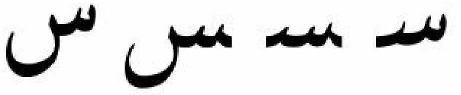
OpenType Layout tag registry
http://www.microsoft.com/typography/otspec/ttoreg.htm

This document contains descriptions of all name tags that can be used in an OpenType font for script, language and feature names.

We will provide brief definitions of the most commonly used features.

init,medi ,fina and isol Features

These features are most commonly used in Arabic scripts and allow one to define four forms of Arabic characters: initial, final, medial and isolated:



Isolated **Final** **Medial** **Initial**

Note that Arabic text is written right-to-left.

Please note that it is the application or the operating system that detects word boundaries and applies one of the features. You are not expected to pay attention to that in the feature definition.

Usually these features are simple substitutions:

```
feature init{
  sub @isolated_forms by @initial_forms;
}init;
```

Latin Features

cpsp Capital Spacing

Globally adjusts inter-glyph spacing for all-capital text.

```
feature cpsp {
  pos @uppercase <7 0 14 0>;
} cpsp;
```

pnum Proportional Figures

Replaces figure glyphs set on uniform (tabular) widths with corresponding glyphs set on glyph-specific (proportional) widths.

```
feature pnum {
  sub @figures by @figures_prop;
} pnum;
```

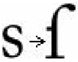
lnum Lining Figures

This feature changes selected figures from oldstyle to the default lining form

hist Historical Forms

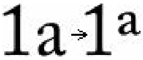
Replaces glyphs with their historical forms, like long form of s or Fraktur form of k.

```
feature hist {
   sub s by longs;
} hist;
```



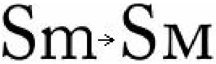
ordn Ordinals

Replaces default alphabetic glyphs with the corresponding ordinal forms for use after figures



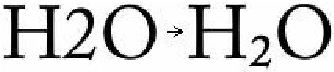
smcp Small Capitals

This feature replaces lowercase characters with small capitals



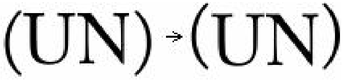
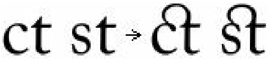
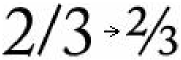
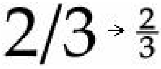
sinf Scientific Inferiors

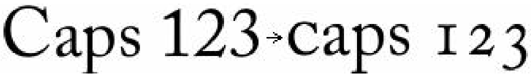
Replaces lining or oldstyle figures with inferior figures (smaller glyphs which sit lower than the standard baseline, primarily for chemical or mathematical notation)



ornm Ornaments

This feature lets the user access ornament glyphs in the font

liga	Standard Ligatures	Replaces a sequence of glyphs with a single glyph, which is preferred for typographic purposes. This feature covers the ligatures that the designer/manufacturer judges should be used in normal conditions feature liga { sub f f i by f_f_i; sub f i by fi; sub T h by T_h; sub f f j by f_f_j; sub f f l by f_f_l; sub f f by f_f; sub f j by f_j; sub f l by fl; } liga;
case	Case-Sensitive Forms	Shifts various punctuation marks up to a position that works better with all-capital sequences or sets of lining figures; also changes oldstyle figures to lining figures 
dlig	Discretionary Ligatures	Replaces a sequence of glyphs with a single glyph, which is preferred for typographic purposes. This feature covers those ligatures that may be used for special effect, at the user's preference feature dlig { sub c t by c_t; sub s t by s_t; sub longs h by longs_h; sub longs i by longs_i; sub longs l by longs_l; sub longs t by logs_t; sub longs longs by longs_longs; } dlig; 
frac	Fractions	Replaces figures separated by a slash with 'common' (diagonal) fractions 
afrc	Alternative Fractions	Replaces figures separated by a slash with an alternative form 
dnom	Denominators	Replaces selected figures that follow a slash with denominator figures

c2sc	Small Capitals From Capitals	This feature replaces capital characters with small capitals 
numr	Numerators	Replaces all with numerator figures
onum	Oldstyle Figures	This feature changes selected figures from the default lining style to oldstyle form
sups	Superscript	Replaces lining or oldstyle figures with superior figures and replaces lowercase letters with superior
sinf	Scientific Inferiors	Replaces lining or oldstyle figures with inferior figures.

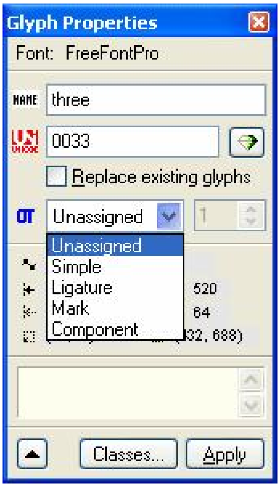
OpenType Glyph Properties

The OpenType format allows you to define a glyph’s type. This can be one of the following values:

Unassigned	Glyph type is not defined
Simple	Single character
Ligature	Multiple characters
Mark	Non-spacing glyph used as a mark
Component	Part of a character

Glyph type is used in a lookup when you need to limit it to the glyphs of a particular type using the **lookupflag** command (page 832).

