The Simple Guide to Type 1 Fonts in LaTeX
Version 0.99

Matthew Amster-Burton (mamster@mamster.net)

April 16, 2003

Contents

1 Important Note

This document has been superseded by Philipp Lehman's "The Font Installation Guide: Using Postscript Fonts to Their Full Potential with LaTeX," available on the web. Lehman's document covers everything this one does and more, and it's better organized.

The source for the document you're reading is available. Here's the main file and the style file. Please feel free to modify and redistribute this file; I request that you keep my name on it.

2 Introduction

It comes up on `comp.text.tex` almost every day: "How do I install my Type 1 fonts in TeX/LaTeX? How do I use expert fonts? How do I specify oldstyle figures instead of lining figures?" Generally these questions get answered with the usual amount of grumbling, but the answers tend to vary in quality and everyone has their own advice.

Most people neither need nor want to delve into the gory details of `fontinst` or TeX's virtual font mechanism—they just want to get their font installed and working with a minimum of fuss. As far as I know, there is no document on this subject that is both clear and complete. This is an attempt to remedy that situation. The process described below will not solve every font problem you come across. It's designed for the simple, everyday case that clogs the newsgroup. Let's begin.

3 Type 1 fonts: background and glossary

The Type 1 format was developed by Adobe Systems. Adobe remains the largest supplier of Type 1 fonts, but there are many other quality type foundries including Agfa-Monotype, DTL, and Hoefler. Type 1 is an *outline* font format, which means that fonts in this format can be scaled to any size. Fonts can be broken down into two general categories: body type and display type. Body type is suitable for typesetting long stretches of text. Display type is suitable only for titles, ad copy, and the like. Most body typefaces work perfectly well in a display capacity, but the reverse is untrue (see figure **??**). This document works equally well for installing body and display types.

Nearly all of the popular typefaces you see in regular use are available in Type 1 format. Before you use this document to install a new font, make sure you don't already have it installed: most TeX installations already include the basic Postscript

fonts Times, Palatino, and Helvetica. See the documentation for PSNFSS.[1]

Not all font sets contain the same number of characters. All will come with capital and lowercase letters (except for certain display types such as Trajan that have only capital letters) and a set of numerals, punctuation marks, and certain accented characters and math symbols. In addition to the above, fonts may also include an *expert set*, which usually consists of small caps, extra ligatures, text figures ("lowercase numbers" that integrate better with text), and some extra punctuation and superscript/subscript characters. A font with its expert set is often referred to as an "expert font." Note that the expert set by itself is as useless as Della's combs in *The Gift of the Magi*. This document explains how to install expert fonts.

Instead of an expert set, a font may offer a SC/OSF variant, which contains capitals *and* small caps, text figures, and punctuation, but no extra ligatures or super- and subscripts. Unlike an expert set, a SC/OSF font can be used by itself to set text in CAPITALS & SMALL CAPS. This document does not explain how to install SC/OSF fonts; however, if you don't care about text figures (I would argue that you should, but it's up to you) you may follow the instructions in this document for non-expert fonts and will end up with a usable result. For an illustration of the difference between an expert font and a SC/OSF font, see figure 1.

A Type 1 font will come with a set of files for each variant (explain this). Depending on the vendor and the package you buy, each variant may be represented by between two and four files as follows:

PFB files contain the actual font outlines. These are always required and always supplied.

AFM files contain font metrics describing the spacing and other characteristics of the letterforms. For example, an italic font's AFM file will tell you the angle of the italic's slant. If you feel like modifying the kerning tables of a font, start here. AFM files are text and can be edited by hand.

PFM files are a neutered binary-format version of AFM files for use on the Windows platform. They are required for installing fonts under Windows, but TEXdoesn't need them at all. If you have an Adobe-supplied font with PFM files but no AFMs, you can usually download the AFMs from Adobe's FTP site. There is a program for converting PFMs to AFMs, but I've never gotten it to work right. I have had some luck generating AFM files from PFMs using the commercial font editor

---

[1]PSNFSS documentation: `http://tex.loria.fr/general/new/fntguide.html`

FontLab[2] and the free editor PfaEdit,[3] but the resulting AFM usually requires some hand-editing.

INF files are text-format files that allow Windows to regenerate a PFM file based on the AFM. As you would expect, these files are also ignored by TEX.

