

Fonts

Update: METAFONT `mode_def` Settings for Various T_EX Output Devices

Doug Henderson

Hi,

I am introducing myself in this Update column since I will be trying to keep track of the METAFONT `mode_def` parameters for the T_EX Users Group. My name is Doug Henderson, I work at the Division of Library Automation at U.C. Berkeley, and I am this year's METAFONT coordinator. If you have comments or questions about creating `mode_def`'s for new printers or about using existing settings for printers you can send them to me at either my bitnet address of `dlatex@cmsa.berkeley.edu` or my physical address in Berkeley:

Doug Henderson
186 University Hall
Berkeley, CA 94720

Please give me a while to respond, as we all know that many T_EX Users Group people are volunteer workers who have jobs that must take priority, and if I take longer than a week, feel free to harass me again.

It seems that there is enough concern out there regarding METAFONT fonts and how they relate to printers (and typesetters) that we will maintain an ongoing list keeping track of established `mode_def` settings for these and new printers. If there are significantly many (more than one) contributions I will submit the `mode_def` chart to be printed in the next TUGboat. Below is a clone of the chart settings last submitted by Barbara Beeton with a few new printer contributions I have added.

The table on the next page contains a summary of the relevant settings gleaned from available sources. Most of the print engines cited in the table are listed below, along with an indication of whether they are write-black (wb) or write-white (ww), if known, and the names of some of the output devices into which they have been built.

Canon CX (wb)	Apple LaserWriter; Cordata; HP LaserJet, LaserJet 500 Plus; Imagen 8/300; QMS and Talaris 8 ppm printers
Canon CXD (wb)	Imagen 3308 ImageServer XP
Canon SX (??)	HP LaserJet Plus, LaserJet Series II; Imagen ImageStation/S, 2308/S
Canon LBP-10	Imagen 10/240

Canon (wb)	Imagen 3320, Imagen 7320
Ricoh 4081 (ww)	DEC LN03; TI OmniLaser 2115
Ricoh LP4120 (ww)	HP 2688A, Imagen 12/300
Ricoh 4150 (ww)	Talaris 1500
Xerox XP-12 (ww)	DEC LN01, QMS 1200, Talaris 1200, Xerox 2700
Xerox XP-24 (ww)	Imagen 24/300, QMS 2400, Talaris 2400, Xerox 3700

As always, additions and corrections to this list are solicited.

A note from John Lavagnino of Brandeis University warns against assuming that "improved" models of printers, or even printers from different manufacturers based on the same print engine, will produce equivalent output:

We have discovered that the LN03 and the LN03-Plus don't print the same way: a font that looks fine on the LN03 will look lighter on the LN03-Plus. In fact it isn't necessary to download fonts to observe this: even the internal fonts look different.

We've been badgering DEC about this for some time, and they have finally agreed that this is the case. The current story is that they "made the pixels smaller" on the LN03-Plus, "to make it look more like a typewriter."

Recently, there has been a similar discovery with regard to the HP LaserJet vs. HP LaserJet Plus printer. Ian Young writes

I was wondering whether the "wimpiness" of the characters I am seeing on the printer I am using (HP LaserJet Plus) could be possibly due to my having generated the fonts originally for a 'real' LaserJet, which I believe has a different print engine.

I called the folks at Hewlett-Packard and Canon, and between the two found out that the engine for the HP LaserJet was, as we knew, the Canon LBP-CX. The surprising thing was that they used a different print engine, the Canon LBP-SX for their new printer the HP LaserJet Plus. So Ian, I guess it's right you are, you seemed to have used fonts built for the CX and new parameters are needed for the newer SX style. It is unclear whether this engine is write-white or not. Seems sort of strange that neither HP nor Canon knew whether it was a write-white engine or not. Oh well. Please keep us posted on your results. Anyone else do this yet?

Again, please be aware that a good `mode_def` for one will only be a poor approximation for the other.

Consider yourselves warned.

