Technical Information

Angle and Ruling Recommendations

The screen angle and ruling recommendations for color separation in this document apply to the **Linotronic* 300, the Linotronic 330, the Linotronic 500 and the Linotronic 530 imagesetters**. More detail on this topic can be found in the Linotronic Screen Frequencies and Screen Angles document, and the Technical Supplement for PostScript Version 52.3 N3. (Contact the author at the address at the end of this document for more information.)

For background information on topics related to halftoning, please refer to earlier technical information pieces on *Resolution and Screen Ruling*, part number 3051, *Measuring Screen Angle and Ruling*, part number 3055, *Digital Halftone Dots*, part number 3060, and *Moiré*, part number 3064.

RT and HQS Screening

For users of Linotronic imagesetters and RIPs, there are two types of halftoning: RT Screening* and HQS Screening*. Both of these methods have been used in high-end scanners, but HQS Screening has only recently been made available to PostScript** users.

RT Screening is the screening algorithm that has been used by the PostScript page description language since 1985. It is particularly suitable for black and white reproduction, but may also be used for color separation. When RT Screening is used for color separation, recommendations for screen angle and ruling should be used to minimize moiré.

HQS Screening is the Linotype-Hell screening algorithm that is available for use with the RIP 30 and RIP 40[1]. HQS Screening is particularly appropriate for color separation because of its ability to achieve screen angle and ruling more accurately than RT Screening. This allows higher quality color separations. HQS Screening works best when recommendations for screen angle and ruling are followed.

[1]HQS Screening works on RIP 30's and 40's with PostScript version 52.3 N3.

Recommendations

Imagesetter resolution plays an important role in the screen angles and rulings that can be achieved by any halftoning method. Because of this, some screen angles and rulings are more appropriate for certain resolutions than for others. Based on research done in Linotype-Hell's R&D facility in Germany, lists of recommendations have been developed for both RT Screening and HQS Screening. These lists, divided by resolution settings, are shown on the following pages. Please check to see that the listed value applies to the target imagesetter.

Filters

As a convenience to our users, filters have been made part of the RIP 30 and RIP 40. When a job is sent to the RIP, these filters choose the recommended value that closest approximates the requested screen angle and ruling of the job. There are actually two filters that may be activated: a black & white filter, and a color separation filter. You can control the use of these filters with version 3.0 or higher of the Linotype Utility.

Discussion continues on back page.

HQS Screening Recommendations

HQS SCREENING   3386 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter
200 lines per inch	Cyan	199.533 lpi	15.0013°	256	**330**
	Magenta	199.533 lpi	74.9987°		
	Yellow	199.216 lpi	0.0°		
	Black	199.561 lpi	45.0°		
171 lines per inch[†]	Cyan	171.0456 lpi	15.0013°	256	**330**
	Magenta	171.0456 lpi	74.9987°		
	Yellow	171.2034 lpi	0.0°		
	Black	171.0526 lpi	45.0°		

[†]Many users have requested a recommendation around 175 lpi. This set is a recently developed recommendation that has not appeared in earlier lists. However, this set is not included in the filter and may therefore only be achieved when the filter is turned off. (See last page of this document.)

	Color	Ruling	Angle	Grays	Imagesetter
133 lines per inch	Cyan	133.042 lpi	14.9996°	256	**330**
	Magenta	133.042 lpi	75.0004°		
	Yellow	132.810 lpi	0.0°		
	Black	133.041 lpi	45.0°		
120 lines per inch	Cyan	119.778 lpi	14.9885°	256	**330**
	Magenta	119.778 lpi	75.0115°		
	Yellow	119.529 lpi	0.0°		
	Black	119.737 lpi	45.0°		
100 lines per inch	Cyan	104.126 lpi	14.9976°	256	**330**
	Magenta	104.126 lpi	75.0024°		
	Yellow	104.205 lpi	0.0°		
	Black	104.119 lpi	45.0°		

HQS SCREENING   2540 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter		
150 lines per inch	Cyan	149.665 lpi	15.0013°	256	**300**	**330**	**530**
	Magenta	149.665 lpi	74.9987°				
	Yellow	149.412 lpi	0.0°				
	Black	149.671 lpi	45.0°				
138 lines per inch	Cyan	138.142 lpi	15.0037°	256	**300**	**330**	**530**
	Magenta	138.142 lpi	74.9963°				
	Yellow	138.545 lpi	0.0°				
	Black	138.158 lpi	45.0°				
120 lines per inch	Cyan	119.670 lpi	15.0184°	256	**300**	**330**	**530**
	Magenta	119.670 lpi	74.9816°				
	Yellow	119.063 lpi	0.0°				
	Black	119.737 lpi	45.0°				
112 lines per inch	Cyan	112.249 lpi	15.0013°	256	**300**	**330**	**530**
	Magenta	112.249 lpi	74.9987°				
	Yellow	112.059 lpi	0.0°				
	Black	112.253 lpi	45.0°				
100 lines per inch	Cyan	99.782 lpi	14.9996°	256	**300**	**330**	**530**
	Magenta	99.782 lpi	75.0004°				
	Yellow	99.608 lpi	0.0°				
	Black	99.781 lpi	45.0°				