3.1   Other font formats

TrueType is a format developed by Microsoft as a competitor to Type 1. There is a web page[4] explaining how to use these fonts with TEX.

OpenType is the newest format on the block. Jointly developed by Microsoft and Adobe, OpenType fonts can contain up to 65,536 characters and comply with the Unicode standard for international text. Unfortunately, TEX itself is limited to 256 characters per font, and the OpenType format is incompatible with most popular versions of TEX.[5] Someone would do well to write a program that converts an OpenType font to a pair of Type 1 fonts, regular and expert.

Multiple Master fonts are a Type 1 variation that allow to you interpolate along various axes such as weight, optical size, or width, meaning, for example, that you can make a font exactly as bold or light as you like. They never caught on, probably because they are tricky to use, and Adobe (who was the main vendor of MM fonts) is replacing them with OpenType fonts as fast as they can. Some people have come up with clever ways to generate Multiple Master (MM) fonts on the fly, but generally, to use MM fonts, you have to generate instances and install them like regular Type 1 fonts. There is a free utility called `mminstance`[6] to handle this for you, but it requires AMFM files, which are hard to come by. Without the AMFM files, you'll have to use a commercial utility such as FontLab.

3.2   Potential pitfalls

All of the expert sets provided by Adobe should work fine with this document. Expert sets from other vendors, however, may not, because they don't sort the characters in the same way. For example, the procedure outlined in this FAQ will not work with the expert sets from DTL or Carter & Cone. These fonts can be made to work

---

[2]FontLab: `http://www.fontlab.com/`

[3]PfaEdit: `http://pfaedit.sf.net/`

[4]Using TrueType fonts with TEX and pdfTEX: `http://www.radamir.com/tex/ttf-tex.htm`

[5]This is not exactly true: A few OpenType fonts are internally stored in TrueType font. One of these, the Palatino Linotype font that comes with Windows XP and Windows 2000, has been adapted for use with TEX.

[6]`mminstance`: `http://www.lcdf.org/~eddietwo/type/`

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyzfifl1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyzfifl1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyzfifl1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyzfifl1234567890

ab¢deilmnorst fffiflffiffl⅓⅜⅝⅞
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyzfifl1234567890

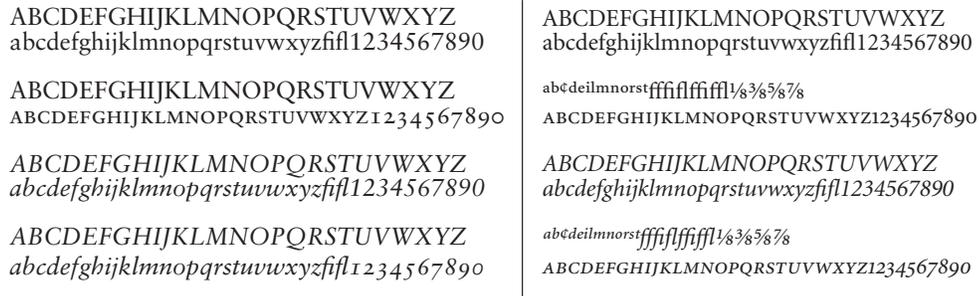*ab¢deilmnorst fffifffiffifl⅓⅜⅝⅞*
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890

Figure 1: SC/OSF vs expert fonts. Left: From top, Sabon Regular, Sabon SC, Sabon Regular Italic, Sabon ItalicOsF. Right: From top, Minion Regular, Minion Regular Expert, Minion Italic, Minion Italic Expert. Note that expert sets do not contain capital letters.

with TeX, but it requires some under-the-hood work with `fontinst` beyond the scope of this document.

4 Is this document right for you?

This is the right document for you if you find yourself in the following situation:

- You have some Type 1 fonts you want to install.

- You may have expert fonts available, in which case you'd like to get small caps, extra ligatures, and text figures working properly. Work through section 7 but see section 8 for the additional steps needed to install an expert set.

- You do not have "SC/OSF" fonts, which are more complicated to install and beyond the scope of this document. (I'll be covering them in a future FAQ.) There are prepackaged metrics for some such fonts (including the popular Adobe releases of ITC New Baskerville, Times Ten, and Stempel Garamond) available from font maven Walter Schmidt.[7]

5 Maintaining a `localtexmf` directory

No matter what TeX system you use, maintain a local directory (either system-wide on a single-user system such as Windows, or under your home directory on a multiuser Unix system). Installing fonts means dropping files all over your hard

---

[7]Walter Schmidt's font page: `http://home.vr-web.de/was/fonts`

drive, and if you don't have a way of keep track of what files you've added to your TEX distribution, you are going to cry later. I will refer to the local directory as `localtexmf`; call yours whatever you want.