You define the glyph type using the glyph properties panel. Select one or more glyphs in the Font window and open the panel with the **Edit > Properties** command:



Glyph Properties

Font: FreeFontPro

NAME three

0033

☐ Replace existing glyphs

OT Unassigned 1

520

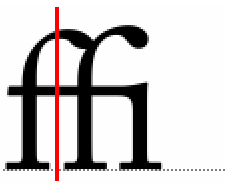
64

32, 688)

Select the glyph class in the list to the right of the OT icon. If multiple glyphs were selected, the new type will be assigned to all of them.

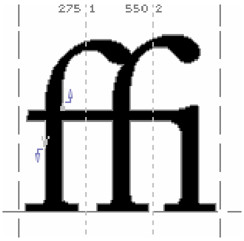
Caret Positioning

When several characters are replaced by a ligature glyph using the ligature substitution lookup, a text-layout application may keep the positioning cursor inside a ligature as if it still was a set of characters:



With FontLab Studio you can define caret positions inside the ligature. **Do the following:**

1. Open the ligature glyph in the Glyph window.
2. Open the properties panel with the **Edit > Properties** command.
3. In the properties panel select the ligature glyph type.
4. To the right of the glyph type selection list enter the number of components in the ligature.
5. Make sure that **View > Show Layers > Anchors and Carets** option is on.
6. You will see several vertical caret lines appeared in the Glyph window. The number of the lines equals the number of components of the ligature minus one:



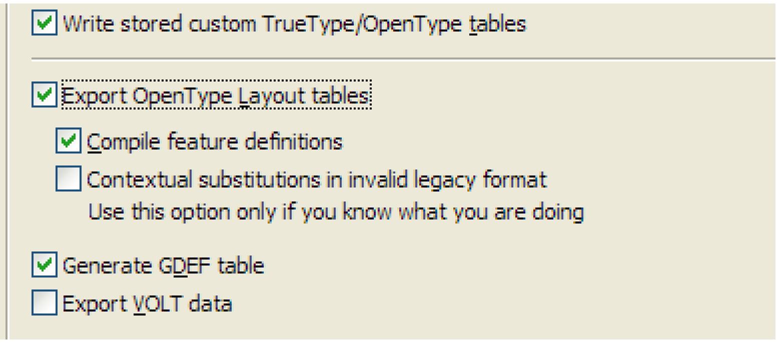
Use the Edit tool to move the caret lines to the desired positions.

Generating OpenType Fonts

When you have a font that contains feature definitions and you want them to be generated as an OpenType font file, the first thing you need to do is to compile and test your features using the tools in the OpenType panel.

If you're trying to generate an OpenType TT font and feature definitions contain errors, they will not be exported and you will get a plain TrueType font file without any features. If you are generating an OpenType PS font and the feature definitions contain an error the font will not be generated at all.

When you know that there are no errors in the features and the features work as expected, you need to check the OpenType generation options in the **Tools > Options > Generating OpenType & TrueType** dialog box:



☑ Write stored custom TrueType/OpenType tables

☑ Export OpenType Layout tables

☑ Compile feature definitions

☐ Contextual substitutions in invalid legacy format
Use this option only if you know what you are doing

☑ Generate GDEF table

☐ Export VOLT data

Write stored custom TrueType/OpenType tables

Enable this if you have previously opened an OpenType font with OpenType Layout tables that are not supported by FontLab Studio, e.g. BASE, with AAT tables such as morx, or with VOLT private tables. These tables will be retained in the new font – FontLab Studio will not touch or modify these. Note that if you rearranged the glyphs in your font or performed some changes to other parts of the font, the custom tables may become unusable.

Export OpenType Layout Tables

If this option is enabled, OpenType Layout tables will be written into the font. If disabled, no OpenType Layout tables will be written.

Compile feature definitions

When enabled, FontLab Studio will compile the feature definition language (specified in the OpenType panel) into OpenType binary tables, and these binary tables will be written into the font.

If the font includes any previously existing OpenType binary tables (e.g. if you opened an existing font or used the **Compile and Store Tables in Binary Form** command from the OpenType panel), FontLab Studio will present a dialog box asking you to choose whether the existing binary tables or the compiled feature definitions should be written into the font.

When disabled and the font contains previously existing OpenType binary tables, these will be written into the font. If no binary tables exist, none will be written into the font.

Contextual substitutions in invalid legacy format

Due to a misunderstanding between Adobe and Microsoft, early versions of Adobe InDesign (1.0, 1.5 and 2.0) contained a bug in the interpretation of contextual substitutions (for features such as calt or clig) so only “invalid” contextual substitutions work in these early versions . In Microsoft applications, only “valid” contextual substitutions work. InDesign CS and CS2 have a special routine so both “invalid” and “valid” contextual substitutions work.