HQS Screening Recommendations (continued)

HQS SCREENING   2032 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter	
110 lines per inch	Cyan	110.514 lpi	15.0037°	256	**330**	**530**
	Magenta	110.514 lpi	74.9963°			
	Yellow	110.836 lpi	0.0°			
	Black	110.526 lpi	45.0°			
95 lines per inch	Cyan	95.736 lpi	15.0184°	256	**330**	
	Magenta	95.736 lpi	74.9816°			
	Yellow	95.250 lpi	0.0°			
	Black	95.789 lpi	45.0°			
85 lines per inch	Cyan	84.521 lpi	14.9996°	256		**530**
	Magenta	84.521 lpi	75.0004°			
	Yellow	84.666 lpi	0.0°			
	Black	84.520 lpi	45.0°			

HQS SCREENING   1693 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter		
133 lines per inch	Cyan	133.042 lpi	14.9996°	162		**500**	**530**
	Magenta	133.042 lpi	75.0004°				
	Yellow	133.684 lpi	0.0°				
	Black	133.041 lpi	45.0°				
120 lines per inch	Cyan	119.769 lpi	14.9911°	199	**330**		
	Magenta	119.769 lpi	75.0089°				
	Yellow	119.952 lpi	0.0°				
	Black	119.737 lpi	45.0°				
85 lines per inch	Cyan	85.523 lpi	15.0013°	256	**330**		
	Magenta	85.523 lpi	74.9987°				
	Yellow	86.102 lpi	0.0°				
	Black	85.526 lpi	45.0°				
80 lines per inch	Cyan	79.780 lpi	15.0184°	256		**500**	**530**
	Magenta	79.780 lpi	74.9816°				
	Yellow	79.375 lpi	0.0°				
	Black	79.825 lpi	45.0°				
75 lines per inch	Cyan	74.833 lpi	15.0013°	256	**330**		
	Magenta	74.833 lpi	74.9987°				
	Yellow	74.706 lpi	0.0°				
	Black	74.836 lpi	45.0°				

Notes:
• Gray values are listed on the charts because of their importance in quality output. The number of gray values is dependent on screen ruling and imagesetter resolution. PostScript allows a maximum of 256 grays per separation.
• With HQS Screening, 15 and 75 degree angles can be achieved very accurately. HQS Screening also allows the screen rulings of each separation to be very close in value. (Compare the HQS Screening recommendations with the RT Screening recommendations listed later on.)
• HQS Screening values alone will not produce acceptable results. HQS Screening must be active on the target RIP.

HQS Screening Recommendations (continued)

HQS Screening — 1270 Resolution

	Color	Ruling	Angle	Grays	Imagesetter		
100 lines per inch	Cyan	99.782 lpi	14.9996°	161	**300**	**330**	**530**
	Magenta	99.782 lpi	75.0004°				
	Yellow	100.263 lpi	0.0°				
	Black	99.781 lpi	45.0°				
90 lines per inch	Cyan	89.827 lpi	14.9996°	199	**300**	**330**	**530**
	Magenta	89.827 lpi	75.0004°				
	Yellow	90.714 lpi	0.0°				
	Black	89.803 lpi	45.0°				
75 lines per inch	Cyan	74.833 lpi	15.0013°	256	**300**	**330**	
	Magenta	74.833 lpi	74.9987°				
	Yellow	74.706 lpi	0.0°				
	Black	74.836 lpi	45.0°				

HQS Screening — 1016 Resolution

	Color	Ruling	Angle	Grays	Imagesetter	
80 lines per inch	Cyan	79.825 lpi	14.9996°	161		**530**
	Magenta	79.825 lpi	75.0004°			
	Yellow	80.211 lpi	0.0°			
	Black	79.825 lpi	45.0°			
72 lines per inch	Cyan	71.861 lpi	14.9911°	199		**530**
	Magenta	71.861 lpi	75.0089°			
	Yellow	72.571 lpi	0.0°			
	Black	71.842 lpi	45.0°			

HQS Screening — 846 Resolution

	Color	Ruling	Angle	Grays	Imagesetter	
85 lines per inch	Cyan	85.523 lpi	15.0013°	99	**500**	**530**
	Magenta	85.523 lpi	74.9987°			
	Yellow	84.666 lpi	0.0°			
	Black	85.526 lpi	45.0°			
75 lines per inch	Cyan	74.833 lpi	15.0013°	127	**330**	
	Magenta	74.833 lpi	74.9987°			
	Yellow	74.706 lpi	0.0°			
	Black	74.836 lpi	45.0°			

RT Screening Recommendations

RT Screening — 3386 Resolution

	Color	Ruling	Angle	Grays	Imagesetter
Approx. 180 lines per inch	Cyan	178.562 lpi	18.435°	256	**330**
	Magenta	178.562 lpi	71.565°		
	Yellow	188.214 lpi	0.0°		
	Black	199.644 lpi	45.0°		

RT Screening Recommendations (continued)

RT SCREENING 2540 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter		
Approx. 157 lines per inch††	Cyan	157.531 lpi	29.54°	256	**300**	**330**	**530**
	Magenta	166.751 lpi	66.80°				
	Yellow	158.750 lpi	0.0°				
	Black	163.271 lpi	45.0°				

††This set uses some unconventional angle combinations and should therefore be used with care. It is most appropriate with a skeleton black. (A skeleton black is a black separation that contains information in the midtones and shadows, but very little in the highlight areas of an image.)