CTAN has some good documentation[8] on maintaining a local directory. The same document includes some incomplete font installation advice and is not a replacement for this document.

6   Prerequisites

You'll need the following:

- A TEX system based on TEX3. This includes most popular free and shareware distributions, including MiKTEX for Windows, OzTEX for Mac, and teTEX for Unix. It does not include Y&Y TEX, which uses its own virtual font system but makes Type 1 fonts easy to install. If you're using Y&Y, read your documentation rather than this document.

- A recent version of `fontinst`, 1.8 or newer.[9] Available from the Comprehensive TEX Archive Network (CTAN).[10]

- A map table based on the Karl Berry font naming scheme.[11] If you have the `fontname` package installed (most distributions install it by default), you should find a directory of map files. Under a TDS-compliant system, it's `texmf/fontname`.

7   The Process

Throughout this procedure, we'll work with an example font. I'll use Adobe Minion, which is the font used to set this document (in PDF form, at least). When appropriate, I'll discuss how to install the expert set.

7.1   Make sure you have all the pieces

You'll need the PFB and AFM files for the font family you wish to install. Don't try to install more than one font family at a time. If you don't have the AFM files, you can

---

[8]Managing a one-person TEX system: `http://www.ctan.org/installationadvice/`

[9]`fontinst`: `http://www.tug.org/applications/fontinst/`

[10]CTAN: `http://www.ctan.org/`

[11]Berry map files: `http://www.tug.org/fontname/fontname_4.html`

download them from Adobe's FTP site.[12] This site tends to go down sporadically; if you have trouble, keep trying, and when you get through, download all the AFMs you think you'll need. You may also have PFM and INF files; these have nothing to do with TEX and may be deleted. Put all your font files in a single scratch directory.

7.2 Rename the font files to the Karl Berry standard

If you understand the naming rules, great. If you don't, who cares? Just follow the map file. For example, here's a line from `adobe.map`:

```
pmnr8a    Minion-Regular                    A    143    morg____
```

This tells you that the font Minion-Regular is known to Adobe as `morg____` (that is, `morg____.pfb` and `morg____.afm`) and in the Berry scheme as `pmnr8a`. So, under DOS:

```
C:>ren morg____.* pmnr8a.*
```

And under bash:

```
% for filename in "$@" ; do ...
```

There's another useful piece of information in the line from the map file. The number, 143, tells you in what directory you'll find the AFM file on the Adobe FTP site.

Now, if you are an old-school batch file hacker, you are probably thinking to yourself, "Why in the world would I do this manually when all the information is right there in the map file?" You are a person after my own heart. I've created a Perl script to rename the files automatically. It's included at the end of this document or you can download it.

7.3 Create a `fontinst` script

The `fontinst` package has a command that takes care of any simple font installation task: `\latinfamily`. Create a file (I tend to call mine `fi.tex`) containing the following:

```
\input fontinst.sty
\latinfamily{pmn}{}
\bye
```

pmn is the Berry shorthand for Adobe Minion; replace it with the abbreviation for your font.

---

[12]Adobe AFM files: `ftp://ftp.adobe.com/pub/adobe/type/win/all/afmfiles`

8

7.4 Run the script through T_EX

Nothing tricky here:

```
% tex fi
```

When `fontinst` finishes (it can take a substantial amount of time), you should have a bunch of `*.pl`, `*.vpl`, `*.mtx`, and `*.fd` files. If you don't, something went wrong. Look through the log (`fi.log` in our example) for errors.

7.5 Compile the `*.pl` and `*.vpl` files

The `*.pl` files must be compiled into `*.tfm` files; the `*.vpl` files must be compiled into `*.vf` files. This is done using the `pltotf` and `vptovf` utilities, which should be included with your T_EX distribution. The syntax is as follows:

```
pltotf file.pl file.tfm
vptovf file.vpl file.vf file.tfm
```

For some reason, the utilities included with MiKT_EX require the full syntax, but under teT_EX most of the arguments are optional, making life much easier:

```
pltotf file
vptovf file
```

As above, you should automate this with a script.