Typical `mode_def` parameter settings for CM fonts

Source of information	<i>pixels_per_inch</i>	<i>blacker</i>	<i>fillin</i>	<i>o_correction</i>	<i>aspect_ratio</i>
PLAIN.MF					
proof	2601.72	0	0	1	
lowres	200	.65	.2	.4	
WAITS.MF					
dover (Xerox Dover)	384	1.2	0	.6	
imagen (Canon CX)	300	0	.2	.6	
qms (Xerox XP-12E)	300	.75*	0*	.5*	
aps (APS-Micro5)	722.909	.2	.2	1	
crs (Alphatype CRS)	4000+4000/3	.4	0	1	
boise (HP 2680A)	180	.55	.1	.3	
DD (DataDisc terminal)	70	0	0	.2	
canon (Canon LBP-10)	240	.2	.2	.4	
newDD (DataDisc terminal)	70	0	0	.2	4/3
cg (Compugraphic 8600)	1301.5	.2	.2	1	1569/1301.5
epson	240	0	0	.2	9/10
Charles Karney, T _E Xhax 86#4, Oct 86 [Note 1]					
qms (Xerox XP-12E)	300	.8	.2	.4	
John Gourlay, May 87 [Note 2; TUGboat 8#2, page 10]					
xerxxxvii (Xerox XP-12)	300	.6	-.3	.6	
Charles LaBrec, T _E Xhax 86#6, Oct 86 [Note 3]					
decln (Ricoh 4080)	300	.9	-.2	.5	
Stan Osborne, Apr 87 [Note 4]					
decln (Ricoh 4080)	300	.2	-.4	.5	
Janene Winter, May 87 [Note 5; TUGboat 8#2, page 20]					
ibm (IBM 3820) (wb)	240	.65	-.2	.45	
ibm-a (IBM 3812) (wb)	240	.4	-.2	.4	
ibm-b (IBM 3800) (wb)	240	.2	-.1	.6	
ibm-c (IBM 4250) (wb)	600	.05	0	.6	
sherpa (IBM 6670) (ww)	240	1	1	.6	
Matthias Feyerabend, GSI, Darmstadt, May 87 [Note 6]					
ibmlaser (IBM 3820)	240	.3	-1	.4	
bensmall (Benson 9211)	200	-.5	0	.4	
bensmall [alternate settings for problem fonts]	200	0	0	.4	
benbig (Benson 9436)	254	-.8	0	.4	
benbig [alternate settings for problem fonts]	254	-.1	0	.4	
Doug Henderson, DLA, Berkeley, Sep. 87 [Note 7]					
varityper (Varityper VT-600)	600	.2	.2	.8	
linoone (Linotronic 100)	1270	.2	.2	1	
linothree (Linotronic 300)	2540	.2	.2	1	

* A note in WAITS.MF states that these settings are conjectural.

Typical `mode_def` parameter settings for CM fonts

Source of information	<i>pixels_per_inch</i>	<i>blacker</i>	<i>fillin</i>	<i>o_correction</i>	<i>aspect_ratio</i>
PLAIN.MF					
proof	2601.72	0	0	1	
lowres	200	.65	.2	.4	
WAITS.MF					
dover (Xerox Dover)	384	1.2	0	.6	
imagen (Canon CX)	300	0	.2	.6	
qms (Xerox XP-12E)	300	.75*	0*	.5*	
aps (APS-Micro5)	722.909	.2	.2	1	
crs (Alphatype CRS)	4000+4000/3	.4	0	1	
boise (HP 2680A)	180	.55	.1	.3	
DD (DataDisc terminal)	70	0	0	.2	
canon (Canon LBP-10)	240	.2	.2	.4	
newDD (DataDisc terminal)	70	0	0	.2	4/3
cg (Compugraphic 8600)	1301.5	.2	.2	1	1569/1301.5
epson	240	0	0	.2	9/10
Charles Karney, \TeX hax 86#4, Oct 86 [Note 1]					
qms (Xerox XP-12E)	300	.8	.2	.4	
John Gourlay, May 87 [Note 2; TUGboat 8#2, page 10]					
xerxxxxvii (Xerox XP-12)	300	.6	-.3	.6	
Charles LaBrec, \TeX hax 86#6, Oct 86 [Note 3]					
decln (Ricoh 4080)	300	.9	-.2	.5	
Stan Osborne, Apr 87 [Note 4]					
decln (Ricoh 4080)	300	.2	-.4	.5	
Janene Winter, May 87 [Note 5; TUGboat 8#2, page 20]					
ibm (IBM 3820) (wb)	240	.65	-.2	.45	
ibm-a (IBM 3812) (wb)	240	.4	-.2	.4	
ibm-b (IBM 3800) (wb)	240	.2	-.1	.6	
ibm-c (IBM 4250) (wb)	600	.05	0	.6	
sherpa (IBM 6670) (ww)	240	1	1	.6	
Matthias Feyerabend, GSI, Darmstadt, May 87 [Note 6]					
ibmlaser (IBM 3820)	240	.3	-1	.4	
bensmall (Benson 9211)	200	-5	0	.4	
bensmall [alternate settings for problem fonts]	200	0	0	.4	
benbig (Benson 9436)	254	-8	0	.4	
benbig [alternate settings for problem fonts]	254	-1	0	.4	
Doug Henderson, DLA, Berkeley, Sep. 87 [Note 7]					
varityper (Varityper VT-600)	600	.2	.2	.8	
linoone (Linotronic 100)	1270	.2	.2	1	
linothree (Linotronic 300)	2540	.2	.2	1	

* A note in WAITS.MF states that these settings are conjectural.