	Color	Ruling	Angle	Grays	Imagesetter		
Approx. 134 lines per inch	Cyan	133.871 lpi	18.435°	256	**300**	**330**	**530**
	Magenta	133.871 lpi	71.565°				
	Yellow	127.000 lpi	0.0°				
	Black	119.737 lpi†††	45.0°				

†††149.671 lpi has also been used successfully with this combination.

	Color	Ruling	Angle	Grays	Imagesetter		
Approx. 100 lines per inch	Cyan	100.402 lpi	18.435°	256	**300**	**330**	**530**
	Magenta	100.402 lpi	71.565°				
	Yellow	94.074 lpi	0.0°				
	Black	89.803 lpi	45.0°				

RT SCREENING 2032 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter	
Approx. 107 lines per inch	Cyan	107.188 lpi	18.435°	256	**330**	**530**
	Magenta	107.188 lpi	71.565°			
	Yellow	112.776 lpi	0.0°			
	Black	119.634 lpi	45.0°			

RT SCREENING 1693 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter
Approx. 134 lines per inch	Cyan	133.843 lpi	18.435°	160	**330**
	Magenta	133.843 lpi	71.565°		
	Yellow	130.256 lpi	0.0°		
	Black	119.713 lpi	45.0°		

	Color	Ruling	Angle	Grays	Imagesetter		
Approx. 89 lines per inch	Cyan	89.229 lpi	18.435°	256	**330**	**500**	**530**
	Magenta	89.229 lpi	71.565°				
	Yellow	84.650 lpi	0.0°				
	Black	79.809 lpi	45.0°				

RT SCREENING 1270 RESOLUTION

	Color	Ruling	Angle	Grays	Imagesetter	
Approx. 109 lines per inch	Cyan	108.503 lpi	19.983°	136	**300**	**330**
	Magenta	108.503 lpi	70.017°			
	Yellow	115.455 lpi	0.0°			
	Black	128.289 lpi	45.0°			

	Color	Ruling	Angle	Grays	Imagesetter	
Approx. 100 lines per inch	Cyan	100.402 lpi	18.435°	161	**300**	**330**
	Magenta	100.402 lpi	71.565°			
	Yellow	97.692 lpi	0.0°			
	Black	89.803 lpi	45.0°			

	Color	Ruling	Angle	Grays	Imagesetter	
Approx. 80 lines per inch	Cyan	80.264 lpi	18.435°	252		**530**
	Magenta	80.264 lpi	71.565°			
	Yellow	84.582 lpi	0.0°			
	Black	89.916 lpi	45.0°			

The Linotype Utility

The Linotype Utility gives you the ability to turn HQS Screening on and off[2]. It also gives you the ability to turn the filters on and off. For most color separation work you will want to turn HQS Screening on.

There are four choices within the Linotype Utility:

- Default - RT Screening with no filter.
- Black & White - RT Screening with a filter for recommended B&W values.
- RT Screening - RT Screening with a filter for recommended color separation values. (These values are listed in this document.)
- HQS Screening - HQS Screening with a filter for recommended color separation values. (These values are listed in this document.)

Users who have unique requirements may wish to try screen angle and ruling values that are not shown on the lists. If you are interested in experimenting with HQS Screening you might like to turn on HQS Screening but turn off the filter for HQS Screening recommended values. This can be achieved by using the code listed below.

[2]When HQS Screening is off, that means that RT Screening is active.

PostScript code

The PostScript code to the left allows you to turn off the filter and run HQS Screening without the filter on. You may download this file using SendPS, LaserTalk** or a font downloader.

If you are using LaserTalk and you want to check to see that downloading the code has had the proper effect, you can download the second file. (See below to left.) It will tell you which filter or screening method is active.

```
serverdict begin 0 exitserv-
er
statusdict begin
true setdefaultaccurate-
screens
true setaccuratescreens
0 setdefaultscreenfilter
```

```
statusdict begin
screenfilter
defaultscreenfilter
accuratescreens
defaultaccuratescreens
pstack
```

The values to the right should be returned to your screen after you download the second file. These numbers may be interpreted as follows: for the screen filter, 0 = Off, 1 = b&w filter, 2 = color filter, for the screening method, true = on (i.e. HQS Screening), false = off (i.e. RT Screening). Therefore in this case, 'true' means that HQS Screening is on, and '0' means that the screen filter is off. The values are shown twice to signify the currently active and default values. When the default is changed, that value stays resident even when the RIP is turned off. The color filter can be turned back on with version 3.0 or higher of the Linotype Utility.

```
true
true
0
0
```

Turning off the filter opens up an immense range of screen angle and ruling possibilities, not all of which will give satisfactory results. For the most consistent output, leave the filter on. Any work done without the filter should be considered experimental.

Comments

Please direct any questions or comments to:

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