If you enable this option, FontLab Studio will generate a font with “invalid” contextual features that will work correctly in InDesign 1.0, 1.5 and 2.0 as well as InDesign CS and CS2, but these contextual features will not work in OpenType-savvy applications from Microsoft or other vendors.

If disabled, “valid” contextual OpenType features will be generated that will work in InDesign CS and CS2 and all other applications, but not in InDesign 1.0, 1.5, 2.0. It is recommended to keep this setting disabled.

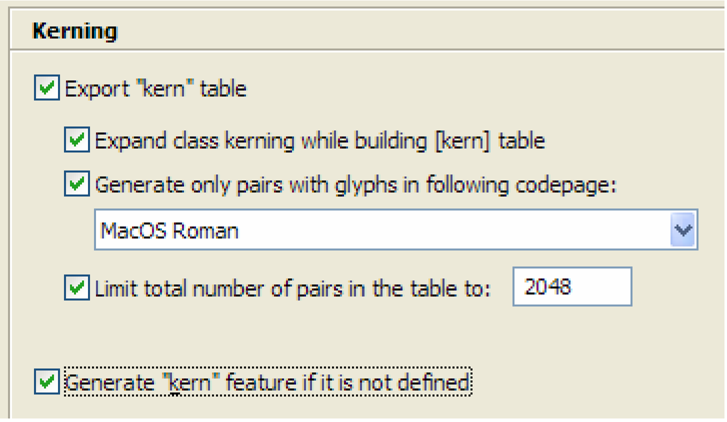
Generate GDEF table

Turn on this feature to save information about the glyph types and caret positions to the font file. Note that this is a requirement if you have used the lookupflag operator in feature definitions.

Export VOLT data

If this option is switched on, FontLab Studio will try to export feature definition data in a format supported by Microsoft VOLT (Visual OpenType Layout Tool). Not all features can be exported. Refer to the next section for more information.

On the **Kerning** page of the Options dialog, one setting is relevant to the OpenType font generation.



Kerning

☑ Export "kern" table

☑ Expand class kerning while building [kern] table

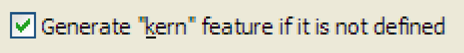
☑ Generate only pairs with glyphs in following codepage:

MacOS Roman

☑ Limit total number of pairs in the table to: 2048

☑ Generate "kern" feature if it is not defined

It is the setting



☑ Generate "kern" feature if it is not defined

If the font contains a pair kerning table but no GPOS kerning in an OpenType “kern” feature and this option is switched on, FontLab Studio will automatically generate the kern feature based on the kerning information in Metrics Window and the Classes panel, so applications that need this feature to make kerning will work correctly.

After all options are set correctly, use the **File > Generate Font** command **to save the OpenType font file**. Select **TrueType/OpenType TT (*.ttf)** to generate an OpenType TT (TrueType-flavored) font or **OpenType PS (*.otf)** to generate an OpenType PS (CFF-flavored) font.

FontLab Studio and VOLT

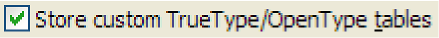
Microsoft VOLT (Visual OpenType Layout Tool) is an OpenType feature editor program developed and supported by the Microsoft Typography group. The big benefit of this program is that it can support all the features of OpenType including those that FontLab Studio cannot handle. VOLT is based on a completely different user interface and provides visual tools to define substitution and positioning lookups.

You can get more information about VOLT at this location:

http://www.microsoft.com/typography/developers/volt/default.htm

VOLT stores OpenType features and lookups information in a text-based format, which, during work on a font, is saved in special tables in a TrueType font. When work on the font is done, these tables are compiled to GPOS, GDEF and GSUB tables and intermediate tables are stripped from the font file.

If this option in the **Tools > Options > Opening OpenType & TrueType**:



☑ Store custom TrueType/OpenType tables

is switched on, you can open the saved font in VOLT and it will contain the special tables that VOLT uses to store intermediate data and on export these tables will be restored unchanged. This means that even if you start work on a font in VOLT, but then realize that some glyphs must be modified, you can save the font in VOLT, open it in FontLab Studio, modify the glyphs and return to VOLT to continue your work on OpenType features.

Another FontLab Studio feature is its ability to save simple lookups and some glyph information in VOLT format so you can start working on a font in FontLab Studio then continue in VOLT.

FontLab Studio can export OpenType Layout feature definitions to VOLT in two ways:

1. Use the button in the OpenType panel to open a menu and then select the **Save Features** command to open a File Save dialog box. Select VOLT project files (*.vtp) as the destination format and FontLab Studio will try to save the features in VOLT format.
2. Enable the **Export VOLT data** option in the **Tools > Options > Generating OpenType & TrueType** menu and generate the font as a TrueType/OpenType TT. FontLab Studio will write both binary OpenType tables and tables that VOLT can read so you can open this font in VOLT and continue editing features.