7.6 Delete the leftover junk

You no longer need the `*.mtx`, `*.pl`, and `*.vpl` files and should delete them.

7.7 Move the files to the proper directories

Under any TDS-compliant system (including MiKT_EX and teT_EX), the files go like this:

File type	Directory
`*.pfb`	`localtexmf/fonts/type1/`*`vendor`*`/`*`name`*
`*.afm`	`localtexmf/fonts/afm/`*`vendor`*`/`*`name`*
`*.tfm`	`localtexmf/fonts/tfm/`*`vendor`*`/`*`name`*
`*.vf`	`localtexmf/fonts/vf/`*`vendor`*`/`*`name`*
`*.fd`	`localtexmf/tex/latex/`*`vendor`*`/`*`name`*

So, for example, `pmnr8a.pfb` (Minion Regular) would go in `localtexmf/fonts/type1/adobe/minion`.

7.8 Create a LaTeX package

If you use LaTeX, you'll want to make a package to simplify the use of your new font. You can place it in the same directory as the `*.fd` files. Your `minion.sty` should look like this:

```
\ProvidesPackage{minion}
\renewcommand{\rmdefault}{pmn}
\endinput
```

7.9 Create a map file for dvips and pdfTeX

Here's what the map file should look like for Minion (regular, italic, bold, and bold italic):

```
pmnr8r Minion-Regular "TeXBase1Encoding ReEncodeFont" <8r.enc <pmnr8a.pfb
pmnri8r Minion-Italic "TeXBase1Encoding ReEncodeFont" <8r.enc <pmnri8a.pfb
pmnb8r Minion-Bold "TeXBase1Encoding ReEncodeFont" <8r.enc <pmnb8a.pfb
pmnbi8r Minion-BoldItalic "TeXBase1Encoding ReEncodeFont" <8r.enc <pmnbi8a.pfb
```

If you think I'm going to explain each part of this line, you've got the wrong FAQ. Just make the changes you'd expect for your own font. All of the necessary information can be found in the Berry map file, and you should never change the `"TexBase1Encoding ReEncodeFont"` or `8r.enc`.

For example, say you were installing Sabon. Perusing the `adobe.map` file, you find the following line:

```
psbr8a     Sabon-Roman                     A    088    sar_____
```

This tells you that the short name for Sabon is `psb`. The full name of the regular variant is Sabon-Roman, and the Berry name is `psbr8a`. Substituting an `r` for the `a` at the end of the name gives you `psbr8r`, the name of the virtual font file that TeX is looking for. Now you have enough information to generate one line of the Sabon map file (`psb.map`):

```
psbr8r Sabon-Roman "TexBase1Encoding ReEncodeFont" <8r.enc <psbr8a.pfb
```

The Minion map file should be named `pmn.map`. Your map file should be named (three-letter font name)`.map`. Place it in the dvips `config` directory. Under MiKTeX, that's `localtexmf/dvips/config`. Place another copy (or better, a link) in the pdfTeX `config` directory (`localtexmf/pdftex/config`) if you use pdfTeX.

Next, you'll need to tell dvips and pdfTEX about the new map file. For dvips, make a copy of `config.ps` and drop it into your local tree. The file should already have a line showing dvips where to find its existing map file (often called `psfonts.map`). Right after that line, add the line:

```
p +pmn.map
```

For pdfTEX, the config file is called `pdftex.cfg`. Copy it to your local tree, and add the following line to the end of the file:

```
map +pmn.map
```

Finally, your DVI viewer needs to know about that map file. For MiKTEX's yap, edit `config.makepk` and add:

```
p +pmn.map
```

Again, this can and should be automated with a script. Keep reading for details.