Notes:

1. Charles Karney states, "...I haven't fully explored the parameter space. If anyone knows of a better (or 'authorized') solution, I'd appreciate hearing about it."

[Karney%PPC.MFEnet@LLL-MFE.Arpa]

2. John Gourlay has diagnosed an unexpected modification to the pen path as *blacker* increases, causing the diameter of such letters as "o" to decrease; the details are discussed in his article in TUGboat 8#2, page 20. The parameter values given here are a compromise, allowing most characters to keep their original sizes, although the value of *blacker* "is not quite enough to compensate for the thinning inherent in the printer." There is still "an inconsistency in the weights of characters. Nevertheless, [Gourlay] feel[s] that this set of parameters is considerably better than the ones that result from the 'conjectural' parameters, and also better than the 'am' fonts they replace."

Gourlay.Ohio-State@csnet-relay

3. Charles LaBrec's comments: "I have twiddled the parameters a bit, and this seems to produce good 12 point cm fonts. I am a bit unsure because changing *blacker*, *fillin*, or *o_correction* seem to make no difference for quite a large range of values. I can't remember exactly, but you will get the same results as [these] for $.4 < \textit{blacker} < .9$, $-.8 < \textit{fillin} < -.1$, and $0 < \textit{o_correction} < .7$. But this probably makes a good starting point."

[crl@newton.physics.purdue.edu]

[Editor's note: The value given in TUGboat 8#1 for `decln fillin` should have been $-.2$, not $+.2$.]

4. Stan Osborne: "The `decln` mode [Mr. LaBrec] suggested did not *fillin* correctly and was too black for the smaller point sizes. His choice of settings produces small sized fonts that are much blacker than the small cmr's found in the cmr book (Vol E). ... I found the [above] values of *blacker* and *fillin* to produce readable small fonts for an LN03. ... These values were not carefully tested for larger point sizes. (I stopped experimenting when I got something I liked and I had verified that larger sizes were also usable.) [...!ucbvax!dual!dbi!stan]
5. Janene Winter has found these settings "to be optimal for the IBM printers". This information was transmitted by Dean Guenther along with his site report (TUGboat 8#2, page 10).

6. Matthias Feyerabend: "Fonts tested are CMR5, CMR10, CMR12 and CMSSI17 for a full range of settings for *blacker* and *fillin*."

7. Doug Henderson: Preliminary reasonable looking fonts produced for these three printers. Since the Linotype typesetters are fairly expensive I cannot do extensive testing. Anyone have one and want to donate some use for testing? Please let me know.

[dlatex@cmsa.berkeley.edu]

Halftone Output from T_EX

Adrian F. Clark

Don Knuth's article in TUGboat volume 8 number 2 described the development of a number of fonts which allow halftone output—pictures—to be incorporated into T_EX documents. This article chronicles the author's experiments into halftone production on a particular computer/laser printer combination, VAX/VMS and the LN03. It is important to understand that the picture is actually *typeset*, not just inserted into the final output by some printer-specific `\special` command; the following results can, in principle, be achieved on *any* output device using a perfectly normal implementation of T_EX.

In the image processing field, where the author works, technical reports are invariably crammed with halftone output. The conventional method of reproducing pictures is photographically. This is slow and expensive, particularly for internal reports with small distributions. Moreover, unless great care is taken over the photographs—using a flat-screen CRT, calibrating films, standardising the processing, and so on—much of the visual impact can be lost. Hence, the possibility of incorporating imagery into T_EX document without recourse to a dark room is very attractive.

A great deal of work has been carried out into the properties of the human eye. One result is that the eye is only really capable of distinguishing about 64 grey levels, although it is very good at detecting boundaries between regions of slightly differing grey level (see, for example, "Digital Image Processing" by R. C. Gonzalez and P. Wintz, published by Addison-Wesley in 1977). Another result is that the eye is much more sensitive to boundaries in dark regions than in light regions.