VOLT itself cannot decompile OpenType binary tables into source information. So Option 2 is the only way that you can open an existing OpenType font with binary tables and turn these into VOLT source information.

Macro Programming

One of the unique features of FontLab Studio is an integrated macro programming language. With this feature you can program repeated tasks, define custom font transformations, create your own editing tools, integrate FontLab Studio into a font development system which may include other tools, and use FontLab Studio in many other powerful ways.

Macro programs in FontLab Studio are written in the well-known and well-documented Python programming language. FontLab Studio uses the standard version of the language so almost all macros written in Python will work in FontLab Studio. In addition to support of Python FontLab Studio provides a detailed set of classes and variables that open all the FontLab Studio data structures to the programming interface.

FontLab Studio 5 supports Python 2.2, 2.3 and 2.4 but Python 2.4 is recommended.

Please note that this chapter covers only the very basic features of FontLab Studio macro programming. More information, specifications and sample programs is available at

http://www.fontlab.com/python/

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The Python Programming Language

Python is a very high-level object-oriented programming language. It combines a very clear and easy-to-understand syntax with great power, flexibility and extensibility.

Python works on all known platforms and is intensively maintained and updated by many professionals around the world.

It is not surprising that during the last few years Python has become a de-facto standard for macro programming related to fonts. FontLab Studio continues this trend and extends it to a new level - providing full integration of macro programming tools with its user interface.

More information about Python programming, manuals and samples is available on the official site:

http://www.python.org

which we recommend highly if you are not already familiar with the language. We will provide minimal instruction in Python programming in this chapter as that is better obtained elsewhere. We will assume that if you plan to write FontLab Studio macro programs that you have read the Python tutorials and have some experience in Python programming.

Installing Python

When you run FontLab Studio for the first time it will know nothing about macro programming and Python. All Python-related tools and interface components are hidden and disabled. This means that if you don't want to use these tools you are not required to and FontLab Studio will work smoothly without any Python integration.

If you want to use macro programs or perhaps create some programs yourself, however, you have to install the Python interpreter.

FontLab Studio can work with the Python interpreter starting from version 2.2.1 to version 2.4.x. Version 2.4.1 or newer is recommended.

Go to the FontLab Python site: http://www.fontlab.com/python/
and follow the links for the download. After you download the Python installer, run it and follow the instructions to install Python.

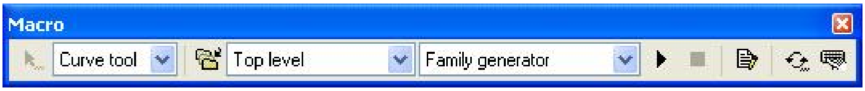
Please note that even if you have a version of Python that is not compatible with FontLab Studio, you need to install a compatible version to run macros inside FontLab Studio.

Macro Toolbar

You can use macro programs without any programming. FontLab Studio includes some sample programs in its basic installation and more programs are available from our web site and from other sources.

The easiest way to run a macro program is to use the Macro toolbar. To open the toolbar click: **View > Toolbars > Macro**. If this command is disabled it means that the Python system is not installed. Exit FontLab Studio; follow the instructions above to install Python and then run FontLab Studio again to activate the Macro features.

When the Macro toolbar appears it looks like this:



Let’s describe the contents of the toolbar from left to right:

Python tool selector. A Python tool is an editing tool (like Edit, Meter or Sketch) which has all its functions defined in Python. I.e. a FontLab Studio tool written in Python.

Macro program selectors. The Left combo box allows you to select one of the categories of programs and the right combo box selects the program within the category.

▶ Run the program selected in the list described above

■ Stop the program that is running

Open the currently selected program in the Edit Macro Panel for editing

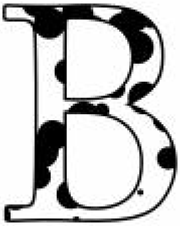
Restart the Python system. Use this command to reload all standard libraries and free all memory allocated by the Python system

Assign the currently selected program to a key combination.

Let's try to run one of the sample programs supplied with FontLab Studio:

1. Open the 'B' glyph in a Glyph Window.
2. Open the Macro toolbar.
3. Select **Effects** in the folders combo box and **Drops** in the macro list.
4. Click on the ▶ button to run the program.