7.10   Rebuild the hash tables

Now you have to tell TEX that you've moved files around, or it won't be able to find any of your new goodies. Under MiKTEX:

```
C:\>initexmf -u
C:\>initexmf --mkpsres
```

or use the MiKTEX Options program (figure 2).
    Under teTEX:

```
% texhash
```

7.11   Test out your new font

That should do it! Try running the following document through LATEX to see if your new font is working:

```
\documentclass{article}
\usepackage{minion} % substitute the name of your font
\begin{document}
How do you like my new font?
\end{document}
```
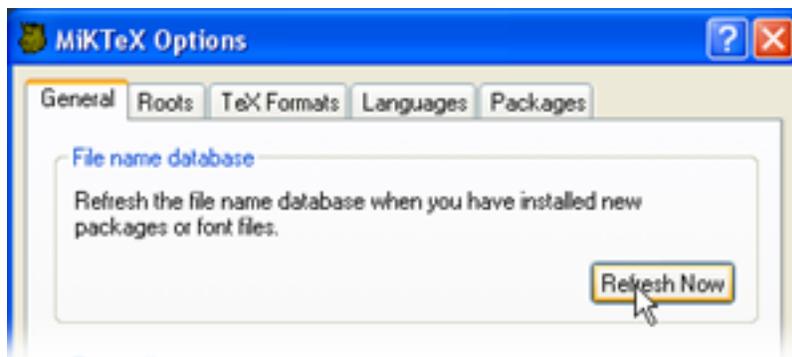
Figure 2: Using the MiKTEX Options program to rebuild TEX's hash tables

8 Expert sets

If you use TEX, you're probably serious about typesetting. And if you're serious about typesetting, you should choose a font with an expert set available. An expert set includes small caps, text figures, extra ligatures, and often other treats such as small punctuation marks and superscript characters. Again, remember that an expert set is useless without the base font. "Minion Regular Expert," for example, is no good without "Minion Regular."

You can install a font with an expert set using almost exactly the procedure above. There are only two differences.

8.1 Text or lining figures?

Text figures (also known as oldstyle figures, hanging figures, and in German the delightful *Mediävalziffern*) are the "lowercase" numbers used throughout this document. Some of them have ascenders and some hang below the baseline, just like lowercase letters. Text figures are the right choice for most documents but are not generally used in technical writing with a lot of mathematics. So if you have an expert set available, you'll want to generate two fonts: one with text figures, one with lining figures. It's easy to switch back and forth within a single document if you like.

8.2 The `\latinfamily` command

The TEX jargon for "expert font with text figures" is "j" and the jargon for "expert font with lining figures" is "x". Your `fontinst` script should look like this:

```
\input fontinst.sty
\latinfamily{pmnj}{}  % Minion expert family with text figures
\latinfamily{pmnx}{}  % Minion expert family with lining figures
\bye
```

8.3   Create *two* LaTeX packages

Because you've created two fonts, you need two LaTeX packages. For text figures:

```
\ProvidesPackage{minionj}
\renewcommand{\rmdefault}{pmnj}
\endinput
```

And for lining figures:

```
\ProvidesPackage{minionx}
\renewcommand{\rmdefault}{pmnx}
\endinput
```

As above, these may be placed in the same directory as the `*.fd` files.

8.4   Create a map file for dvips and pdfTeX

Your map file needs to include lines telling the DVI drivers where to find the expert sets. Your map file should contain the following lines *in addition* to those explained in section 7.9.

```
pmnb8x MinionExp-Bold <pmnb8x.pfb
pmnbi8x MinionExp-BoldItalic <pmnbi8x.pfb
pmnr8x MinionExp-Regular <pmnr8x.pfb
pmnri8x MinionExp-Italic <pmnri8x.pfb
```

Note that these are a lot simpler than the lines for the non-expert parts of the font.

8.5   Switching between the two fonts

To switch between oldstyle and lining figures, just switch fonts. For example, if you're currently using Minion with text figures (`pmnj`: 12345) and wish to switch to Minion with lining figures (`pmnx`: 12345) use the following command:

```
\fontfamily{pmnx}\selectfont
```

A Helpful scripts

Warning: These scripts are like this FAQ as a whole. There is no warranty. Additionally, the scripts are in the public domain. Change and improve them however you like; there are plenty of missed opportunities for error checking and additional functionality, but they work well enough for me.

I'm currently working to make the script more portable, so I haven't included it in this draft. If you know of any existing scripts for renaming files to the Berry standard, please email me.

B Acknowledgments

Thanks to Laurie Amster-Burton, Gunther Schmidl, and Gabriel Zachmann for looking over drafts of this document, and to Don Knuth for creating the world's most powerful and maddeningly satisfying typesetting system.

C Copyright

The 1.0 release of this document will include LaTeX source and will be licensed under the GNU Free Documentation License. This draft, however, is © 2002 Matthew Amster-Burton and may not be modified.