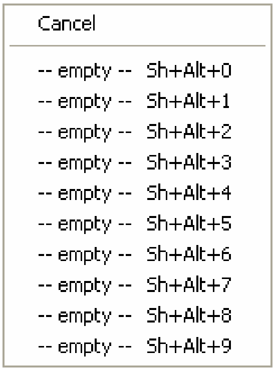
This is what you should see as a result of the transformation:



Assign to Keyboard

Using the Macro toolbar you can assign up to 10 macro programs to the keyboard combinations **Shift+Alt+0**, **Shift+Alt+1**, and up to **Shift+Alt+9**. To do so:

1. Select the macro program using the two combo boxes on the toolbar.
2. Click on the ⌨ button and select a combination in the popup menu:



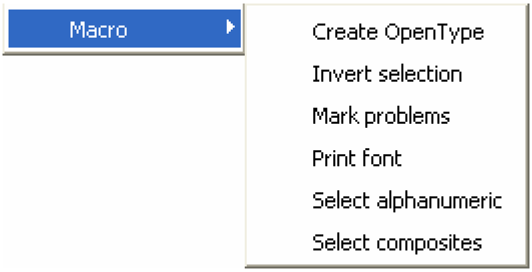
Cancel

-- empty -- Sh+Alt+0
-- empty -- Sh+Alt+1
-- empty -- Sh+Alt+2
-- empty -- Sh+Alt+3
-- empty -- Sh+Alt+4
-- empty -- Sh+Alt+5
-- empty -- Sh+Alt+6
-- empty -- Sh+Alt+7
-- empty -- Sh+Alt+8
-- empty -- Sh+Alt+9

The next time you press the key combination FontLab Studio will run the assigned macro program.

Integrating into Menus

You can integrate macro programs (supplied with FontLab Studio, written by you or downloaded from the Internet) into many context menus in FontLab Studio. If a menu has macro programs assigned they appear in the **Macro** submenu at the bottom:



Integration of macro programs into menus is done automatically when macro programs are stored in one of the event subfolders within one of the following two folders:

[FontLab Studio application folder]\Macro\System

[FontLab Studio user data folder]\Macro\System

while [FontLab Studio application folder] usually is C:\Program Files\FontLab\Studio5 and [FontLab Studio user data folder] usually is C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5.

Note that the location of the FontLab Studio user data folder can be changed in **Options > Folders and Paths > FontLab Studio 5 files**.

We recommend placing **your own** macros in the Macro subfolder within the FontLab Studio **user data** folder and not within the FontLab Studio application folder.

Note that Python macro programs must have a ".py" extension to be accepted by FontLab Studio.

Event subfolder name	Description of the associated menu
Bitmap	Context menu when the bitmap background manipulating tool is active
Component	Context menu when the component editing tool is active
Font	Font window context menu
FontsList	Popup menu that appears when you click on the ▶ button in the Fonts list panel.
Glyph	Glyph window context menu
Metrics	Metrics window context menu
Node	Node context menu
Selection	Selection (in the Glyph window) context menu
TTH	TrueType hinting tool context menu.

Macro Tool

With FontLab Studio you can define special editing tools that are entirely written in Python. By default FontLab Studio provides 3 sample tools: Curve, Line and Drops. To activate a tool:

1. Open a glyph for editing in the Glyph window.
2. Select the tool in the leftmost list of the Macro toolbar.
3. Click on the ↖ button on the toolbar to activate a tool.

Activate one of the standard editing tools (on the Tools toolbar) to finish using the macro tool.

The default macro tools do the following:

Line tool - draws lines. Click the left button anywhere and drag the mouse to draw a line. If the nodes are visible (**View|Show layers|Nodes**) you can continue defining a new contour by drawing a new line from the end node of the previous line.

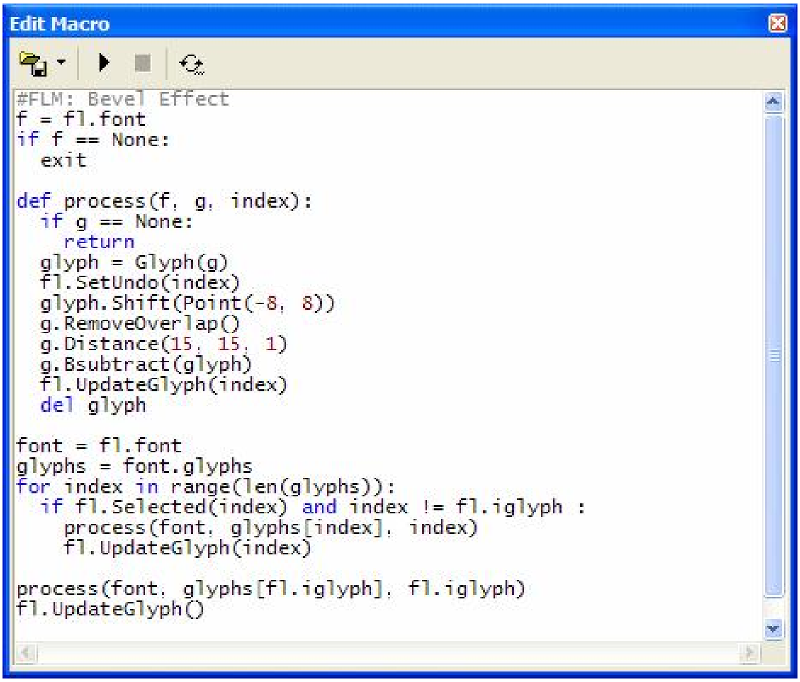
Curve tool does the same but draws curves. It emulates the curve drawing process that is common for Macromedia Fontographer® and Freehand®.

Drop tool - just a whimsical example – when you drag the mouse it adds a series of filled circles of random radius.

We will not document the process of creating new tools here. It is a relatively complex programming job. If you are interested, please visit our website for more technical documents related to FontLab Studio macro programming.

Edit Macro Panel

If you feel ready to create your first macro program you can start by opening the Edit Macro panel. Use **Window > Edit Macro panel** to make it visible:



```
#FLM: Bevel Effect
f = fl.font
if f == None:
  exit

def process(f, g, index):
  if g == None:
    return
  glyph = Glyph(g)
  fl.SetUndo(index)
  glyph.Shift(Point(-8, 8))
  g.RemoveOverlap()
  g.Distance(15, 15, 1)
  g.Bsubtract(glyph)
  fl.UpdateGlyph(index)
  del glyph

font = fl.font
glyphs = font.glyphs
for index in range(len(glyphs)):
  if fl.Selected(index) and index != fl.iglyph :
    process(font, glyphs[index], index)
    fl.UpdateGlyph(index)

process(font, glyphs[fl.iglyph], fl.iglyph)
fl.UpdateGlyph()
```

This is basically a simple text editing control with a toolbar at the top. The buttons on the toolbar mean:

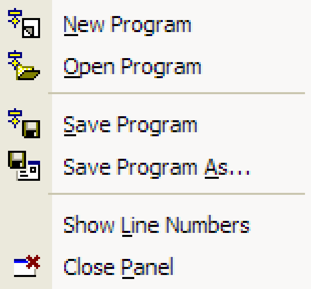
Open the menu that contains New, Open and Save operations

Run the currently edited program

Stop the program that is runnin

Restart the Python system. Use this command to reload all standard libraries and free all memory allocated by the Python system

When you click the button you will see a menu:



The commands in this menu let you perform standard file operations on your current macro program.

Naming the Programs

When you are saving a program and want it to be used in the Macro toolbar or to be integrated into one of the FontLab Studio menus you need to name it. There are two ways to name a program: you can store the name in the file name (followed by the ".py" extension) or you can embed the name into the program code. The latter way is recommended – it allows you to keep the filename small but descriptive.

To name a program put the following line at the very beginning of the program:

#FLM: <program name>

where the <program name> is the name of the program, as on the following example:

#FLM: Shadow Effect

note that there is exactly one single space between #FLM: and the name.

Save your macro within the

[FontLab Studio user data folder]\Macro

folder. [FontLab Studio user data folder] usually is C:\Documents and Settings\Your Username\My Documents\FontLab\Studio5 but the location of that folder can be changed in **Options > Folders and Paths > FontLab Studio 5 files**.

You can make your own subfolders within the Macro folder. They will appear as new categories in the Macro folders combo box on the Macro toolbar.

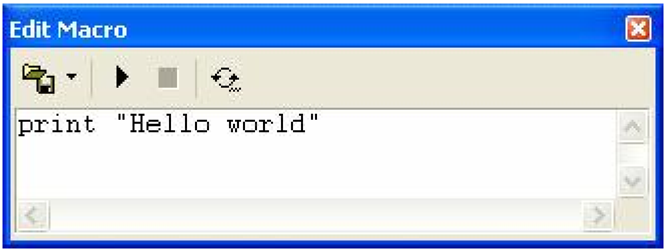
Note that there are two Macro folders in FontLab Studio 5: one in your user data folder and one in the application data folder. We recommend placing **your own** macros in the Macro subfolder within the FontLab Studio **user data** folder and not within the FontLab Studio application folder.

First Steps

Let’s write a few basic programs. The “Hello World!” program is a typical benchmark of the simplest useful program you can write. It is very easy to do in FontLab Studio/Python:

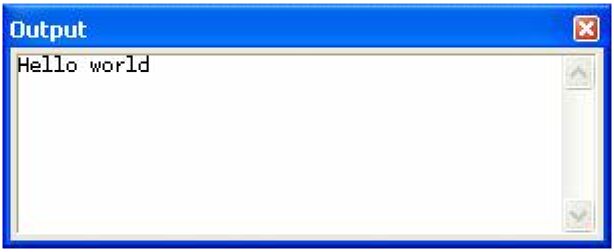
1. Open the Edit Macro panel.
2. If there is something there, click on the 📂 ▾ button and select the New program command to clean the editing field.
3. Enter the following code:

```
print "Hello World!"
```



```
print "Hello world"
```

4. Click on the ▶ button to run the program.
5. You will see the output panel appear on the screen containing our text:



```
Hello world
```

All text you output with the Python print operation appears in the Output panel. There is more information about using this panel in the “OpenType Fonts” chapter on page 849.

OK, now let’s do something more useful using FontLab Studio classes (which are partially described below). Suppose we want to find all the glyphs that are empty: i.e. don’t have an outline or any components. The “space” is a good example of such a glyph.

First, open the font that you want to check and open and clear the Edit Macro panel.

Type in the following simple program:

```
for g in fl.font.glyphs:
  if len(g) == 0 and len(g.components) == 0:
    print g.name
```

Run the program and check the results in the output panel.

Let's talk a little about the code above:

for g in fl.font.glyphs:

This line starts a loop that assigns the variable "g" to each of the glyphs contained in the current font (which is referenced as "fl.font").

if len(g) == 0 and len(g.components) == 0:

This line compares the length of the glyph outline and the length of the "components" array (which contains all components) with zero and if there are neither outline nor components it executes the next line.

print g.name

If the condition given in the second line is true, this line prints the glyph name.

As you can see, with only 3 lines of code we have solved a problem that typically takes about 30 minutes to perform.

FontLab Studio Python Classes

In this section we will discuss a basic set of FontLab Studio classes and variables. The full specification is available as a separate document for download from our site (www.fontlab.com) and most classes are also self-documented. For example, to print a short reference of the class Font, type in the Edit Macro panel:

```
print Font().__doc__
```

And check the Output panel for the reference. Note the two underscore characters before and after the “doc”.

FontLab

The highest class in the FontLab Studio hierarchy is a class named FontLab. You cannot create it explicitly, but the object of this class is always available and is named “fl”.

This class contains seven most important members:

ifont	Index of the active font
font	Current font as a Font object
ifontslist	Index of currently selected font in the fonts list panel
iglyph	Index of the currently active glyph in the current font
glyph	Current glyph as a Glyph object
count	Read-only - number of opened fonts
count_selected	Number of selected glyphs in the Font Window

You can also access the fl object as a list of Font-type objects:

```
print fl[0].font_name
```

There are several important methods:

Close(fontindex)	Closes the current or 'fontindex' font

Open(filename)
Open(filename, addtolist)
	Opens the font from the file using the current opening options. If 'addtolist' is True, the font is added to FontLab Studio's font list

Save(filename) **Save (fontindex, filename)**	Saves the current or selected font using the standard FontLab Studio Save routine
Add(font)	Adds 'font' to the list of open fonts and opens the Font Window for it

UpdateFont()
UpdateFont(fontindex)
	Updates the current font or 'fontindex' (slow operation)

UpdateGlyph() **UpdateGlyph (glyphindex)**	Updates the current or 'glyphindex' glyph of the current font
EditGlyph() **EditGlyph (glyphindex)**	Opens a Glyph window for the 'glyphindex' glyph in the current font

Selected()
Selected(glyphindex)
	Returns True if the current glyph or 'glyphindex' glyph is selected (relatively slow operation)

Select(glyphid)
Select(glyphid, value)
	Changes the glyph's selection state. 'glyphid' may be string (glyph name), Uni (Unicode index) or integer (glyph index)

Unselect()	Deselects all glyphs in the current font (fast operation)
Message(message, question, OKstring, Cancelstring)	Shows the alert message dialog box, all the parameters but the first can be omitted
BeginProgress(title, counts)	Opens the Progress dialog box with. 'counts' - number of 'ticks'
EndProgress()	Closes the Progress dialog box
TickProgress(tick)	Updates the Progress bar, returns False if Cancel button was pressed. This is a relatively slow operation

Random(hivalue)
Random(lovalue, hivalue)
	Returns a random value (very fast operation)

ForSelected(function_name)	calls 'function_name' for each selected glyph in the current font. Function has the following format: function(Font font, Glyph glyph, glyphindex)

We will provide some examples using the functions described above when we discuss Font and Glyph classes.

Font

The Font class contains all the data that is related to the font in FontLab Studio internal data structures. The Font class by itself has no interaction with the user interface elements. You need to use other classes such as the fl object of the FontLab Studio class to interact with the font.

The most important members of the Font class are:

classes	Python list with the strings containing FontLab Studio classes
ot_classes	String containing OpenType classes (text that appears in the bottom control of the OpenType panel)
features	List of OpenType features. Each element of the list is an object of the Feature class
customdata	A string that may contain any data you want to attach to a font. This data is saved in the FontLab Studio font file so you can use this member to store information that is not editable by FontLab Studio tools.
truetypetables	List of custom TrueType tables. Each element of the list is an object of the TrueTypeTable class.
ttinfo	TrueType information (mostly hinting-related tables)
glyphs	Array of glyphs. Each element of the array is an object of the Glyph class

So, for example, if you want to see the advanced width of the glyph with index 12 you would write:

```
print fl.font.glyphs[12].width
```

Here “fl” is an object of the FontLab Studio class that represents the FontLab Studio user interface; “font” is the currently active font (object of the Font class); “glyphs” is a member of the Font class representing an array of glyphs; [12] directs us to the 12th element of the glyphs array; “width” is a member of the Glyph class representing the glyph’s advance width.

A shorter way to access the glyphs of the font is to access the Font object as an array:

```
print len(fl.font)
print fl.font[12].width
```

The first line will print the number of glyphs in the font. The second line is a shorter version of the example described above.

With the glyphs member you may perform several operations, like adding a new glyph:

```
g = Glyph()
fl.font.glyphs.append(g)
```

This example will append a new glyph to the font.

To remove all the glyphs in the font use this method:

```
fl.font.glyphs.clean()
```

Other members of the Font class represent Font Header data and you can get a list of them using the following operation:

```
print Font().__doc__
```

Two methods of the Font class relate to FontLab Studio internal format:

Open(filename)	opens font from VFB format
Save(filename)	saves font in VFB format

These operations are not connected to the FontLab Studio UI, so you may use them with fonts created inside a Python program and not connected to the FontLab Studio system.

Glyph

The Glyph class represents the glyph as a data structure in FontLab Studio. The most important members are listed in the following table:

parent	Glyph's parent object, the Font
index	Index of the glyph in the font (it is –1 if the glyph is not connected to the font)
nodes	List of nodes. Each element of the list is an object of the Node type.
customdata	A string-type data that may be attached to the glyph. This data is stored to the FontLab Studio font file (VFB) so you can use it to define glyph properties that are not supported by FontLab Studio
note	Note defined for this glyph (string type)
mark	Color code for the glyph mark or zero if glyph is not marked.
anchors	List of anchors. Each element is of Anchor type.
hhints, vhints	List of horizontal or vertical hints. Each element is of Hint type
hlinks, vlinks	List of horizontal or vertical links. Each element is an object of the Link type.
components	List of components. Each element is Component object.
kerning	List of kerning pairs. Each element is KerningPair class object.
layers_number	Number of masters in this glyph
nodes_number	Number of nodes, same as 'len(Glyph)'
width	Advance width (for the first master if glyph is Multiple Master)
height	Advance height
unicode	First Unicode index in integer form
unicodes	List of Unicode indexes
name	Glyph name
rpoint	Glyph reference point

You can get a list of operations defined for the Glyph class if you run the following line:

```
print Glyph().__doc__
```

You can replace “Glyph” with the name of any class mentioned above to get a description of its members and operations.

Here are some examples:

Marking all glyphs with a different color depending on the number of components.

Non-composite glyphs are not marked. Glyphs that have exactly 2 components are marked green and glyphs that have some other number of components or have outline and components are marked red:

```
for g in fl.font.glyphs:             for every glyph in the current font
  c_len = len(g.components)          store the number of components (length of the
                                     components array
  n_len = len(g)                     store the number of nodes (length of the nodes
                                     array)
  if c_len == 0:                     if number of components is 0
    g.mark = 0                       unmark the glyph
  elseif c_len == 2 and n_len == 0:  if number of components is 2 and number of
                                     nodes is 0
    g.mark = 100                     Mark the glyph with green
  else                               if all conditions above are false
    g.mark = 1                       Mark the glyph with red
fl.UpdateFont()                      finally, update the font so the Font window will
                                     refresh
```

Selecting all glyphs that have no outline or components:

```
fl.Unselect()
for g in fl.font:
if len(g) == 0 and len(g.components) == 0:
    fl.Select(g.index)
```

First thing we do is deselect the font. It is faster to deselect all glyphs at once than to change the selection of all glyphs. In our example we are selecting only those glyphs that comply with the condition.

Modules

More complex Python programs can be written using so-called modules (refer to your Python documentation for more information). There are three different folders in which FontLab Studio looks for modules.

[FontLab Studio user data folder]\Macro\System\Modules

> typically C:\Documents and Settings\Your Username\
> My Documents\FontLab\Studio5\Macro\System\Modules
> Put your own FontLab-specific Python modules here

[Python folder]\Lib\site-packages

> typically C:\Python24\Lib\site-packages
> Put your non-FontLab-specific Python modules here
> that you would like to use in stand-alone Python
> (outside of FontLab Studio) as well as in FontLab Studio

[FontLab Studio application folder]\Macro\System\Modules

> typically C:\Program Files\FontLab\Studio5\Macro\System\Modules
> Do not put your own modules here, reserved for modules from
> Fontlab Ltd. and registered FontLab scripting vendors

Note that the location of the FontLab Studio user data folder can be changed in **Options > Folders and Paths > FontLab Studio 5 files**.

Please, refer to our website (http://www.fontlab.com/python/) for more examples and information about macro programs. You may also examine the source code of the sample programs that are supplied with FontLab Studio.

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